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REFUTURING STUDIES

Rehumanizing Futures through/by Design



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ACT I

Preparing For the Journey

1. Introduction

With the onset of climate and ecological breakdown, organized human life faces a precarious present and an even bleaker future. This dissertation in Industrial Design will attempt to engage with this pressing issue. Over the last four years, my research question has been, “How can Industrial Design enable the imagining of more radically hopeful futures in the context of long-term sustainability?” This broad question has motivated and inspired me to apply my designerly skills to develop this inquiry, broadened in dialogue with research and theories from other disciplines and creatively brokering them. With that said, I now invite you to join me on this journey.

In the spring of 2022, the Intergovernmental Panel on Climate Change (IPCC) released its long-awaited Sixth Assessment Report (AR6). Each of the three Working Groups (WG) produced a report, expanding on the IPCC’s previous assessment efforts of the climate and ecological crises and reporting on the rapidly deteriorating state of the Earth’s climate systems. Human-induced climate change is ‘forcing’ the climate and ecological systems towards a catastrophic future. These reports unambiguously state that climate breakdown is already here and is accelerating the unraveling of the Earth’s climate system, which has already affected *every* human being. UN Secretary-General António Guterres minced no words and called the IPCC’s monumental report “an atlas of human suffering and a damning indictment of failed climate leadership” (Harvey, 2022a).

These reports have been consistent with the long-term trends forewarned by climate scientists like James Hansen roughly half a century ago. Yet, since the first IPCC report released in 1990, more global fossil carbon has been dumped into the atmosphere than ever in the history of humanity. This was done in full knowledge of the crisis rather than in ignorance of it (Stoddard et al., 2021; Wallace-Wells, 2019, p. 4). Words seem inadequate to comprehend the weight of this one fact. Today, the science is as certain as ever, as Hans-Otto Pörtner, co-chair of Working Group II, asserts—“any further delay in concerted global

action will miss a brief and rapidly closing window to secure a livable future” (IPCC, 2022).

The destabilization of the climate system brings dire consequences for all organized human life now faced with an uncertain future. These reports undeniably show the fate that awaits planetary civilization if the emissions trajectory continues unabated. With the window for climate action closing fast, nothing short of a radical course correction and clamping down on present-day and historical fossil fuel-based carbon emissions will be sufficient, as we have already seen the baselines for climate action shift. The scale of the challenge far exceeds what even net-zero emissions pledges can account for—net emissions would need to turn negative. Without proposals for fossil non-proliferation, abolition, and carbon-negative alternatives, 1.5°C seems closer to being ‘locked in’ while a far more catastrophic 2°C or even 3°C warming seems acceptable in certain circles.

Thus, economist William Nordhaus, who won the Noble prize in economics in 2018, can imply that a 3°C to 4°C of global warming is reasonable enough to continue economic growth without much loss to society, with some green tweaks here and there (2018). These are, however, merely more sophisticated forms of climate denial and delay and have been heavily criticized for basically what amounts to continuing “Business as Usual” (BaU) and assuring climate catastrophe (Hayden, 2021; Hickel, 2018b). The climate catastrophes the world is witnessing today are merely at 1.2°C of warming. What the science calls for is transformative action, not delay.

Yet, as the calls for action grow deafening, delay and denial seems ingrained, even though these actions are feasible and achievable. Despite the significant strides in recent years with the availability of renewables, there is an ever-widening gulf between claims of progress and the actions on the ground, which do not seem to have made much of a dent where it matters most—cumulative fossil emissions. Despite the insistence that carbon emissions have been declining for specific nations and institutions, global emissions seem to keep rising, showing a general upward trend. This may suggest that, at the very least, there is far more talk of action than there is actual action, and whatever actions are being carried out are not adequate for the magnitudes and urgency of what the climate science tells us (Edeholt et al., 2021).

There is an implicit sense of inevitability, an understanding that perpetuates the realities of climate action—those who inherit the planet from previous generations have no choice but to inherit the climate catastrophe. This transpires in a general disappointment with an uncertain climate future. Once

taken for granted, the promise of a better future has become a nightmare that lies heavy on the minds of those still living. In many ways, this entrenched disappointment has given rise to the almost hyper-normalized atmosphere of anger, frustration, and despair that cuts across the fissures in society and enlarges them into ever more bottomless chasms.

In some instances, seeing the hopelessness of climate action fail at so many levels upends the worldviews of those young people now desperately striking for the climate, realizing that the civilization they were born in no longer cares for their present or future. Perhaps Greta Thunberg is not so far off in her assessment; we have indeed had 40 years of "blah blah blah" and not much else to show for it, as reported by Guardian's Environment editor Damien Carrington (2021a). Somehow, expecting a secure, livable, and thriving long-term sustainable future is asking the impossible. Thus, while the future remains threatened and delayed for a few, it may never arrive for the many, as it would be stolen from them. In one sense, the continued lack of necessary action can feel like the ending of the world by a thousand cuts.

A Parasitic System

The philosopher Fredric Jameson most famously stated that it has become far easier to imagine the end of the world than to imagine the end of capitalism, and to imagine capitalism is to imagine the end of the world (2003, p. 76). It is a statement so overused that it has gone from being insightful to an ironically detached caricature of itself. Today it symbolizes a mythology of inevitability constructed to make sense of a socio-economic system intent on destroying its life-giving planetary biosphere. It is a system that negates the possible futures of human and non-human others or what the design theorist Tony Fry defines as 'defuturing' (1999, p. 12).

In climate negotiations, the path to climate action is often presented as a tragic choice between the economy and ecology. This false dichotomy is presented as necessary for progress and civilization—one must pursue infinite economic growth by sacrificing the planetary ecology—for one to survive requires annihilating the other. Conversely, the planetary biosphere survives, but the economy collapses, and the entire human project with it. It would seem that this is the 'realism' of the times, declaring that humanity is inevitably stuck negotiating these artificial dogmas to pay for a complex civilization destined for infinite progress—"there is no alternative" (TINA).

Even if one supposes these artificial dichotomies of economy and ecology it

has provided for undeniable progress on many fronts. However, one is left with a niggling question—has the promise of progress reached all of humanity for whose well-being supposedly these claims are made? As it stands, it would seem that it is a system that only seems to benefit an ever-narrowing group of society, with rising inequalities and historical injustices that become a reliable predictor of who's most responsible for the climate crisis and who suffers from it the most (Althor et al., 2016; Chancel & Piketty, 2015; Sultana, 2022). Thus with the evidence now available, it would seem that the progress of a few seems to have been paid for and depends on the marginalization of the many.

These are strong statements to make, but there is a curious dissonance in trying to claim progress for the future by expecting a system that has undeniably created the crisis to do the very thing it has consistently demonstrated it is incapable of doing—unless radically changed. For those living through constant dehumanization in the everyday, climate dystopias add to the many everyday dystopias of the now, as they yearn for alternatives that never fully arrive. For those still privileged enough, the reality of climate change can upend one's worldview, often turning hope for a better future into climate despair, eventually settling on blaming 'anthropocentrism' for the crisis, where the choices are either climate cynicism (doomism) or naïve optimism (BaU).

However, can one really call this system anthropocentric if only a few are responsible for and benefit from the crisis? Or is it a systemic parasitism¹ that plagues both civilization and the planetary ecology? One can perhaps imagine that what became of our social realities as a consequence of a systemic parasitism in action, but this also means that it could just as well have been different.

It would be reasonable to acknowledge that a creative turn is in order, if not essential, for decalcifying the imagination.² Thus, I want to explore with this thesis the possibility of radical hope through and by design. With such high stakes, can a thesis in Industrial Design realistically and necessarily contribute to the conversation, and if so, what could those contributions be?

1 However, in the natural world, every parasitic system is bound by the limits of its reach, of the host system it necessarily needs to survive and lives within a complex interdependent ecology of relations.

2 As the late philosopher Roy Bhaskar observed, it is human creativity that cares for this system and perpetuates and sustains this parasitism across the many levels of social reality in conscious and unconscious, explicit and implicit ways (Singh et al., 2020, p. 164).

1.1. FORM AND OUTLINE OF THE THESIS

I will argue in line with what Harold G. Nelson and Erik Stolterman have asserted in *The Design Way*, that design is oriented towards the future; it is capable of imagining “that which does not yet exist, to make it appear in concrete form as a new, purposeful addition to the real world” (2012, p. 12). Through their disciplinary training, designers are interested in the possibility of ‘*what could-be*’ given ‘*what-is.*’ This is a recurring theme throughout the body of work I will explore in the thesis and will often be highlighted as it unfolds.

What you hold in your hands is both a 'Thesis by Compilation' and a 'Thesis by Work.' My intention with this thesis is to 'seriously play' with certain conventions of a kappe/exegesis. In this playfulness, I offer the totality of the work submitted in multiple mediums accompanying this text, such as written publications in the form of research papers and tangible work as designed artifacts, documented in the appendix at the end of this text.

The thesis is divided into two standalone texts—this Ph.D. thesis and the fictional design journal, *The Open Journal of ReFuturing* (Figure 1). Before I begin discussing this research thoroughly, it is essential to understand what these two texts are trying to do. The thesis and the journal, with their artifacts, are in conversation with each other. Although you may read these two texts themselves as you encounter them, you could start with any text and move to the next to continue the conversation.

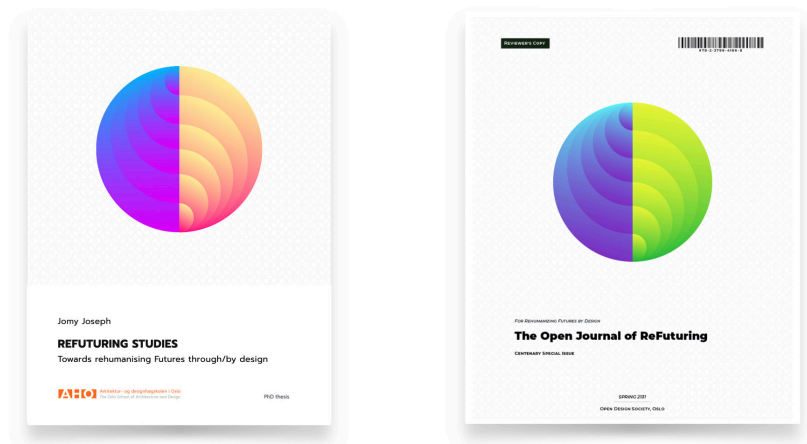


Figure 1. The two parts of this Thesis by Compilation/Work—this Exegesis (kappe) written in 2022AD and the design fiction, *The Open Journal of ReFuturing*, dated 2131AD.

The journal itself is written, however, as a designer would write a speculative history of the future-past—it is a design fiction, a synthetic artifact, and a research outcome generated through and by design. The world this design fiction represents is just as complex and dynamically contested as the world we inhabit. This dialogue is between two paradigms. Paradigm 1 (P1) represents a social reality we are familiar with, based on a worldview threatening the life-sustaining biosphere—*What-is* at hand. The fictional journal speculates and lives within a reality that doesn't yet exist, based on a worldview of climate reparations towards long-term sustainability. This is Paradigm 2 (P2), the *what could-be*.

However, it is not enough that this journey from P1 to P2 takes place; having made the journey, it is also essential to understand what can be learned from it. Thus, the journal ends with a Postscript that breaks the 'fourth wall' as a trigger/reminder that the journal is clearly fictional and explains why so that the reader can return to the present to change 'what-is.' This thesis discusses the implications of this backcasted knowledge by 'returning' to the present to inform actions today.

These two written manifestations of this design research aim to understand the conditions for which the other might exist. This synergetic interplay between these texts has shaped the research outcomes you see here; the journal speculates what design research might be in P2 and then back-casts itself into this exegesis in P1. This work is, thus, playing with the seemingly linear conventions of the present-future time. In this sense, while the texts, their knowledges, and artifacts are separated by time—the thesis written in 2022AD and the journal designed for 2131AD—they all live in an alternative now.³

Guidelines for Reading

This thesis will be presented in three distinct acts—Act I-*Preparing for the Journey*, Act II-*The Journey from What-is to What Could-be* and Act III-*The Journey Back in Preparation for Voyages Elsewhere*. I will briefly describe these levels.

Act I, Chapter 1 sets the stage for this project by situating the context for this research, stating the research question and the theoretical approaches taken to

3 One may encounter this alternative now with these two bodies of text written in English, which are trying to stay close enough to the genre expectations of a design Ph.D. thesis but are also playfully trying to go beyond them. This playfulness directs the very designerly nature of this inquiry. It should inform how one 'reads' this thesis and the body of work presented here, replete with artifacts, experiments, research papers, and the fictional journal, which form a holistic orientation.

pursue the nature of this inquiry. In Chapter 2, I present how this investigation was carried out along with methods and strategies that creatively brokered its generative synthesis.

In Act II, I will present the answers to the Research Question in 3 phases:

Firstly, Chapter 3, '*What-is,*' discusses the world that is, paradigm P1. It is a world-building exercise that uses primarily secondary and tertiary literature to investigate and develop the typologies and conditions of defuturing and its relation to the question of dehumanization within P1.

Secondly, Chapter 4, '*What-if,*' develops three provocations for a radical turn, reclaiming design in its unique capacity to reconfigure and radically transform itself for ReFuturing and rehumanization.

Thirdly, Chapter 5, '*What Could-be,*' discusses the world that could be, paradigm P2. This phase discusses the typologies of ReFuturing and its relation to the question of rehumanization. This phase presents the primary research generated through/by design in the form of a fictional design journal from the future, *The Open Journal of ReFuturing*, and discusses it here briefly, along with a summary of the designed artifacts.

In Act III, I will present the implications of this work for charting an alternative now.

Chapter 6 discusses the implications of ReFuturing and what design and designing might learn from this exercise. I will discuss the findings and outcomes of this primary research along with supporting secondary and tertiary literature.

Chapter 7 summarises and reflects on some of the significant discussions and contributions of carrying out such a speculative journey.

This act will end with a summary of the articles submitted, the documented artifacts and other materials in the addendum, which will wrap up the thesis.

1.2. POINTS OF DEPARTURE

Over the course of design training, as a student and a professional, one may find drawn to questions of social relevance and, with it, domains of ever-expanding complexity and challenges, which are also fun to engage in as one develops deep levels of expertise. For me, it was a relatively naïve desire to play about with better futures, to articulate the possibility of ‘that which is yet to exist,’ and the pleasure of being the cause. There is perhaps something to this profoundly human notion that I will explore and develop here, to be drawn to the possibility of *what could be* different from what came before, using one’s skills to build whole and new conceptual worlds.

This is reflected in the progression of my approach for developing my disciplinary position as an Industrial Designer, using the speculative approach to long-term sustainability to grapple with the compounding climate and ecological crisis. The methods I employed in addressing these contexts became more evident in my progression at AHO leading up to my master’s diploma, which laid the groundwork for this Ph.D. and has been deepened over the past four years. In this journey, the research has been nurtured for and critically situated in the designBRICS research project. designBRICS⁴ aims to build a platform for a *lean* network of different design institutes in BRICS countries and the Oslo School of Architecture and Design (AHO). The Norwegian Agency for International Cooperation and Quality Enhancement in Higher Education (DIKU) funded the project.

“The BRICS are represented by the design departments at Hunan University (HNU) in China and Cape Peninsula University of Technology (CPUT) in South Africa. What brings these three together is a profound belief that the single most urgent issue for designers to work with today - and unfortunately also tomorrow – are ways to address Climate Change on both a local and global scale. In order to achieve substantial impact, the project assume that two things are crucial: (i) a new kind of dialogue between the, so called, “developed Global North” and the “developing Global South”; (ii) a new design education that moves its current focus from designing for societies in affluence that believe they can afford increased ‘standard of living’ that’s primarily based on consumption, to a more realistic one that rather focus on ‘quality of life’.”

— designBRICS Network, 2019

⁴ More details on the designBRICS project and network can be found at: <https://www.designbrics.net/>

For this Ph.D., the research project designBRICS has been the primary research ‘partner’ and supported the development of this investigation. Thus, the research activities proposed have leveraged the frameworks already established within the project and have carried over to other research circles within and outside AHO. Here, designBRICS network served as the base from which the design research activities were carried out and mediated to the wider public. On pragmatic issues, the project also contributed with necessary funds for prototyping, exhibitions, printing, and travel expenses.

The research project and this Ph.D. aim to address climate change and better understand the crisis in design. Fortunately or unfortunately, projects like designBRICS have become more relevant than ever in design education to help students go beyond the traditional tropes of designing for sustainability and imagine alternative futures for well-being. It also comes at a time when there is a radical inadequacy of our knowledge systems to enable climate actions (Fazey et al., 2020; O’Brien et al., 2013; Stoddard et al., 2021). This is a question for this research project too. How does one negotiate knowledge and action without relinquishing complexity and criticality for action or relinquishing action by getting paralyzed by complexity? How does one reconcile and situate oneself with these epistemological and ontological entanglements?

1.2.1 BROKERING THE EPISTEMIC AND THE ONTOLOGICAL

To make sense of how I have structured my approach, I want to introduce the philosophy of Critical Realism (CR), first developed by the late philosopher Roy Bhaskar. What CR posits, according to Bhaskar is that there exists a real world beyond the dimensions that humans can know and experience (the actual), and while parts of it can be studied (the empirical), there exists a much larger world (the real) beyond these definitions (2010, p. 2). Essentially, CR offers a non-reductionist philosophy of science that embraces the fact that we can only ever experience the effects of such complex ‘open systemic phenomena’ such as climate change—a phenomenon that cannot be completely closed off for a study and create predictive criteria without compromising the system itself (Ibid, p. 2).

Often, in trying to understand a complex open phenomenon, it is easy to forget that one’s models of the system can become confused with the reality

of the system as it is and can restrict agency.⁵ This is what Bhaskar termed the ‘epistemic fallacy’ or “analysis or reduction of being to knowledge of being” (Ibid, p. 1). This can be seen in the knowledge systems of studying climate change, where climate models can often reduce whole living ecologies to their CO₂ emissions. CR offers an approach that accounts for these social dimensions of knowledge while also staying true to the material realities of the problems, acknowledging the “enormity of the unknown and the unproven: the world does not correspond to our knowledge of it” (Cornell & Parker, 2010, pp. 27–31). Being cognizant of this has helped me stay grounded and ‘critically realistic’ about what this investigation can and cannot do when addressing the complex phenomenon and how it will be investigated.

While CR does not provide a method, it helps broker this work's analytical and synthetic movements. It offers a structured view of reality nested at multiple levels—a *necessarily* laminated system or totality (Bhaskar & Danermark, 2006, p. 280). Since it also accommodates the plurality of ontological approaches, CR affirms that design and designing can be helpful in this task. So, I am also playing with and through CR as much as a designer possibly can, as though one might with any design material.

Within such a laminated, structured view of reality, one can be conscious of the direction and context of explanatory research and be methodologically capable of navigating between levels that can be ontologically plural and possibly maintain epistemological clarity. Thus, having understood the laminated totalities of *what-is*, one can also ‘move’ to new laminated systems of *what could-be*. This thesis's interpretation of a laminated system is operative in many dimensions, sometimes explicit, implicit, and tacit, traveling through real and imaginary worlds and guided by a simple research question.

5 For example, economic models vs. real-world indicators of development, or Ergonomic guidelines that are used for good design practices, but are ultimately based on and biased towards certain privileged groups and extrapolated as a universal practise. Elsewhere, this is also clear from how an overreliance on knowledge production for climate change, which without the appropriate action, has created a form of policy paralysis where more knowledge of the phenomenon has not corresponded with complementary action.

1.3. THE RESEARCH QUESTION AND ANALYTICAL APPROACHES

This research exploration leads with the following question:

“How can Industrial Design enable the imagining of more radically hopeful futures in the context of long-term sustainability?”

As far as research questions (RQ) go, this formulation seems banal and far too open. The RQ has remained unchanged over the past four years. This formulation has allowed this investigation's ‘unfolding’ generative nature to present itself. On the one hand, the challenge of a more open RQ is that it leaves a broad set of answers to choose from and can end up in an open inquiry one can never intellectually contain or stabilize. Thus, any solution could just ‘fit’ and be claimed to have answered the question. On the other hand, posing a precise question assumes that one knows precisely where to look for answers, thus allowing for a focused deep dive. In the pursuit of precision, it might just be that one reaches the same set of answers that seem to have been tried before.

While this framing can be construed as self-justifying, it is essential to understand that the question is designed to be generative, aid in a creative synthesis, and does not intend to prove or predict what this future will be. The more crucial thing here is understanding what this type of research question is devised for, situated within the concerns and needs of a ‘designerly’ study that seemingly does not have a client or any specific user group in a future that doesn't yet exist and thus cannot ‘speak back.’

To begin, I will briefly consider the RQ a design brief and try to unpack or de-brief it. In this designerly de-briefing, I will read between the lines of the brief and understand what is needed to answer it. One way to do this is to unpack the RQ into its constituent parts, starting with the most comprehensive frame of all—*long-term sustainability*. Having asked the question, one can try to understand the heaviness of the question. Can one realistically comprehend long-term sustainability without understanding what we are trying to sustain?

Moreover, to talk of sustainability thus also requires that we know the context of the urgency and magnitude of the climate crisis, its leading causes, and the contexts and forces of a system that continues its trajectory intact and leads us further into unsustainability. To do this, one must then ask why it was that, having known the nature of the crisis and given the need for urgent action, why it was that emissions continued as though the knowledge of the emergency didn't exist. What then were these forces of denial and delay, intrinsic and

extrinsic, that ensured a paralysis of the imagination such that climate action remains inadequate concerning the task at hand and instead continues Business as Usual (BaU)?

This further requires an investigation into what BaU is, which in this context is a multi-dimensional system that constitutes our economic and industrial systems which continue to plunder the life-sustaining biosphere in the pursuit of mass consumption. The climate crisis, then, adequately understood, upends our expectations for the *future* as it brings an uncertain future for organized human life. This means understanding the forces of development and progress, at least how they relate to this unknown future.

In this chain of inquiry, one must also encounter the challenges of what would happen if these trajectories do not change. This further implies the necessity for understanding what kinds of short-term or long-term futures can be made under these conditions if nothing radically changes and if things *do* change. The IPCC reports clearly articulate the former; the latter remains unknown. In this unknown-unknown there remains the possibility of a *radically hopeful imagination*.

For this reason, one might begin confronting design's institutional legacy, particularly in this case, *Industrial Design* which has been complicit in furthering unsustainability while either being oblivious to the responsibility or claiming otherwise. Therefore, given as our visions of the future have mostly resigned to self-fulfilling prophecies of climate dystopias, the question comes down to—*what can design do?* This question, of course, presupposes that design can do anything at all. In a crucial sense, this question also presupposes the possibility of hope that the design discipline has something to say, despite the evidence being very sparse.

Lastly, I make way for the last element of the RQ—*the how?* If design, Industrial Design, could do something, how would it go about it? Given its present configuration, the evidence is scant; but what then should design become, that is, what new frames should it operate under to enable the imagination for better futures? However, since there is no way to prove the future, one can reimagine this 'how-to' be a 'what-if' question—*what if* Industrial Design could already imagine far more radically hopeful futures? What would the structural conditions need to be for this to be true and what would become of our social reality if this were possible? This is where thinking and acting through/by design emerge, even how theories are developed.

1.4. A DESIGNERLY WAY OF THEORIZING

The way designers work with theory is quite different from how other disciplines might. In *Making Design Theory*, Johan Redström posits that “the concern for change seems to drive designers toward methods, which may lack in terms of theory development but is compensated for when it comes to methods which are intentioned to support processes of change, as they explicitly relate to the temporal and the unfolding, whereas theory traditionally builds on the stable and the constant” (2017, p. 27). Elsewhere, Birger Sevaldson points out that while design research is not merely problem-solving, in the process of reconciling and negotiating design knowledge through ‘multi-layering’ of knowledges, it may be riddled with ‘fuzzy’ and, at times, inaccessible theoretical frames (Sevaldson, 2010, pp. 16–17).

This characteristic temporality of theory, which Redström has termed Transitional Theory, is made through design (2017, pp. 1–2, 31). In this sense, the theoretical, conceptual structures are investigated, structured, explored, and expressed through the design activity and, in Redström’s words, are “literally made by hand” (Ibid, p. 3). This fluid theory is a conceptual tool that allows for creatively ‘playing’ with concepts, just as designers play with the material conditions—to aid in synthesis.⁶ In terms of research activities, rather than being plugged in at the far end, the design activity is at the forefront of the research question. Thus, as previously discussed, while the transitionality of theory can be limited to inspiration and annotation, they are meant to serve as scaffolds for the creation of artifacts which are “the definite facts” of research through design (Ibid, p. 12).

Sevaldson describes what can be called ‘Research by Design,’ as a “special research mode where the explorative, generative and innovative aspects of design are engaged and aligned in a systematic research inquiry” (2010, p. 11). For him, ‘Research through Design’ involves ‘design practice’ for generating new knowledge (Ibid, p. 11). Nonetheless, there remains much confusion about what these terminologies mean in actual research or practice, a combination of both Research Through Design and Research by Design would fit the nature of this investigation. Sevaldson notes that this knowledge production differs from

6 For instance, in this thesis, there are many theoretical concepts borrowed from many disciplines, from climate sciences and social sciences to evolutionary biology, from political sciences, anthropology, archaeology, engineering to philosophy. These are being interpreted and played with quite freely to generate speculative future worlds and ‘alternative nows’ (as Redström would put it) and are not a precise understanding of how theories are defined or as intended in their original formulation.

design practice, research in/for design practice, and even the conceptions of what we consider practice in design (2010).

However, given that many of these domains of knowledge are constantly in flux between design practice and research, the semantic questions can be overwhelming since I am not entirely engaging as a designer who happens to do research and nor a researcher who happens to do design. I want to bring forward this fluidity to explain what value this approach brings as opposed to others, which, while being formidable, since not all design knowledge is empirical or even explicit, has been valuable for generating this work. Thus I will here try to integrate both Redström and Sevaldson's insights and call my approach 'Research through/by Design' as expressed in the title of this thesis. This thesis can be considered an example of this Research through/by Design.

In this definition, research knowledge is still pursued 'by' engaging with the design activity which comes to the forefront and new knowledge is illuminated, 'through' the solution spaces generated 'by' designing—as a design researcher would.⁷ While it is true that many of the theoretical developments seen in a design inquiry cannot always be disseminated in the written word alone, one cannot merely play with words to claim a new definition of design and designing. It is helpful to remember here the weight of the challenge as Redström describes it, “to actually redefine design, we need to present new designs, new projects, and new programs that, as they come together, offer a different understanding of what designing could be like” (2017, p. 42). Furthermore, even if the interpretations are faulty, these transitional theoretical frames might remain useful in generating “concrete images of the potential” (Ibid, p. 25).

With that said, I will discuss how I make of this approach to design research by Redström and Sevaldson and embrace the fluidity of transitional theories. ReFuturing, therefore, is a transitional theory I have constructed here for this design research which I will expand on later. In the following pages, I discuss how I apply this approach to traveling between *what-is* (P₁) and *what could-be* (P₂) paradigms. In Act II, the fluid and transitional scaffolds allow for a structured investigation of P₁ and P₂. This is the foundation upon which the creative brokering (*what-if*) of this research's analytical and synthetic aspects become tacit and embodied in the artifacts. In the following pages, I will describe the concepts that aid in these transitional movements and develop

7 In other words, the 'theory' shapes 'things' and 'things' in turn shapes 'theory' contained within a design research process; both are made 'through' design and 'by' designing.

an understanding of and between the nested laminated layers of the two paradigms. I begin this layering with optical metaphors, move to ecological analogies, and travel further to higher levels, slowly building more human ways of understanding and acting through this research. These might ground and orient the reader in this fluid and transitional space of an unfolding research journey.

1.4.1. ON USING METAPHORS AND ANALOGIES

Donald Schön most famously popularized the notion that designers are reflexive practitioners who, over the course of a design process, construct design worlds for themselves in working with a material situation (1992). Though Schön was talking of a reflexively developed design world, reflection suggests an optical metaphor, which I have borrowed to engage with this aspect more self-consciously. Donna Haraway, on the other hand, is suspicious of reflexivity and reflection being applied as a critical practice which “displaces the same elsewhere” and considers it “a bad trope for escaping the false choice between realism and relativism in thinking about strong objectivity and situated knowledges in technoscientific knowledge” (Haraway, 2018, p. 16). Instead, she would prefer ‘diffraction’ as the more preferred metaphor, if the effort was to make a difference in the world.

However, the use of optical metaphors might tend to reduce or flatten the complexity of the context of designing for long-term sustainability and the complex phenomenon of climate change. Thus, one cannot solely rely on optical metaphors. One can then move up a level higher and consider a more living, ecological analogy to complement understanding for a higher level of reality. In *The Mushroom at the End of the World*, the anthropologist Anna Tsing offers an appropriate ecological analogy that might be useful here. Tsing proposes that we think of intellectual life through mushrooms (2015, p. 286). I would paraphrase her proposed analogy and translate it here to think of this scholarly work as a peasant woodland, a source of many valuable outcomes emerging in intentional design, where one might find many helpful products. As a ‘forager’ in this creative woodland, I encountered the landscape in the knowledge space I mapped out early in the PhD (Figure 2a) which was an early look at where this work could go.

However, much of the knowledge produced quickly expanded beyond maps or what could be made explicit and thus, what you encounter here with this thesis and the artefacts can be considered the fruiting bodies of the hidden mycelial network (Figure 2b). At the same time, this research ‘mycelium’ under the soil

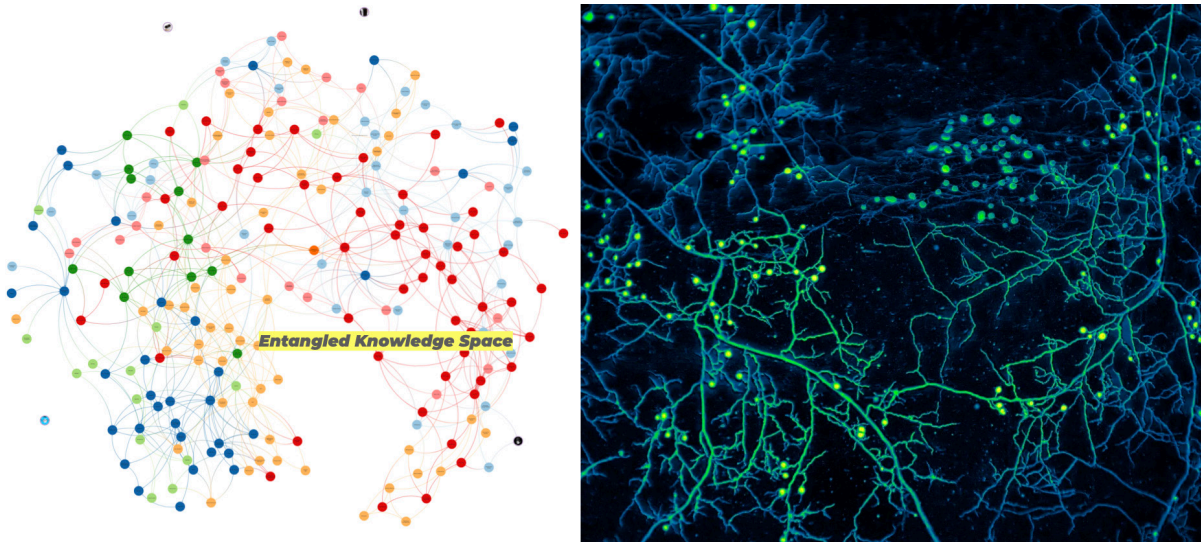


Figure 2. a) On the left is the network mapping of the entangled knowledge space from early in this Ph.D. project. (b) The right image shows a high-resolution image of Mycelium networks in soils. Image Credit: Loreto Oyarte Galvez

has been cared for by many encounters with other ‘species’, working in common to create the possibilities of unfolding and reconfiguring and making new connections as the possibility for a new ecology of disciplines that have been imagined to be part of this abundance.

Such a living, ecological analogy allows this thesis to speak of more systemic, networked relationships rather than mere research data, enriching the conceptual frames discussed here rather than confusing them. While it is sensible and practical to reduce the overwhelming complex phenomena of climate change to make it more manageable, there remains a danger of reducing the mycelium for its mushrooms and the forest for its trees. Nonetheless, metaphors are, by definition, untrue and, together with analogies, inherently reductive and thus require a more inclusive, more rehumanized understanding—bringing the human back into steering this research activity.

1.4.2. ON SELF CONSCIOUS PLAY AND THE STUDIED IMAGINATION

At this stage, I want to introduce a characteristic of this investigation, briefly alluded to earlier, that can often be hiding in plain sight—serious play. I believe the notions of ‘playfulness’ in this design research have been a ‘serious’ endeavor in practicing a studied imagination to creatively broker the broad spectrum of known-knowns and unknown-unknowns this work has traveled. This playing with seemingly far-flung and wide-ranging conceptual landscapes has been strategic to weave and negotiate the movements between the “particular and the

universal,” which, as Redström reminds us, can often be hard to pin down (2017, p. 35).

The aim here is to be least reductive given the context of this research, and the levels of reality it has engaged with, this playfulness embraces the spectrum between the particular and the universal and keeps the conceptual landscape open to see what emerges. At this point, I would like to identify the entire spectrum of the conceptual tools available to aid in understanding—from optical metaphors to ecological mycelial analogies to the domain of critical realist laminated totalities, that might get us closer to the possibility of human agency in the ‘real’ world and discover the unknown-unknown that is the future of long-term sustainability and all the ways in which they might be known.

This research intends to lift up the broad spectrum of conceptual movements being played with here—a continuum of living encounters at the different levels of knowledge and action nested between the known-knowns and unknown-unknowns. They are presented here in the illustration in Figure 3. The known-knowns here are the deep disciplinary knowledges of design and designing, and the unknown are places this work might need to travel to so that preferred

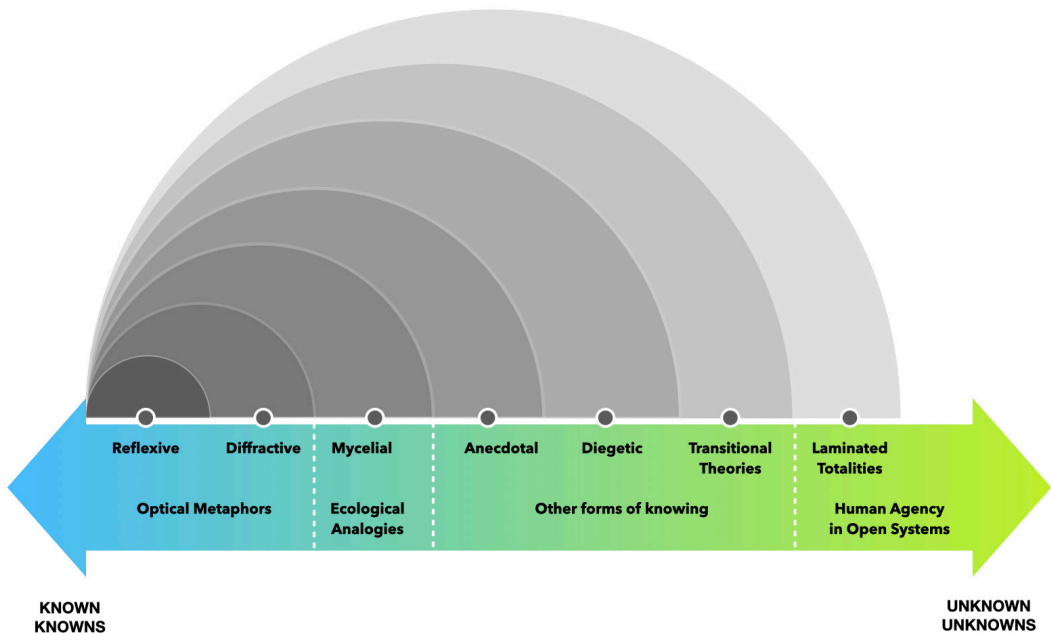


Figure 3. Self-Conscious play and the Studied imagination: moving across the spectrum of the known knowns and the unknown unknowns using dimensions of metaphors, analogies, human, and laminated totalities that unfold through human agency, from levels that can be knowable to the unknown.

worlds may emerge. It shows the range of reductive concepts engaged with and used to make sense of and creatively broker new synthetic arrangements and generatively unfold these paradigms. This illustration is a structured approach articulated at different levels of reality, which shape how this unfolding has occurred. Therefore, what is being attempted here is a move to go beyond the data-information-knowledge-understanding-wisdom of P₁ (the *what-is*) in relation to the new data-information-knowledge-understanding-wisdom of a more desirable structured reality of P₂ (the *what could-be*) that is emergent.

As a design researcher, I am 'seriously' playing along this continuum by freely reclaiming and moving between them through/by design (*what-ifs*). Paraphrasing Nelson and Stolterman, I employ design and designing to relate this non-existing reality of P₂ to the present reality of P₁ (2012, p. 124). Hence, the artifacts are more than mere thought experiments. They are the instruments for opening conceptual portals or 'worm holes' to other preferred worlds just enough to make them thinkable and doable (Figure 4).

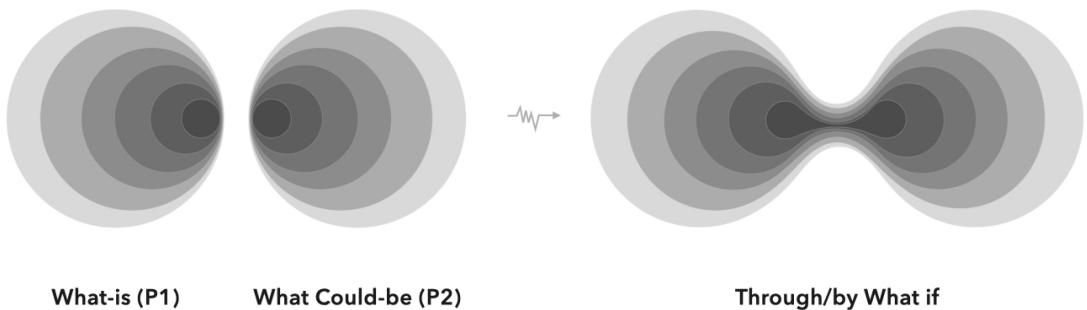


Figure 4. Worm-holing from the what-is (P₁) so that what could-be (P₂) emerges through/by the designerly what-ifs.

The illustration in Figure 4 represents a relational playing between these structures and realities of paradigm such that P₂ creatively emerges from P₁ via the conceptually transitional and unstable worm-holing through/by what-ifs. In this creative brokering, which I describe as a 'studied imagination,' generative design activities are at the forefront of research inquiry as the conceptual scaffolds for 'inter-paradigm' travel through/by the designed artifacts.

In the next chapter, I will present the methods and tools I use to develop and prepare the disciplinary scaffolds for this ambitious worm-holing between structured realities.

2. Research Methodology

In this chapter, I discuss the methods and tools specific to this investigation of the seriously playful, studied imagination that I have used to wormhole through and construct the unknowns of paradigm P2 in a designerly way. As mentioned, I employ Research through/by Design as a praxeology for this studied imagination, where the design activity comes first. For this investigation, I apply methods and practices that I am already familiar with and have trained for as an Industrial Designer. This serves as a point of departure for the wide range of generative design activities at the forefront of this investigation manifesting in the various artifacts.

While I discuss them in more detail later in this text (section 5.1.3), I will briefly mention the artifacts that enable this worm-holing here. The artifacts in question are spread across three themes—energy, soil, and water. For the energy theme, the artifacts are— a volumetric fabrication device for organic batteries (biomA), volumetric optical solar cells, and energy harvesting devices for ritual energy harvests. For soil—forest seeding devices for agroforestry practices, 'firefly' autonomous seeders for old-growth ecosystem regeneration, and Symbiotic Fabrication Pods for symbiotic manufacturing. Finally, for water—Biominerlisers for biomining, 'rainmakers' for harvesting atmospheric rivers and making artificial glaciers, and electrified carbon-negative reefs for coral regeneration (see 5.1.3. and Appendix for more).

Before discussing how these artifacts were generated, I will point out that I had already developed some the concepts and artifacts of energy theme such as 'bioma,' the volumetric solar cells, energy ritual device, and one from water, like the rainmaker devices before this Ph.D. and the rest of the artifacts were explicitly designed for this investigation. This research exercise took these established concepts and reimagined them to relate to other artifacts enriching the shared paradigm of P2. In the following pages, I will present the methods that helped generate these artifacts of P2 through/by design.

2.1. GENERATIVE RESEARCH THROUGH/BY DESIGN

To generate the research artifacts through/by design, I use Speculative and Critical Design (SCD) as popularised by the works of Anthony Dunne & Fiona Raby (2013). Simply put, SCD offers a conceptual framework for 'dreaming up' or designing alternative futures that challenge traditional modes of designing that provoke engagement and discourse. Dunne and Raby propose posing *what-if* questions to open up alternative future visions that may or may not be desirable. By taking a critical look at alternative futures and future imaginaries, they engage in alternative futures, not of how things are but how they *could be* (Ibid, p. 3).

SCD articulates a form of constructive design research where design activities and design probes are the core research activities designed to provoke discourse around designed artifacts (S. Bardzell et al., 2012; Malpass, 2017). As an approach to design research, SCD practice relies on designed artifacts as 'research probes' to evoke provocation, requiring the viewers to suspend disbelief and let their imaginations wander to make a "world of ideas rather than objects" (Dunne & Raby, 2013, p. 3). SCD thus often draws from art, design, architecture, cinema, and photography, pulling threads from other fields such as futurology, political theory, social anthropology, the philosophy of technology, synthetic biology, computational science, and literary fiction (Ibid, p. 3).

While it doesn't propose a specific method, SCD provides an approach to create and provoke discourse through designed artifacts that are focused on creating the possibility of discourse around the alternative futures such that we understand the present better, make reality more malleable, and be ready to allow for desirable futures to emerge (Ibid, p. 6). This approach has been an established mode for investigating possible alternative futures in design research and their implications for today (J. Bardzell & Bardzell, 2013; Malpass, 2017). However, as mentioned already, since I am using Critical Realism to structure and critically look at these approaches to speculation, this discussion will extend beyond the artifacts as the objects of knowledge. This exercise aims to go beyond constructing these artifacts for provocative discourses and developing them into solution spaces as I will explore later.

Furthermore, given that this research aims to address an important and socially relevant topic, I have tried to apply and be inspired by methods other than SCD that guide and articulate action beyond discourse. For this task, I use a speculative (fluid) interpretation of Participatory Action Research (PAR), as discussed by Kemmis & McTaggart (2005), reconfigured here to put the design research upfront, which may imagine new participation and hopefully lead to

future actions. The 'action' from the design point of view is, at many levels, to reimagine forms of collective action and imagination, arguably 'stuck' in more ways than one. The design research here also imagines possible participatory climate actions that might be needed to aid future efforts and how the worldview might change in that process. I will use design fiction, fictionalized research, and diegetic prototypes to support this speculative foreshadowing of climate action.

2.1.1. SPECULATIVE DESIGN FICTION AND DIEGETIC ARTIFACTS

The Open Journal of ReFuturing is a speculative design fiction. In simple terms, a design fiction centers around the deliberate use of designed artifacts to suspend disbelief about change and build the world that could-be and open a conceptual space for discussion and building fictional worlds (Coulton et al., 2017; Lindley & Coulton, 2015b). In a design fiction, the artifacts are predominantly based on the logic of the diegesis or narrative world as though it were part of everyday life. The artifacts that support this diegesis or narrative are called 'diegetic prototypes,' a term popularized by David Kirby (2010).

Although Kirby's definition of the diegetic prototype was first discussed in the context of cinematic storytelling, the concept has traveled and informed many disciplines, and has been very popular in SCD practise. While the notion of diegetic prototypes is diverse and broad given the range of fields¹ that use speculative fictional narratives to provoke discourse around an issue, the application of diegetic prototypes/artifacts within design differs. While a film or science-fiction might use designed artifacts and their performative nature to support their diegetic or narrative logic, it is often not central to the story. In contrast, designers use diegetic artifacts as the principal protagonists around which the diegesis pivots or change is imagined. The point here is to imagine alternative futures through the designed artifacts to make the diegesis of a desirable future that doesn't exist in relation to what does.

To elaborate on the discussions from 1.4.2, this investigation uses diegetic prototypes or diegetic artifacts here in a more specific capacity to wormhole through the worlds of P₁ and P₂, where they generate the world of P₂ in which

¹ For more on diegetic prototypes and their original description see Kirby (2010). For world building in film production see (McDowell, 2019). For the use of design fiction in film and television see (Wille, 2015). For Speculative fictions in climate science communication, see Radical Ocean Futures project from Stockholm Resilience Centre, which uses fictional world building through science fiction prototyping (Merrie et al., 2018). For World-building in Future Studies and other science fiction practices see (Zaidi, 2019).

they live *and* relationally shape the artifacts in the world P1. Thus, in this case, the diegetic prototype is negotiating and creatively brokering *two* diegetic realities, P1 & P2, the *what-is* and the *what could-be*, and building a conceptual wormhole between them. These diegetic artifacts thus creatively broker these unstable and transitional realities such that one suspends disbelief about change from one to the other. Thus in this sense, the diegetic artifacts developed here *emerge* from this creative negotiation between these structured worlds in the alternative now, which I elaborate on at the end of this thesis (Act III).

The artifacts are not final solutions but more unstable conceptual 'solution spaces' that outline the proposition and can be considered to possess a more archetypal quality to illuminate a broad conceptual space from which possible better solutions might emerge. The SCD approach I use here uses design fiction to generate these artifacts and 'backcasts' them to imagine what alternative solutions, strategies, or policies might be needed to make this future possible today, as I have discussed elsewhere (Joseph, 2019 in appendix). For developing the design fiction for the journal, I have used playful games like Futures Poker,² which I already have experience with from earlier (Figure 5 next page).

Many such tools and methods for playing with future scenarios are well-known in the fields of SCD and Future Studies. Essentially they serve as an intellectual tool for triggering *what-ifs* that support the development of the fictional world of design fiction. The game is played by combining four cards that describe a social, technical, economic, and ecological context, and the player has to imagine and write or draw a solution space and scenario in four minutes that amplifies or undercuts those triggers with the time and place fixed. This differs from random brainstorming and is more akin to 'brain-sailing' for a studied imagination towards preferred shores.

Since I sought preferred futures, I was constantly directing what was desirable and what wasn't—not everything that could be imagined needed to be fabricated or realized. The cards also helped speed up the scenario-building process and support the early what-ifs for solution spaces simultaneously which would then be developed and researched into. It's worth noting that these cards were biased both in their construction and application but also designed to 'short-circuit' some biases that typically one might have of, say, techno-optimism, policy perfectionism, or even pessimism of socio-economic change.

² This card game was originally developed by the now defunct London-based studio Strange Telemetry, here modified to suit the purposes of the themes in question, which I had already worked on in my Master's diploma thesis. See (Joseph, 2018).



Figure 5 Starting point of *The Open Journal of ReFuturing*, playing with modified Futures Poker for building future design fiction scenarios.

One of the game's features is that it quickly generates a scenario every four minutes. Over time and with practice, one can develop many diverse yet rich scenarios that generate more desirable future directions. In this case, the multiple generated scenarios were narrowed to nine distinct future scenarios. These 9 scenarios were later developed and clustered into three themes of soil, water, and energy, each consisting of three scenarios that could be woven into one cohesive thematic narrative while preserving the solution spaces themselves, as illustrated in Figure 6.

As mentioned already, the artifacts of the energy theme and one for the water theme had already been conceptualized or fabricated earlier. Their common task was to fit into the diegetic world of P2. Eventually, there emerged three design fictions, each consisting of three solution spaces, generating nine solution spaces. These themes were not always predetermined but emerged through parallel literature analysis and systems mapping activities, which are not presented here for pragmatic reasons. Thus, this investigation's playful, generative nature is apparent in how even complex worlds can be possible from seemingly simple starting points, as long as one is conscious of what the tools are meant to do (Figure 6).

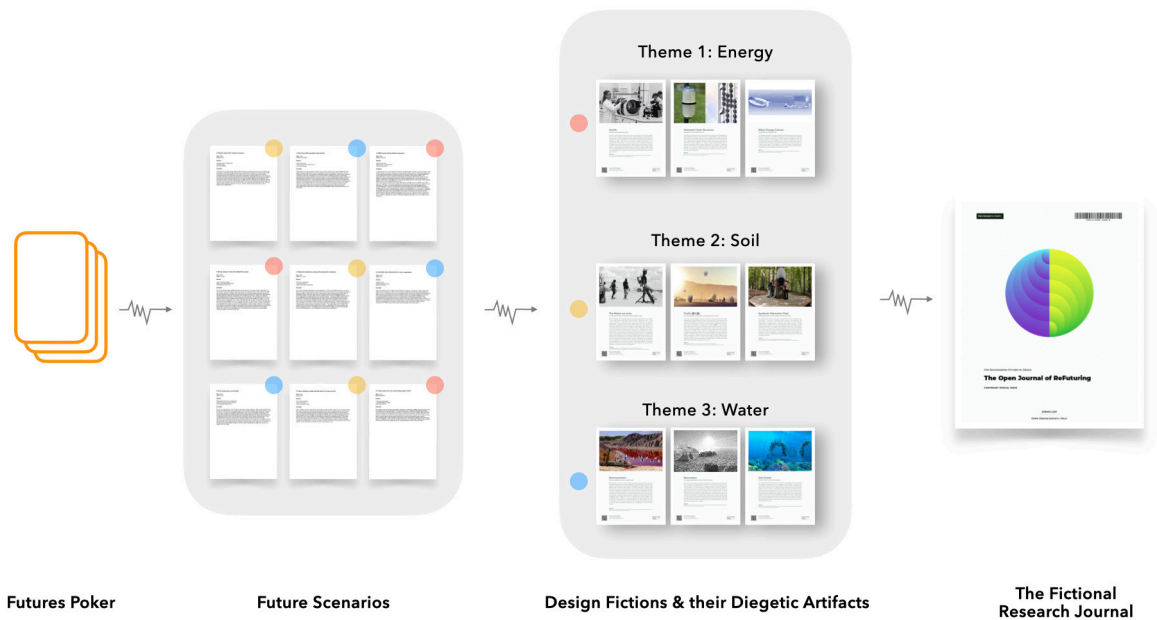


Figure 6 From Futures Poker to quick fictional scenarios and clubbing them into themes and relating the themes and solution spaces for carbon negative futures eventually into the journal.

However, what is important to note is that the cards provoked speculations based on existing studies to imagine new contexts and their solution spaces where they might be needed. Thus one might speculate on technologies that could be based on technical papers but project them onto a unique social scenario generated from a different study. Over time and intending to create the design fiction, this process generated the diegetic artifacts and their future worlds, which would later be condensed into the fictional journal. In the following pages, I will briefly discuss why a fictional research journal was chosen rather than any other format.

2.1.2. SYNTHETIC CASE STUDY: FICTIONALIZING DESIGN RESEARCH

Initially, the plan was to develop each design fiction and their corresponding artifacts in simple narrative form and send them to journals or present them at conferences as separate publications, as is familiar to scholars like Joseph Lindley & Paul Coulton, who have previously discussed the challenges in disseminating such research (2015a). Given the generative nature of the research, the solution and diegetic spaces were constantly leading an ever-growing mycelial knowledge space. With the restrictions of the Covid pandemic,

academic life and the fabrication of these artifacts were also disrupted.

Given these peculiar constraints to both dissemination and fabrication, I decided to reimagine dissemination and fictionalize some aspects of my research—to present these once short narrative design fictions as fictional research papers from an imaginary research journal from the future (P₂), which would be ‘diegetically’ appropriate for the future academic culture it would live in, related to the one today (P₁). Lindley & Coulton have discussed their fictionalized research paper written as design fiction, its possibilities, and ethical considerations one may want to consider in applying such a method of inquiry (2016).

Thinking, acting, and being a ‘design researcher’ made me speculate on a design journal from the future where these fictional papers could live. This journal from the future would live and enrich the diegesis of the paradigm P₂, in which these fictional design research papers would be published, even imagining its previous editions and academic traditions. A reasonable timeline was chosen, just outside the zone of predictions where the IPCC’s climate models end at 2100AD. The year 2131AD was selected to be slightly out of reach of the IPCC models because they predict precisely what would happen if things don’t change, and the intention was to change in concrete ways and imagine a radically different future. The fictional researchers who write in the journal in 2131AD are documenting their findings, looking back at the state of the world in 2022AD.

This future worldview seems just as alien from our standpoint as our current worldview that these imaginary descendants are studying. According to the narrative, this design journal is a centenary special issue, marking the launch of the journal’s first issue in 2031AD, coinciding with the rough timeline of when IPCC asserts fossil emissions drastically drop for 1.5°C (although the latest science says it should be much faster).

Since this world-building is not an empirical exercise, the aim is not to prove the future but to envision a different yet desirable future. To the best of my abilities, I have maintained a cohesive frame of secondary literature references and complemented them with the concepts to address those challenges in the journal. You will encounter many of them in Act II. I will discuss in the next section how this world of P₂ became ‘real’ and tacit through diegetic prototypes.

2.1.3. TACIT WORLDBUILDING THROUGH DIEGETIC PROTOTYPING

As mentioned earlier, this development emerged from the knowledge I already had learned and developed from previous exercises. I applied it to generate and creatively broker the other artifacts within the same diegetic world, weaving their diegetic and conceptual connections between and across other themed chapters and their artifacts. I want to present in the following pages a brief self-conscious look into what the late polymath Michael Polanyi described as the 'tacit dimensions' of knowledge (1966). I want to discuss an approach that Industrial Designers have given their disciplinary training and articulate this self-conscious process here which will be based on the artifacts that were fabricated solely for this Ph.D., as seen in Figure 7, and have been documented more thoroughly in a 360-degree walkthrough in the appendix.

To conceptualize and fabricate any designed artifact is not a linear process; no design process ever is. Being an Industrial Designer oriented design processes to make the design fiction real and tangible enough to be fabricated through



Figure 7. Some of the thematic diegetic artifacts fabricated specifically for this thesis: Left: Forest Seeders for regenerating Old-growth forests (soil); Centre& Right: Biominering cartridge for biomineraliser. Biomineralizer for biominering minerals symbiotically with microorganisms (water). For more, see 5.1.3 and the appendix.

and by design. Developing the wormhole for moving between worlds requires movements between the artifact-diegetic dichotomy that require many fluid assumptions that are hard to pin down at any given moment.

Here, I embraced this fluidity as a feature of this research journey by, paraphrasing Schön, employing my training of various other 'designerly' senses and modes of movement that are necessary given the materials of the situation (1992, p. 5). Here the tacit dimension of one theme was necessary to develop the solution and diegetic space of another by reconfiguring their mycelial connections across space and time through the diegetic artifacts and the shared world they would shape and live in.

However, even from a familiar starting point, it is unusual in design practice to have such a wide frame to play with, and it can paralyze the creative process or relegate it to abstractions. Even when playing with research, such an open frame can often lead to unending *what-ifs* that can span far and wide, covering dizzying grounds, and leading to questions that, even when situated and embodied throughout the process, can wander forever. Nonetheless, this constant unfolding could still be managed and cultivated within the scope of this work. This is best explained in the form of a personal anecdote.

An Anecdote for a Generative, Studied Imagination

The following anecdote is meant to offer a glimpse into how the studied imagination, observation, and experience in fabricating these artifacts have assisted in my world-building. On numerous occasions, I had to travel to buy a single screw (Figure 8), this was quite frustrating, but over time, I would let the speculative mindset take over and continue the process of world-building where this problem would be solved.

So, for a screw, say, it might be a matter of production, consumption, and distribution. I wondered about logistics and started negotiating with the diegesis—what conditions would enable the fulfillment of material needs in a fossil abolition context; what might happen if the global supply chains that rely on fossil fuels today were different; how different might they need to be? What would the conditions be for specific technologies, socio-political movements, economic systems, and ecological shifts emerging from this world if the world were serious about tackling climate and ecological crises? Would a screw be any different if this happened?

This is better illustrated by reconstructing an internal self-conscious world-building dialogue, as I often found myself doing when making trips to the

hardware store for that solitary screw. It went something like this:

“What would an extraction policy be for resources to be produced, who would care for the material processes, would they be extractive, or would they be persuasive like the Neolithic practices? Would they be sustainable or ecologically destructive? Could there still be toxic materials used in manufacture, or would it be reasonable to apply them in low quantities? Who would care for the materials that get made? Would it be enough to satisfy needs? What about desires? Would economic policies reflect that fulfilment? How would people enjoy this process in the process of participation? What social or climatic conflicts might emerge, and how might they be tackled? What conditions of needs fulfilment would allow for that, that may also become sites of social play? Would we still need experts? How would new knowledge get produced? Would these sites of new knowledge disseminate knowledge? Would journals still exist? Would predatory journals or patent trolls still exist? How would this new knowledge get produced, what would be a research program that allows for that, and how would it affect the development of a technological culture if some cultures went about pursuing it or not?... What would the world need to be for this to be the case?”

...and so, it unfolded...

The point of this self-conscious speculative exercise is to suspend disbelief and imagine and embody the possibilities of moving between P1 and P2 in the here and now through design and designing. Thus, this diegetic logic would then be backcasted to today to understand the conditions for which the fictional future research would be ‘true’ as imagined and the prerequisites for which it would

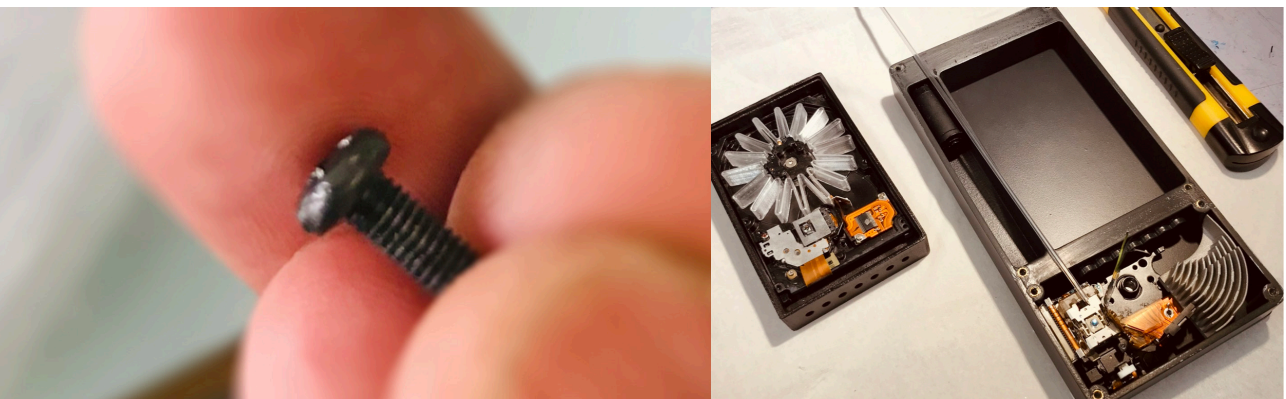


Figure 8. Inter-Reality worm-holing with diegetic artefacts. Left: The Screw that got away. Right: The biomineraliser cartridge it eventually generated.

be possible to fabricate these artifacts differently. Thus, the speculations were being reflected, diffracted, generating *what-if* questions of their own and being backcasted from such that whole material ecologies could be speculated. This required that I suspend disbelief about the changes and allow for the constant unfolding and the places it might lead to, as seen in Figure 8.

This is a cognitively tumultuous process, as the knowledge and solution spaces are unstable and constantly moving, even though thematically fixed. Moreover, this only describes the *internal* dialogue of the process, not accounting for all the other *external* conversations and experiences that shape the holistic approach. Nonetheless, these are thought experiments in action, grounded by the most relevant studies I could find that either verify or discredit the presupposition or generate more *what-ifs*. Undoubtedly, these questions can be asked by anyone if one can find enough factoids about the world. Although doing it well and being critically conscious of what is being imagined requires practicing a studied imagination. That is why designers use many creative strategies to manage and develop their processes. One is, after all, dancing with ideas.

With this in mind, it is time to move on and explore the outcomes of such dancing and the worlds they make, the *What-is* (P₁) and the *What Could-be* (P₂), through the wormhole of *What-ifs* in the following three phases of Act II.

ACT II

The Journey from What-is to What Could-be

3. The What-is: Defuturing & Dehumanization

I will begin this first phase of Act II with *The What-is* (P₁). In the following pages, I will develop defuturing and dehumanization as the essential characteristic of the paradigm P₁—a worldview that colonizes all other worlds and distorts what it is to be human. Understanding this complex challenge necessitates the development of an explanatory framework to explore the values, knowledge, worlds, and things that defuture and dehumanize.

Defuturing is loosely borrowed here as Tony Fry defines it, as the negation of world futures for human and non-human others (1999, p. 12). Dehumanization is the distortion of the vocation of becoming 'fully' human, as defined by the late philosopher Paulo Freire (2014, p. 18). For Fry, the cultures of design and designing have been enthusiastic agents of colonizing the possible future of humans and non-human others, and it is by design that defuturing materializes a 'characteristic' anthropocentrism at the heart of the climate crisis (1999, p. 12). In contrast, I use Freire's conception of dehumanization to suggest that what design does and what it has become is better understood within a larger historical and systematic project of dehumanization and the crisis of imagination it brings.

These will only be a partial transitional discussion to understand the levels of defuturing and dehumanization manifesting in the paradigm P₁. The many concepts, contexts, and phenomena I have drawn on here cover much ground—spanning social, political, economic, ecological, history, technology, and climate science and holistically addressing the question of design and sustainability.

These discussions ultimately serve as conceptual scaffolds for navigating this totality and investigate the conditions for which such defuturing and dehumanization occur in P₁ as necessarily laminated and what might be learned to prepare for the journey to P₂. I will begin this investigation by discussing what is at stake with the urgent crisis of climate and ecological breakdown.

3.1. A CIVILIZATION IN CRISIS

“Global GHG emissions in 2030 associated with the implementation of nationally determined contributions (NDCs) announced prior to COP26 would make it likely that warming will exceed 1.5°C during the 21st century. Likely limiting warming to below 2°C would then rely on a rapid acceleration of mitigation efforts after 2030. Policies implemented by the end of 2020 are projected to result in higher global GHG emissions than those implied by NDCs.”

— IPCC AR6 Working Group III, in the approved *Summary for Policymakers Report* (2022, SPM-15)

On June 23rd, 1988, Dr. James Hansen, then director of NASA’s Institute for Space Studies, gave his famous testimony to US Congress Senate Energy and Natural Resources Committee, stating in no subtle terms that the greenhouse effect “is changing our climate now”. At the time, Hansen’s testimony allowed climate change to enter the political arena as politicians, corporations, and environmental organizations acknowledged and began to address this issue (Brulle, 2018).

Eventually, 165 nations signed an international treaty, the United Nations Framework Convention on Climate Change, leading to the Paris Agreement in 2015. None of the signatories so far have fulfilled their goals since. This failure to fulfill climate goals makes the above statement from the IPCC AR6’s Working Group III reveal a more insidious problem behind the neutral language. The Nationally Determined Contributions, agreed upon by nations in the form of the Paris Agreement, are well on their way to exceeding 1.5°C over the 21st century.

The question of a 1.5°C and 2°C hotter world can seem too abstract to come to terms with. Why does this difference matter? Half a degree or even two degrees of warming sounds negligible enough for a summer afternoon of, say, 27°C. However, the same difference in average body temperature of 37°C is between Hypothermia (below 35°C) and Hyperthermia (above 38.3°C). For human body temperature to break these thresholds is the difference between life and death. This illustration stands somewhat analogous to the state of the planetary ecological and circulatory systems habitable for human civilization, which is seeing unprecedented extremes due to human forcing.

Since Hansen’s testimony, there has been no doubt as to the human-induced forcing of the climate system—global warming observed today is unprecedented

in the last two millennia, and the links to human actions are now indisputable (Figure 9). The cause of this excess warming, accounting for natural cycles, the IPCC asserts, is down to human influence on the climate systems (IPCC 2021, AR6 WGI, SPM-7). Thus, hiding behind these figures of warming is instead an existential question for organized human life.

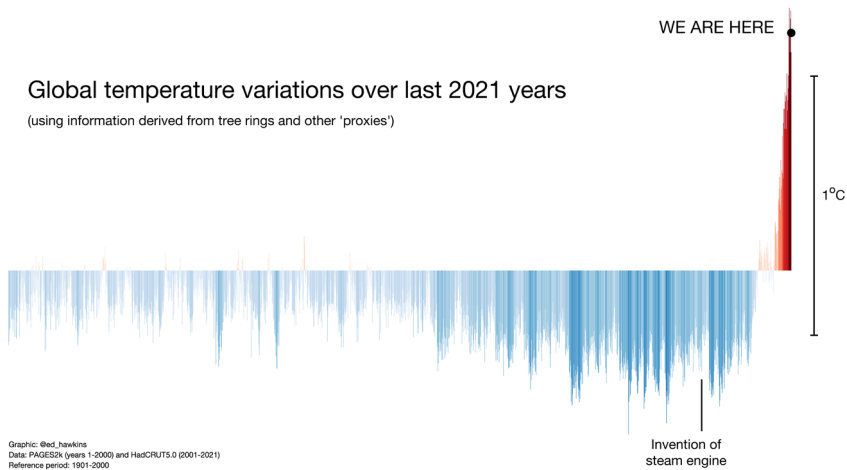


Figure 9. Observed Unprecedented Human Influence on Global Warming. Image: Prof. Ed Hawkins (National Centre for Atmospheric Science, University of Reading).

Crossing the 1.5°C and 2°C thresholds might erode the optimal climatic foundations of civilization as we know it by triggering climate tipping points, food systems collapse, accelerating mass species extinctions, and increased global pandemics, to name a few. Thus, when the IPCC says that the NDCs proposed are inadequate for the challenge, one should take note of this assessment. As the UN General Secretary noted recently, the climate crisis affects every human on the planet, “Half of humanity is in the danger zone, from floods, droughts, extreme storms, and wildfires. No nation is immune”, as reported by environmental correspondent Fiona Harvey (2022d).

Every aspect of life will change in response to the crisis, some more than others. If what is known as “Business as Usual” (BaU) continues, warming will force the planetary ecology into a new state. If, on the other hand, global climate actions can be executed at the scales recommended by the IPCC, whole systems change, and the paradigm (P₁) of BaU changes. The question of change is indisputable. Whether this change will be by mitigation, adaptation, and climate justice, a

long-drawn-out maladaptation, or by multiple climate tipping point failures remains an open question (Lenton et al., 2019). What is also apparent in the scientific assessment is the scale and speed at which profound shifts need to occur, calling into question the very foundation on which human civilization as we know it rests.

3.1.1. MAGNITUDE AND URGENCY OF THE CRISIS AND ACTION

The IPCC AR6 reports paint a comprehensive yet 'bleak' picture of the climate emergency (Harvey, 2022a). However, it also points to the specific causes of the problem of Global Warming, which requires rather specific conditions to occur. The IPCC AR6's first Working Group report (WGI) identifies this as 'human-caused radiative forcing' that has warmed the climate system. This heating is primarily, among many factors, caused by accumulating Greenhouse Gas (GHG) concentrations in the atmosphere (IPCC 2021, AR6 WGI, SPM-13). The most egregious of them is the anthropogenic emissions of carbon dioxide (CO₂).

Thus, the *magnitude* of the challenge comes into focus. Figure 10 illustrates the scales at which this task needs to happen. The total share of fossil fuels in the global energy supply has grown dramatically since the 1940s. The question of clamping down on fossil fuel emissions has to also address the consumption capacities that increased in the same period. This period saw the material conditions for modern life develop over many decades through various economic regimes, transforming the definitions of everyday life in their wake.

According to the reports, there is a near-linear relationship between cumulative anthropogenic CO₂ and the global warming they cause (Ibid, SPM-36). Atmospheric CO₂, a significant contributor to global warming, was higher in

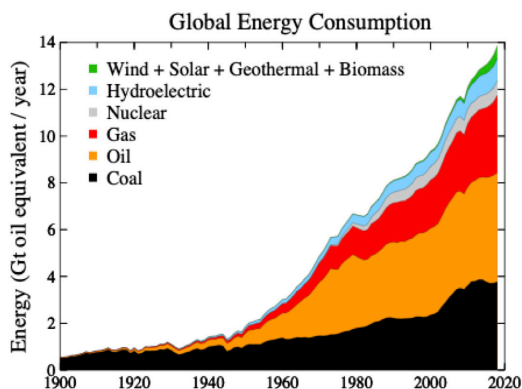


Figure 10 Magnitude of Global Energy consumption, notice share of combined renewables growth in relative terms that do not replace fossil fuels but add to total consumption. Image: Hansen (2020).

2019 than in the past 2 million years (Ibid, SPM-9). Thus, while the planet may have seen higher CO₂ concentrations since its formation over billions of years, human civilization has not seen CO₂ levels this high. Furthermore, of the total anthropogenic CO₂ emissions, the contribution from the combustion of fossil fuels has grown dramatically between 2010-2019, while land-use change accounts for the rest (Ibid, TS-46).

Thus, as things stand, human forced global warming directly results from large parts due to fossil fuel emissions from industrial and economic activity. The prescription to avoid catastrophic climate breakdown is to stop GHG emissions immediately, which, as mentioned earlier, the current national pledges, as they are, will be inadequate for the task. Notice here that the promised transition of renewables is just one fraction of the total energy use, and while accelerating, it is adding to the cumulative pool of global energy consumption, which is far more substantial. In Figure 10, the scales of renewable energy needed to decarbonize global energy use would require *replacing* the existing fossil fuel infrastructure and clamping down on total energy consumption. One thing is clear, however, that fossil fuel extraction and consumption capacity will need to collapse, which implies fossil abolition and non-proliferation, which can significantly change everything on its own.

However, this transformation, fortunately, or unfortunately, also will need to be rapid which illuminates the more critical question of *urgency* with which these transformations need to happen (Figure 11). A 1.5°C world remains possible if the emissions drop immediately, which seems like a steep drop, almost falling off a precipice. Even limiting warming to below 2°C will require rapid

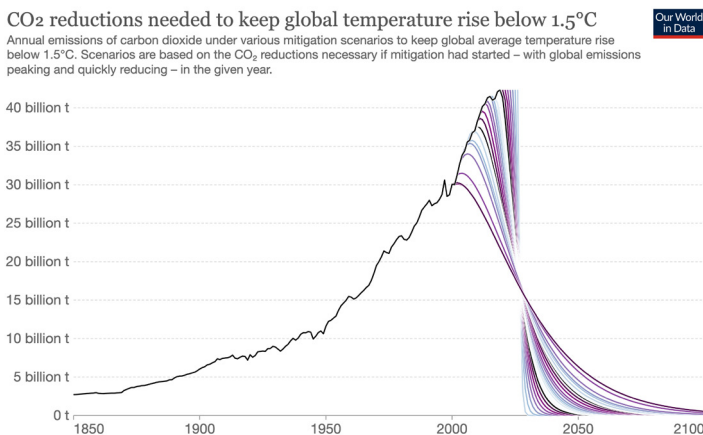


Figure 11 Urgency of Action needed to curb CO₂ for 1.5°C that will shift paradigms. One can think of this as P₁ before emissions reduction and P₂ after emissions reduction. Image: Our World in Data

acceleration of mitigation efforts after 2030. However steep this paradigmatic shift might be, it leaves a question worth asking—can this be done intentionally and by design for a much smoother landing?

For this to happen, one might need to look beyond the framing of these issues in terms of CO₂ emissions. The ecological philosopher, Karl Høyer argues, there is a tendency to discuss the more significant issues of climate, energy, and environment as reduced to their CO₂ emissions (2010, pp. 35–36). He points out that the contemporary discourse on climate change is saturated with this CO₂-reductionism. While reductionist view helps makes the problem simple to grasp, an overreliance on it also separates the crises from the real world, flattening the complexity of the climate crisis. Critical as CO₂ may be, it can hide the wickedly complex phenomena that it is a symptom of, one that interacts at many levels of reality. One way to expand this understanding further might be to understand it in terms of overreaching planetary thresholds (Figure 12).

Scholars have pointed out that, as things stand, the anthropogenic forcing of the planetary boundaries far exceeds the safe operating limits of the planet (Persson

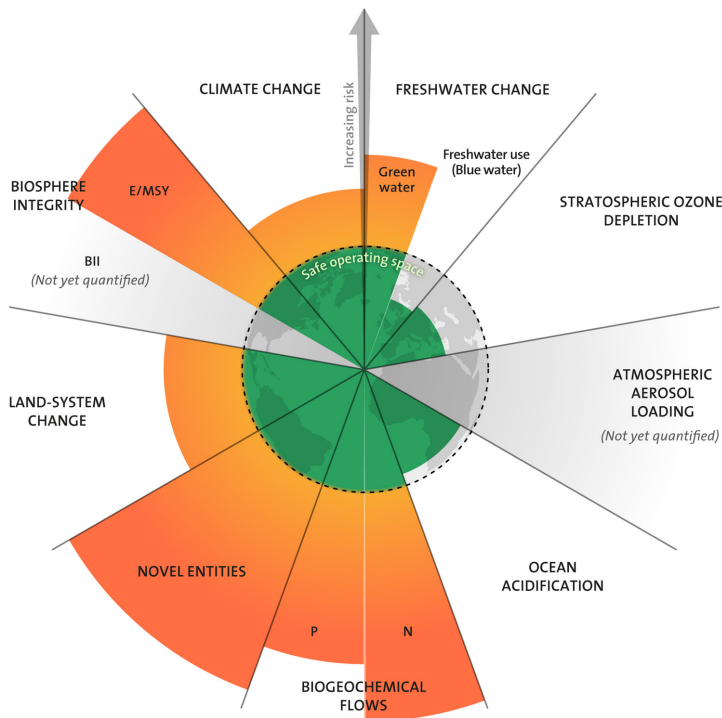


Figure 12. Beyond Planetary Thresholds: Pushing the safe limits of the carrying capacity of the planet. Image: (Wang-Erlandsson et al, 2022)

et al., 2022; Wang-Erlandsson et al., 2022). Therefore, while Figure 9 points to the explicit, undisputed links of human-induced warming, Figures 10 and 11 show how delicate the optimal conditions for human civilization are, and the trajectory they are on now has never been experienced in the history of human civilization before. IPCC is no longer being alarmist in stating that the scale of the crisis is enormous and wide-reaching, and the window of opportunity is narrowing fast.

The scale of the challenge needs an adequate response at scales and urgency never seen in recorded history. For climate scientists like Katherine Hayhoe the stakes are unimaginably high, “our infrastructure, worth trillions of dollars, built over decades, was built for a planet that no longer exists” (Harvey, 2022b). She lays out succinctly a frank but sobering view—“If we continue with business-as-usual greenhouse gas emissions, there is no adaptation that is possible.”

3.1.2. CLIMATE INACTION AND DISCOURSES OF DELAY

One would then assume that statements of climate scientists would be taken seriously with the weight of their proclamations. If the stakes have been this high for so long, it begs the question—why then haven’t we bent the emissions curve? What we see instead, is more than half of all anthropogenic carbon emissions have occurred since Hansen’s testimony over three decades ago, than in the entire history of the human species (Stoddard et al., 2021; Wallace-Wells, 2019, p. 4). In Figure 13 one can see this bewildering fact as a legacy of failed climate leadership and action.

Since the first IPCC report, every climate conference since 1979 has done little to prevent the emissions from climbing. Emissions thus continued to rise in full knowledge of the crisis than in ignorance of it. The UN General Secretary’s statement is understandably blunt when he laments that “we continue to feed our fossil fuel addiction” even as the choices are clear—“collective action or collective suicide” (Harvey, 2022d). Yet, the unprecedented scale and urgency of the crisis have not seen an adequate scale and urgency of action; instead, proposals for actions have faced immense inertia, opposition, and further entrenched inaction and delay.

In *Discourses of climate delay*, Lamb et al. identify the discourses of climate delay and inaction seen today (2020). They categorize these discourses into four categories: “(1) redirect responsibility; (2) push non-transformative solutions; (3) emphasize the downsides of climate policies; or (4) surrender to climate change”

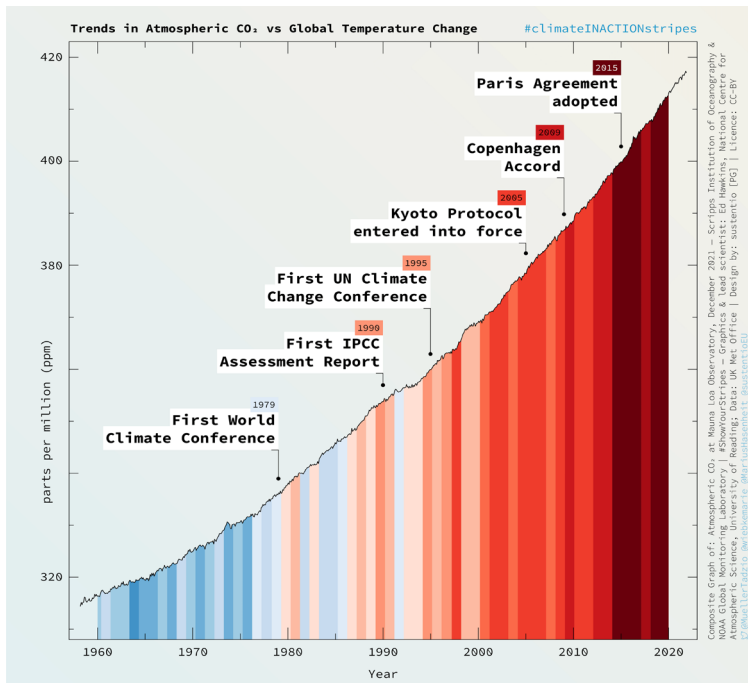


Figure 13. The Line keeps going up—Climate Inaction over the past half century. Image: Mueller Tazio, Wiebke Marie, Marius Hasenheit, SustentioEU [PG]

(Ibid, p. 1).

In Figure 14, the authors map out the most egregious and subtle forms of discourses of climate delay that accept the calls for addressing the climate crisis but then justify inaction instead. As the authors summarize, these discourses lead to doubt, obscuring responsibility and amplifying “negative social effects of climate policies and raise doubt that mitigation is possible” (Ibid, p.1). These discourses of delay they claim are distinct from “climate denialism, climate-impact scepticism and ad hominem attacks, but are often used in combination to erode public and political support for climate policies” (Ibid, p.1).

The detailed unpacking of each aspect of delay lies beyond the scope of this discussion, but something to note is that this mapping shows how genuinely complex delay discourses can make the lack of action sound justifiable. A part of this delay may be because when the climate crisis gets reduced to mere CO₂ emissions, it gets disconnected from the context in which the threat materializes.

Hence, there could be more to climate denial and delay than one can account for here. One might try to understand them in terms of the systemic conditions

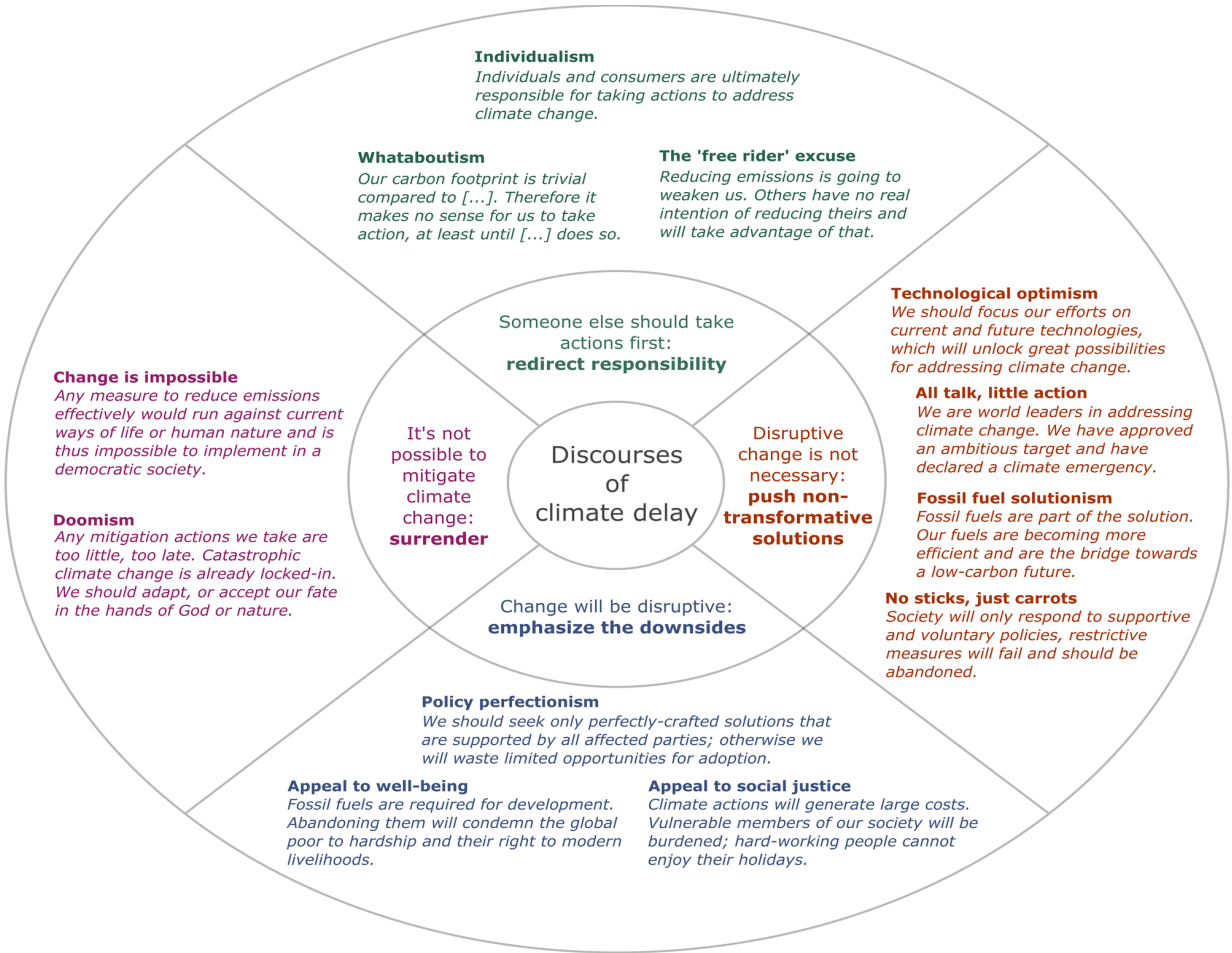


Figure 14. Discourses of Climate Delay. Image: Lamb et al., (2020)

that may necessitate climate delay and denial. At this stage, I want to focus on one of the most significant forces of continued climate delay and climate denialism—the fossil fuel industry.

3.1.3. THE WAGES OF DENIAL AND DECEPTION

In the face of overwhelming scientific evidence, it is reasonable and conclusive to state that climate denial is science denial. If one takes this notion seriously, the fossil fuel industry has done more to sow denial and doubt about the

climate crisis than any other institutional actor.

The industry was at the cutting edge of climate science as early as the 1970s, almost two decades before Hansen's testimony, and knew climate change was a threat to organized human life (Bonneuil et al., 2021; Hall, 2015). Despite their own studies showing overwhelming evidence, the industry and its benefactors decided that it would instead pump their resources to sow doubt in the public mind inspired by the tactics of the tobacco lobby and got the public to think that the science of climate change was unsettled and thus debatable (Bonneuil et al., 2021; Hall, 2015; Oreskes & Conway, 2011). Even CO₂ reductionism played well into the hands of the industry, which invented the fable of 'individual carbon footprints' to deflect their institutional responsibility onto consumers (Kaufman, 2020).

Over half a century then, these institutions strategically pursued sophisticated campaigns of public and policy disinformation, resisting and dismantling any regulations for accountability, and further deflected and delayed policies aimed toward decarbonization (Lerner, 2019; Monbiot, 2019b; Westervelt, 2019). These efforts to deny the crisis and delay climate action were remarkably successful and profitable. According to recent estimates, these companies and their shareholders have secured unfathomable profits, about three billion dollars a day, over the past 50 years (Carrington, 2022b). Strangely, the public also underwrites its own deception by subsidizing these fossil institutions at an estimated 11 million dollars a minute (Timperley, 2021). One can be mistaken to overlook how sophisticated *and* profitable this mass operation of public deception truly is, which might explain why it continues, even if its overwhelming scope and reach are only just coming to light.

In *The New Climate War*, climate scientist Michael Mann discusses the aggressive tactics used by the fossil fuel industry to encourage people toward what he calls 'climate inactivism' (2021). While, fossil fuel institutions are anything but inactive, it helps them that civil society is. As climate deniers and delayers, their strategy has been that of engaged participants, acting steadfastly to hinder and block climate action at each step¹ only occasionally conceding some ground in other spaces as they reap record profits. Left unchecked, these institutions' planned fossil emissions output for the coming decades far exceeds the global

1 The largest delegation at the 2021 Conference of Parties (COP26) was of fossil fuel executives. The participant list published by the UN was found to have 503 people with links to fossil fuel interests had been accredited for the climate summit according to Global Witness (McGrath, 2021). The number of fossil fuel lobbyists has been even higher in 2022 (COP27).

carbon budget and would be a ‘carbon bomb’ for the planet, pushing it over the precipice (Carrington, 2021b; Carrington & Taylor, 2022). It might not be surprising then that there is a wave of palpable anger even in the usually sober diplomatic spaces, as aptly expressed by the UN secretary-general António Guterres:

“We seem trapped in a world where fossil fuel producers and financiers have humanity by the throat. For decades, the fossil fuel industry has invested heavily in pseudoscience and public relations—with a false narrative to minimise their responsibility for climate change and undermine ambitious climate policies.”

– António Guterres, UN Secretary General, (Harvey, 2022c)

These institutional actors nonetheless hold unprecedented power over the fate of planetary ecosystems. However heinous their actions might be, even accounting for the staggering profits accumulated by fossil fuel institutions and their benefactors, it would be negligent to dismiss the conditions that allow for such impunity to occur in the first place. It would be to miss the forest for the trees. It is rather fitting then, to follow up Guterres’ speech at the White House and highlight certain revelations about such centers of power that have only recently come to light.

In the revealing book, *They Knew*, James Gustave Speth, the former Chair of the US Council on Environmental Quality in the Carter Administration, documents what the US Federal government did and did not know about the climate crisis since the 1970s and what it actively did and failed to do (2021). His expert testimony relates to the federal lawsuit, *Juliana vs United States*, currently in the US Supreme Court where young people have filed a class-action lawsuit against the US Federal Government for failing in its constitutional duties. In his testimony, Speth presents the evidence and concludes that the US Federal Government *did* know of the basic science of climate change since the 1970s, and even earlier. They knew that the continued indiscriminate burning of fossil fuels caused climate change and would lead to climate catastrophe. Despite this knowledge the public institution ignored the mitigation pathways recommended by experts to transition away from fossil fuels and instead promoted the development of fossil fuels economies globally.

The US Federal govt leased oil fields, researched the early studies for fossil fuel extraction, signed off on extraction permits, and enthusiastically advocated for its global adoption. They deliberately supported the development of a fossil-fuel economy not just for itself but also for promoting the use of fossil fuel capacity

development globally. Furthermore, when the crisis became undeniable, they lobbied to weaken the content of the UN Framework Convention on Climate Change (UNFCCC) in 1992 (Speth, 2021, p. 79). Even after negotiating to weaken the content, they made climate commitments that were never honored (Ibid, p. 81). According to Speth, these actions violated the fundamental constitutional rights of the young plaintiffs and thus actively and knowingly endangered their future (Ibid, p. 157). He concludes that what transpired over the following decades was more akin to “government malfeasance on a grand scale” (Ibid, p. 5).

One might, therefore, rephrase Mann’s words to understand better now that it was not merely constitutional inaction or “inactivism” but, as Speth would describe it, it was willful, affirmative, and concerted action to interfere with climate actions, sowing doubt and interfering with the climate science (Ibid, p. 107). The national actors benefiting from such fossil fuel use, often called ‘petro-states,’ promised to transition away from fossil fuels only to further entrench the world deeper into fossil fuel dependencies. These willful actions locked the developed economies into a fossil fuel-based economic system and, given the geopolitical hierarchies, practically ensured that the so-called developing countries were locked into the trajectory of high fossil emissions. Thus, climate action was sabotaged well before it got off the ground.

It is impossible to know how much time society has lost or how institutionally ingrained denial and delay is today given these actions that endangered everyone on the planet. Nonetheless, what these revelations suggest is that these forces do not occur in a vacuum. Despite the ubiquitous nature of climate misinformation and denial, a growing body of scholarship describes the human choices that went into making fossil capital come about as it did, not merely an accident of history. Shocking as these revelations are, they reveal a more insidious nature of the crisis that requires a deeper, systemic level of understanding of the modern fossil fuel economy driving the engine of the climate crisis emerging from the socio-economic system of capitalism and colonialism.

3.2. ON CAPITALISM AND COLONIALISM

“Vulnerability of ecosystems and people to climate change differs substantially among and within regions (very high confidence), driven by patterns of intersecting socio-economic development, unsustainable ocean and land use, inequity, marginalization, historical and ongoing patterns of inequity such as colonialism, and governance³¹ (high confidence). Approximately 3.3 to 3.6 billion people live in contexts that are highly vulnerable to climate change (high confidence). A high proportion of species is vulnerable to climate change (high confidence). Human and ecosystem vulnerability are interdependent (high confidence). Current unsustainable development patterns are increasing exposure of ecosystems and people to climate hazards (high confidence).”

– IPCC Working Group II in *Summary Report on Impact, Adaptation and Vulnerability* (2022, SPM-12)

It is not often that the term colonialism is mentioned when talking about Climate Change, since it seems like a future crisis to mitigate and adapt to. It is not nearly as often that the IPCC comes out and states it as explicitly as it has in their latest assessment reports. Nonetheless, the citation above is arguably an acknowledgment that sets the historical context for why certain communities are more vulnerable to the climate crisis than others. It is a testament to how hidden, unacknowledged and erased the legacy of colonialism is in relation to the climate crisis.

Furthermore, the Guardian columnist George Monbiot observes that there seems to be an implicit taboo in calling out the socio-economic system that emerged from this historical context and continues to oversee the continued denial and delay of climate action—global capitalism (Monbiot, 2021a). It is perhaps for this implicit taboo of the relations between capitalism and colonialism that it took so long for the IPCC to include colonialism in its report after decades of advocacy (IPCC 2022, AR6 WGII, SPM-12). To understand climate crises today is to understand the structural conditions that gave rise to the crisis.

Since fossil capitalism, much like European Colonialism that preceded it, remade the world in its own image, it calls for a more inclusive reading of the intimate relationship between the two. For this reason, it requires an investigation into why these systems are necessary for having caused the inequality of emissions and, discounting for geographical and cultural differences, the vulnerability of some nations more than others. What the following pages will explore is the nature of this relationship.

3.2.1. THE STOLEN WEALTH OF NATIONS

In *Capital and Imperialism*, economists Utsa Patnaik and Prabhat Patnaik point out that to understand capitalism is to look at its contextual history and requires an understanding of the forces of extractive imperialism that preceded it and shaped it (2021). From a purely fiscal point of view, the extraction was not inconsequential either. An earlier estimate by Utsa Patnaik concluded that the British empire financially extracted about \$45trillion at current rates out of India over two centuries, and used it to fund its development and further its colonial ambitions (Sreevatsan, 2018).

Elsewhere, sociologist Gurinder K. Bhambra has argued that the post-war welfare state in Britain “coincided with the systematic dismantling of the British Empire but was also significantly shaped by the empire that preceded it” (2022, p. 4). The author points out that the studies of this post-war emergence of the welfare state in Britain was built upon the economic and political subordination of the needs of its former and remaining colonies to secure the financial health of the British state at the time (Ibid, p. 13).

Despite this, during the 60s and 70s, the economic anthropologist Jason Hickel documents in *The Divide*, the decolonized sovereign nations of the 'third world' were defining development on their own terms and were remarkably 'catching up' to the Global North on many indicators of well-being (2018, p. 21). This was the 'third' alternative to social development and made a significant statement of intent. The so-called Neoliberal era threatened to undo it all.

As Patnaik & Patnaik clarify, this period is often confused as a state vs. market dichotomy, and they clarify that it was, in reality, a “change in the nature of state intervention” (2021, p. 267). Neoliberalism, the authors argue, was, in effect, a “reassertion of imperialism” by creating income deflation for the working people of the so-called Third World to stabilize capitalism’s inherent structural crises. It took aspects from preceding colonial mechanisms and its Keynesian alternative that pursued aggregate demand through state intervention (Ibid, pp. 262-263).

This change in state intervention would allow for a change in how resources were distributed in society and how the exploitation of colonized people was now carried out using complex financial mechanisms of international debt, structural adjustment programs, political coups, corruption (assisted by offshore

tax havens and secrecy regimes), transfer pricing, and other institutions.² The global inequality we see today was created such that rich nations continued to loot the poor ones (Hickel, 2018a; Monbiot, 2021b). Thus, Monbiot points out that the great fortunes amassed under capitalism relied on “looting, monopoly and rent grabbing, followed by inheritance” (2021a).

This context thus sets the stage for how the IPCC AR6 reunites CO₂ to the historical responsibility of emissions between nations—not all carbon emissions are created equal (Figure 15). A cursory look at the historical and present emissions reveals how the emissions are largely the historical responsibility of overconsumption of a few actors (IPCC 2022, AR6 WGIII, SPM-11). According to IPCC, 10% of global households with the highest per capita incomes contribute 34-45% of global consumption-based household GHG

The countries with the largest cumulative emissions 1850-2021

Billions of tonnes of CO₂ from fossil fuels, cement, land use and forestry

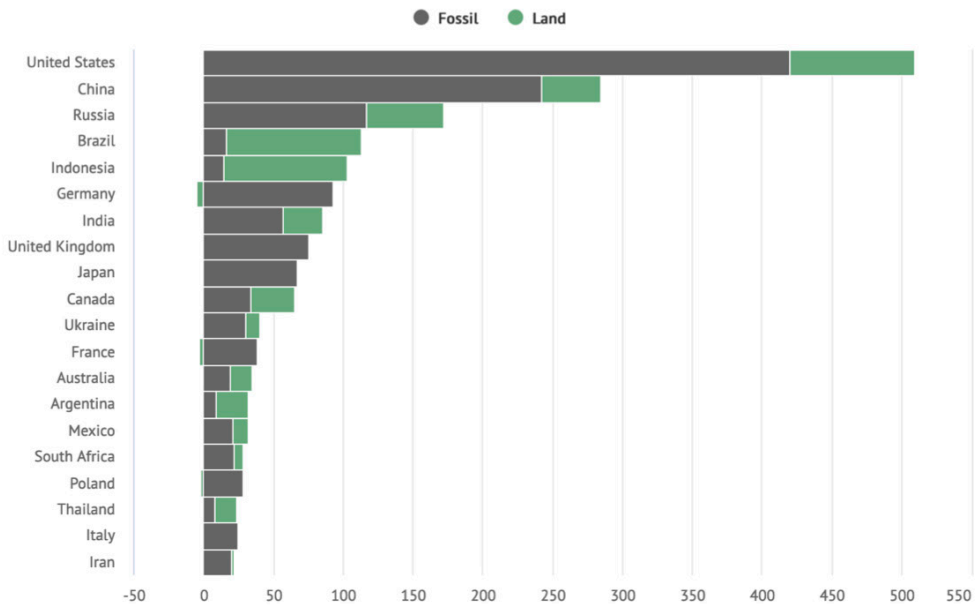


Figure 15. Inequity of historical Carbon Responsibility. Image Credit: Carbon Brief. (Evans, 2021)

2 Worth a mention here is the instrumentalization of financial coercion, through institutions like the World Bank and International Monetary Fund that would restructure global debt relations causing the third world debt crisis and created austerity programs to extract from the Global South. These arrangements in effect turned back the many gains made by decolonization. See Hickel (2018) for a more thorough discussion.

emissions (Ibid, SPM-9). The ideal recipe for economic development had been promoted by rich nations to be synonymous with economies of scale and high consumption powered by cheap fossil energy as it unfolded in the post-war period.

Thus, the race toward sustainable well-being and development was never fair to begin with, and this often becomes a bone of contention when climate goals are negotiated. The so-called developing countries point out that the historical responsibility of emissions is on the rich countries far more than the poor. They question whether the burden of carbon reductions and historical responsibility of such unsustainable consumption should be equally shared by the poor countries.

Given this global inequality of emissions, there is much debate and tension between sovereign nations and is often a bottleneck in climate negotiations when the so-called ‘developing’ world asks how they can be expected to lift themselves out of poverty without pushing the world into dangerous global warming (Mathiesen, 2014). These tensions were most presciently articulated by the late Indian Prime Minister Indira Gandhi, whose speech at the plenary session of the UN Conference on Human Environment (UNCHE) in Stockholm in June 1972:

“On the one hand the rich look askance at our continuing poverty, on the other, they warn us against their own methods. We do not wish to impoverish the environment any further and yet we cannot for a moment forget the grim poverty of large numbers of people. Are not poverty and need the greatest polluters? For instance, unless we are in a position to provide employment and purchasing power for the daily necessities of the tribal people and those who live in or around our jungles, we cannot prevent them from combing the forest for food and livelihood; from poaching and from despoiling the vegetation. When they themselves feel deprived, how can we urge the preservation of animals?”

— Indira Gandhi, Former Indian Prime Minister speaking at UN Conference on Human Environment (UNCHE), Stockholm on June 1972 (Mahapatra, 2022)

Eventually, this idealized, narrow model of development recreated in the Global South, socio-economic hierarchies that would privilege few. This would also structure the consumption habits of these groups, driving economic growth often similar in character to the Global North. We see this disproportionate distribution and responsibility of consumption and emissions today (Chancel

& Piketty, 2015). While there is enough reason to celebrate some of the real progress in the quality of life in some areas, the climate crisis has brought profound vulnerability to the Global South in the long run and the more long-term questions of social and ecological well-being remain. What we call development today may have come at too high of a price to pay.

3.2.2. ON SUSTAINING UN-DEVELOPMENT AND IN-EQUALITY

In *The Nutmeg's Curse*, author Amitav Ghosh points out that ecologically destructive development through industrialization in the Global South was being resisted on two fronts, externally and internally, but for different reasons. The external resistance came from the colonizing nations in the Global North to subdue alternative decolonial developments and the internal resistance came from the diverse, powerful indigenous resistances within these nations (2017, p. 150). Ghosh discusses for the Global North this alternative Third World development was a threat to the prescribed notion of development what it had it expected the Global South to follow.

To resist these prescribed methods of development invited trouble. He argues that if any country chose to follow its own trajectory of development, not only did it face outright aggression, but it could also face economic sanctions, be cut-off from international trade, and even faced coups against its democratically elected leaders (Ibid, p. 22). Thus, one can read in Gandhi's earlier speech a vision of modern post-colonial development forged under the colonial era, which seems understandable since, after all, it clearly worked for the benefit of nations that got rich from exploiting their natural resources.

At the same time, one can also sense a challenge to the patronizing idea that it is the poor nations who are responsible for pollution and should now hold back their development or to even attempt alternatives. There was a sense that one could only 'stage' development in a preordained linear path along which some nations, communities, and peoples were ahead and some were relegated to always catching up. This staging reproduced similar structural inequities and ecological crises in the image of the Global North to achieve this narrow view of development. It also reveals a more apt response to an implied expectation that poor countries should remain poor and achieve the kinds of ecological grace that the rich countries did not practice at all for themselves or those it exploited.

On the other hand, to her credit, Gandhi was prescient enough to point out the vulnerability of the indigenous poor, populations that remain the most vulnerable to climate change. Today, the IPCC (WGII) report acknowledges the

increased climate vulnerability to unsustainable socio-economic development. The report attributes it to the historical and continued intersecting patterns of inequity, such as colonialism that the Indigenous Peoples and local communities face that lead to substantially different patterns of the vulnerability exposed to drastic climactic shifts (IPCC 2022, AR6 WGII, SPM-12). The report further points out that “this vulnerability is exacerbated at different spatial levels by inequity and marginalization linked to gender, ethnicity, low income, or combinations thereof, especially for many Indigenous Peoples and local communities” (Ibid. SPM-14).

Therefore, the inequity and vulnerability these communities face today also call for pause and reflection on the less-acknowledged second form of resistance to neo-colonial development—Indigenous Resistance. In India, for instance, these environmental resistance traditions have had a long and vibrant documented history, often led by indigenous peoples (Gadgil & Guha, 1994). The various indigenous movements resisting these policies were not naïve but understood the costs of such extraction and chose to resist with alternatives, asserting their critiques and offering alternatives to such development.

However, in the same breath, perhaps not intentionally, the speech also demonstrated a dehumanizing view of the indigenous cultures and peoples as defilers of wild natural resources—internalizing and perpetuating a neo-colonial mindset. Thus, it became justifiable to believe that it was the impoverished indigenous people holding national development hostage rather than challenging these conceptions of what it meant to be developed—a legacy leading to indigenous erasure. The perception of indigenous people as despoilers of vegetation and lands was rather customary in settler-colonial discourses of conservation—viewing nature without its people.³

It is also rather striking today that those standing in the way of this ambition for reaching the ideal stage of development are forest-dwelling indigenous Adivasis, as Ghosh argues that colonialism is “first, foremost and always” about the land (2021, p. 231). These lands were labeled as ‘undeveloped resources’ first, and the Adivasis who occupied and are stewards of the lands and forests were deemed, by their very presence, as barriers to exploitative development (Ibid, p. 231). He observes that there seems to be a strange sense of history repeating

3 Thus, if the actions of fossil fuel companies that pillage indigenous lands in the Amazonas (Nenquimo, 2020); or whether nation-states break indigenous treaties for building fossil fuel pipelines (Lakhani, 2021; Spiegel, 2021), it cannot be understood or be possible without this sense of history, and the ongoing global settler colonial programs (Cagle, 2019).

itself where nations in the Global South, such as India, are “now striving to remake itself in the image of settler colonialism” (Ibid, p. 231).

In that light, one can get a new sense of infantilization in Gandhi’s speech about the indigenous poor. Ironically, it is the indigenous alternatives that are today being acknowledged as critical sources of wisdom and inspiration for climate action and planetary stewardship today (Gardner et al., 2022; Ødemark, 2019; Whyte, 2017). Therefore, contrary to ideological conceptions, Indigenous People were not merely passive bystanders, having done the least to cause the crisis, but were at the forefront of the resistance to colonization, actively critiquing and resisting unsustainability and ecological destruction.

At this stage, one may question whether the lessons of development, preceded by and premised on colonial and extractive mechanisms, ever fulfilled their claims. Here, it is important to point out how one defines human development and well-being to make sense of these developments. The ecological economist Robert Costanza calls for a better understanding of the challenges to sustainable human well-being, which needs to account for disruptions caused by climate upheavals (Costanza, 2010). Going further, he calls on distinguishing between “real poverty in terms of low quality of life, and merely low monetary income” (Ibid, p. 138).

Furthermore, one may borrow the economist and philosopher Amartya Sen’s perspective in terms of hunger and starvation. He would define starvation as “the characteristic of some people not having enough to eat, not of there not being enough food to eat” (1981, p. 1). In the present food distribution systems, people go hungry because they cannot afford a nutritious diet.⁴ This impoverishment coincides with the fact that global food production has reached unprecedented abundance in human history and still remains unaffordable for most people who effectively need it (He et al., 2021; Holt-Giménez et al., 2012).

Elsewhere, Hickel points out that poverty and hunger once measured in real

4 Here, Hickel has pointed out the problem with how hunger is understood by calorific and nutritional values; calories cannot be understood as a good measure of nutrition because they cannot account for disease and nourishment in real terms. As a policy it can cause harm. If one is poor, one is often selling their manual labor and thus requires more nutrition and still be undernourished, leading to further spirals of poverty. See Hickel (2016) for a more thorough discussion.

terms⁵, may have worsened since 1981 (Hickel, 2016). In this context, the ‘feel good’ ideological claims of progress as a march to civilization hide a dark side of global development which ultimately belies in no small measure to some form of statistical mythmaking to fit such a worldview.⁶ In this aspect, Hickel has also pointed out that behind the rhetoric, and despite the best intentions, the Sustainable Development Goals (SDGs) were ultimately never designed to achieve these goals but to conceal the failure of Millennium Development Goals that came before (MDGs) and to construct self-justifying narrative lest the narrative of progress collapse (Hickel, 2016). At the same time, claims of reduction in poverty, inequality, and hunger can become disconnected from the lived reality of those experiencing it (Hickel, 2017).

However, recent scholarship has pointed out that the scientific evidence to account for the transformative impact of the SDGs have been mainly discursive, with little evidence of institutional changes or transformative impact yet (Biermann et al., 2022). If one takes the definition of sustainable development seriously as meeting the needs of the present without hampering the same for future generations, looking at the data, it may have strayed very far from its ideals and claims (Edcholt et al., 2021). Why then, is this form of cognitive dissonance tolerated when ground realities suggest otherwise?

In *Capitalism and Ideology*, the economist Thomas Piketty suggests an answer, that “every epoch therefore develops a range of contradictory discourses and ideologies” to make sense or rather legitimize the social order that exists or believes it should exist (2020, p. 1). Piketty states that the phenomenon of modern inequality is not a natural fact but ideological and political in that it expresses a particular idea of social justice (Ibid, p. 9). This preferred form of social justice offers the ‘winners’ a justification for the inequality that exists and should continue to exist (Ibid, p. 2). Depending on their typology, these ideological vestiges can end up naturalizing inequality (Ibid, pp. 2, 7). These vestiges seem to be littered across many of the seemingly well-meaning initiatives that policy and design decisions base their evaluations on. Those

5 Hickel documents how the measurement of the \$2.15/day international poverty line (updated) set by the World Bank (based on 2017 prices) today was originally based on arbitrary measures. The more ethical \$5/day poverty line, about half the global population is in poverty. The upper limit, set by the World Bank, a more realistic \$10/day poverty line, tells us that nearly 80% of the world’s population is below the poverty and has continued to rise since 1981 and continue to rise (2016, p. 7).

6 In many aspects the situation for many societies have improved. However on a global scale the story is very different. What gets lefts behind in this story is the way this statistical story has come about. Hickel points out that these numbers only make sense when one includes the growth of China, which went against austerity measures prescribed by the IMF and World Bank who now prefer to use the data from China as an example (Hickel, 2017, p. 3).

who ‘fail’ to progress on these often mythical constructs can be punished, often making modern inequality, as Piketty argues, just as brutal as the premodern societies that preceded it (Ibid, p. 2).

These discussions offer a sobering, tragic view given the urgency and the magnitude of the challenge the way it is. One might be then be compelled to ask—what are we trying to sustain? If it is a particularly narrow framing of development as a rush towards artificial scarcity rather than regenerative abundance, then sustainability begins to look more like a zero-sum game of winners and losers. That is to say that the affluent standard of living of a few, has been founded on and continues to be sustained by the un-development and the marginalization of most of the world. One might ask then, what happens to climate mitigation and adaption under these conditions.

3.2.3. THE WAGES OF MALADAPTATION: SURRENDER AND FATALISM

The implications of the IPCC’s findings call for change on structural levels, not the least of which is to cut fossil fuels consumption drastically, but also a fundamental change in the assumed socio-economic and political structures. However, given current regimes, with their fealty to market mechanisms and state apparatuses geared towards accumulation and founded on fossil infrastructures, it leaves very little room to expect these structures to change.

This continued inaction resulting from such inertia warrants an exploration of what might happen if the structural conditions remain fixed and the political and social edifices begin to show signs of collapse. I want to explore two distinct reactions to the climate crisis that have taken shape in recent years, the more dangerous maladaptive turns that represent climate surrender and fatalism.

Maladaptation 1: Climate Surrender

The first form of maladaptation I want to present here is what the UN special rapporteur Philip Alston called ‘Climate Apartheid’ (Carrington, 2019). He argued that prevailing patterns of adaptation that rely on privatizing essential social services would only further entrench inequalities and climate vulnerabilities. He points out that it is a form of maladaptation, where the privatization of the mitigation infrastructure under present disparities will mean that the wealthy pay to escape the problems of climate-induced disasters. In contrast, the majority world, unable to afford mitigation and adaptation measures, is relegated to prolonged suffering.

In *Climate Leviathan*, Joel Wainwright and Geoff Mann discuss the political character of this phenomenon, which they claim stems from a 'premeditated' refusal and inaction of the privileged elites in society to address the crisis (2020). The authors contend that underlying such tendencies is a cynical belief of these privileged social groups that the current world order is incapable of change and are instead making political moves to "cement structures to protect their wealth, status, and power" (Ibid, p. 157). Thus, even when many may believe in climate science, it is effectively being leveraged to secure investments and political advantage as a climate adaptation strategy while "the relatively poor and least powerful are left to fend for themselves" (Ibid, p. 158).

The authors argue that if acting on the climate remains a collective action problem, it may be down to this crisis of political will which has dangerous consequences for human and ecological well-being in the long run. The lackluster, grab-what-you-can-get approach to the climate crisis is accelerating extreme inequality across societies to ensure Business as Usual (BaU) continues at all costs since social well-being has been conflated with economic growth while economic growth has yet to necessarily translate into human well-being. However, to keep the edifice operational implies these costs are paid for by the people today marginalized and considered 'sacrificial.' Those sacrificed are visible across the intersecting axes of class, religion, caste, gender, and race that compound and amplify existing injustices and inequities (Sultana, 2021).

These discussions, therefore, offer the necessary context to comprehend the social and ecological implications of proposed Green Growth and even the more progressive Green New Deals, the Defense Production Acts, and the Climate Marshall Plans. While these plans have some critical ideas and essential tools for leveraging action, they still seem to rely on solely technocratic forms of climate mitigation and adaptation. Given the arc of recent history, it appears nostalgic for a world constructed when coloniality was the normative order and mass consumption-fueled economies were creating unfettered accumulation. Ideas of Green Growth it seems, ultimately depend on the idea that one could decouple economic growth from emissions, which has been pointed out to be unproven and is very unlikely *even* in the best-case scenario (Hickel & Kallis, 2020).

Furthermore, when ecological concerns are taken seriously, one may find a tendency to create a neo-colonial order under the rhetoric of conservation and climate action, where the sovereign rights of land and water for Indigenous Peoples and marginalized poor are sacrificed, those most vulnerable to climate change who have done the least to cause it (Althor et al., 2016; Ghosh, 2021, p. 231; Nenquimo, 2020; Thekaekara, 2019).

Given today's competitive, geopolitical hierarchy of development, nations in the Global South might be coerced into sacrificing nature and society as necessary to keep their position in a proverbial race to the bottom (Ellis-Petersen, 2020; B. Roy & Schaffartzik, 2021). Ideologically however, the desired endgoal of this race to development seems to be to 'catch-up' or 'leap-frog' the idyllic Global North, which is busy securing renewable climate-resilient infrastructures for itself. However, one might wonder if this is true climate resilience if the privileged few nations continue pursuits of infinite growth, high-consumption, and high-energy lifestyles built upon the extraction of labor and ecological resources from the Global South, which entrenches climate vulnerability of all (Bernes, 2019). Climate Apartheid might be maladaptation by climate surrender where a 'new deal' for the few might be the same old one for the many.

Maladaptation 2: Climate Fatalism

The second form of climate maladaptation worth pointing out is the rise of extreme political polarization in recent decades in direct response to the climate crisis. Wainwright and Mann caution that climate change will radically transform the world in ways that have profound significance for the struggles for democracy, liberty, equality, and justice, even the ones taken for granted for a long time (2020, p. xi). Much like our essential infrastructure, climate change upends and breaks down the stability of our socio-political infrastructure. The authors assert, when the world is in upheaval, so too are the definitions of political life (Ibid, p. xi). While there are many reactions to the crisis across the political spectrum, I want to specifically focus on the rise of two broad authoritarian trajectories, which have been significant in derailing coordinated efforts for climate action—fossil fascism and eco-fascism.

In *White Skin Black Fuel*, Andreas Malm and the Zetkin Collective explore the 'politics of fossil fascism' (2021). According to the authors, those who practice such politics do it to protect a way of life that is disappearing so fast that they are not averse to using force to save it (Ibid, p. 533). They describe this political ideology as one that offers a narrative of victimhood to justify violence against imagined enemies, but it ultimately remains a powerful deflective tactic set within a nexus of fossil fuel interests and influential political actors (Ibid, pp. 270, 277, 493). According to the authors these movements tend to invent a mythical past and resist any change to its prescribed order of things, failing which, now yearn for the demise of all by all (Ibid, p. 532).

Similarly, the politics of 'eco-fascism' employs the systemic critique and moral force of the climate crisis to mobilize climate action as a tool in the service

of misanthropic totalitarianism that believes in a return to a mythic, pristine nature. Ghosh speaks of how the Indian far right, with its political discourse, has, in a classic ecofascistic manner, “concocted an environmentalism which has tended to serve, to strengthen the grip of dominant groups while marginalizing the majority—Dalits, Adivasis, and poor Muslims” (2021, p. 230). Such ecological totalitarianism belies a far more insidious agenda—a sanitized nature without its people.

These political ideologies are not merely hypothetical; they frame the real-world policies that result in climate maladaptation. For sociologist William I. Robinson, the global rise of ‘21st-century fascism’ has taken a more plural approach, in its myriad geopolitical manifestations, intersecting often forming strategic alliances to achieve their political goals even if at odds with each other (2019). Despite their plurality, these political forces seem to channel a common disappointment and discontent with the social and political edifice. One might see it as a general crisis of political legitimacy, given the degradation of social life and the growing precarity of economic well-being in a future now threatened by climate upheaval. However unique these forces seem to this moment; they are ultimately also a pattern of modern history that seems to repeat itself.⁷

It is also worth noting the tools these forces use to maintain legitimacy and hegemony—the media ecosystem and its digital filter bubbles. These systems, designed to monetize cultural engagements, were already prone to distorting public reality, are now employed for achieving the primary objectives of maintaining hegemony through disinformation (Monbiot, 2019a; Wong, 2021). Totalitarian regimes are today emboldened by a media ecosystem that are now echo chambers for xenophobia, misogyny, and peculiarly consistent denial of the climate crisis (Holmes, 2020; Lapowsky, 2019; Statt, 2020). In this mix, often enough, one can find vitriolic expressions of denialism and doom weaponized in the service of far-right ideologies that eventually end up in either climate alarmism or climate inactivism (Mann, 2021).

However, beyond the crisis of information warfare is the danger of war itself. Ghosh, therefore, offers a more sobering view on the “grave error” of assuming that the world is not acting on climate change; it is “not preparing by taking

7 The late Aimé Césaire famously declared that fascism in Europe was the ‘coming home’ of, what it enthusiastically unleashed in the name of a civilizing mission to the majority world for centuries (2000, p. 39). Fossil Fascism has legacies rooted in this recent history and today have merely reinvented itself to legitimize its pursuit of power (Malm & The Zetkin Collective, 2021, p. 174).

mitigatory measures or by reducing emissions: instead, it is preparing for a new geopolitical struggle for dominance” (2021, p. 129). One sees this in the ramping up of geopolitical tensions as militarization has become a go-to response for the climate crisis. The increasing severity of climate disasters now contributes to steep increases in military spending worldwide in preparation for present and future upheavals to preserve the current edifice from collapsing.

It is increasingly common to hear military planners worldwide who consider the climate crisis a severe threat to national security (Ahmed, 2020). Nevertheless, one might ask how much emissions the world can afford in the maintenance and upkeep of war infrastructures which, despite their profound social and ecological costs and staggering emissions, get very little attention in climate negotiations (Crawford, 2019). This escalation has clear implications for the assumed stability of the geopolitical order as the crisis becomes a site for struggles for geopolitical domination in a race to grab resources, a race ultimately spiraling the world further into peril and unsustainability. To wage war on climate change externally while a war of all against all rages internally seems to be ultimately maladaptation by fatalism.

3.2.4. THE COVID 19 PANDEMIC: A CASE STUDY

The peculiar nature of history is such that it rarely ever allows for real-time experiments to be done on it, and yet, the ongoing Covid-19 pandemic is perhaps the closest one can get to witnessing such an experiment. If there was ever a textbook case of how the global response to climate change would look like if it were compressed within a narrow timeline, the pandemic delivered on every aspect. With the stable conditions of a social reality upended, it became a real-time study of how unprepared the planetary civilization is for climate mitigation and adaptation.

At the beginning of the crisis, the civilizational experiment was paused for a moment. The response to the pandemic demonstrates that when faced with a global crisis, the global community seems perfectly able to stop and take deliberate action—forgetting economic growth and channeling resources where society needs them the most to ensure well-being; accelerating necessary technological development for public health in the form of vaccines; allowing changes to work infrastructure like working from home; and even renumeration people for not working at all, to prevent social and ecological harm (a proto universal basic income program). The forces of fossil capital too, were put on hold, proving in no small measure that the world could just as easily have been different. As the author, Arundhati Roy, pointed out, the pandemic was a portal

to a new world (2020).

However, this was a story that those of us privileged would like to tell ourselves. For the marginalized majority world, the pandemic also unleashed unimaginable horror exacerbated by the inequalities and injustices encoded in the system. The present impoverishing of global populations never stopped; rather, it was a trend that transcended national and international boundaries amplifying existing injustices (Sidik, 2022; Sultana, 2021). While the privileged dominant groups of society secured their health by hoarding vaccines and resources in the "new normal," it was the poor of the world who bore the brunt, struggling for access to food, medicine, care, and income as they lost livelihoods (Milanovic, 2020; A. Roy, 2020). For instance, the disparity of vaccine access created a 'vaccine apartheid,' which was not just brought on by Covid but was a continuation of the regimes of global healthcare inequities that exist to this day, where rich countries continue to reject appeals for technology transfer for producing life-saving vaccines (Krishnan, 2021).

Access to vaccines was just one side of the story. While on the one hand, the poor were castigated for being poor and deprived of healthcare; on the other, pandemic denial, disinformation and anti-vaccine forces were taking shape (Drażkiewicz, 2022). These forces of denial and disinformation were often linked to fossil fuel institutions, which were using the same tools of climate denialism (Beyerstein et al., 2021; Wong, 2021). These resistance movements against a public health emergency seemed to represent, as Malm & the Zerkin Collective note, "a revolt against adaptation" (2021, pp. 519–520).

This so-called revolt was to reclaim the social order back into particular conceptions of 'normal,' now under threat. These ruptures in society, however, were essentially in plain sight—from economic inequality between rich and poor, science denial, the fragile global supply chains, and distribution infrastructures, the crumbling or non-existent essential social infrastructure like healthcare and climate resilience (Sultana, 2021; Westervelt, 2020). It was a brief encounter for the privileged to experience, in a rare moment, the true weight of the all-consuming horror of an everyday apocalypse that modern inequality and impoverishment have created, which is a normalized reality for the marginalized majority, for whom it may well continue long after the covid pandemic is forgotten.⁸

8 Covid19, with its continuously mutating nature, is on its way to becoming endemic. This does not mean that the disease is any less deadly. However given the inequities of vaccine apartheid and access to healthcare, much like Malaria and Tuberculosis, it might become a poor, third-world disease to be conveniently forgotten.

The rush to normalize a ‘post-pandemic’ normal seems like a normalization of living with mass death and mass catastrophe for the many while the few buy their way out of the crisis. Therefore, this act of forgetting seems more deliberate, to justify the current state of things since alternatives are unimaginable. The story of the pandemic remains illustrative of the continued global injustices perpetuating the skewed conception of what makes civilization as we know it. A point rather eloquently put by Ghosh below about the immense profoundness of the unthinkable the crisis seems to conceal:

“It is a crisis that is all- pervasive and omnipresent, in which geopolitics; capitalism; climate change; and racial, ethnic, and religious divides interlock, each amplifying and accelerating the other. In these upheavals the residues of human history interact with nonhuman entities and agencies in ways that no one would have thought possible even a few years ago.”

— Amitav Ghosh in *The Nutmeg’s Curse* (2021, p. 222)

Despite the compounding nature of the crisis, recent scholarship offers hope, as more and more we see the possibility that there may be ways to curb emissions without the need for complicated mechanisms to keep BaU continuing and make for a smoother landing of the emissions curve. Crucially, it might even lead to more drastic improvements in the overall quality of everyday life for every single human being on the planet and remain well within planetary boundaries (Keyßer & Lenzen, 2021; Kuhnhehn et al., 2020; McGreevy et al., 2022).

Thus, it seems entirely possible to see reduction in total energy consumption, and societal transformations, along with the distribution, and development of high-quality climate-resilient infrastructures and accomplish a 1.5°C limit surprisingly easily. Hickel argues that ultimately addressing poverty and hunger might turn out to be a matter of ending the structures of impoverishment and transforming the structural basis of modern-day well-being and development as we know it (2018a, p. 32). From a systemic point of view, these findings should be cause for celebration, that it is not a matter of if or how but choosing to act from a structural point of view and it is the one thing that seems impossible within the current climate of Pt.

It may be why structural changes do not go beyond niche circles of civil society, that such answers are rarely acknowledged by the institutional actors that need certain conceptions of BaU to remain unchanged. The problem of inaction and delay, it seems, has remained political, which, as I have explored earlier, has been quite profitable in its disempowering of climate action, creating the dangerous

polity of maladaptation, socio-political schisms, and even constructing avoidable forms of policy paralysis that delays action.

In this mix, then a crisis of legitimacy reveals itself, on which the whole political and social edifice stands. While eco-fascism and climate apartheid might look like separate responses to the climate crises and might even seem like a form of climate action, each point to a crumbling worldview untethered from reality of the task at hand. Effectively both are just science denialism and maladaptation presented as realistic options for mitigation and adaptation.

Nevertheless, seeing the entrenched inaction as justified, the future seems bleak, and if nothing changes, the IPCC reminds us of where the planetary future is headed. Given this context then, it might be relevant to explore and develop the larger discussion about what design and designing is in the context and more important understand what role design has played in the crisis—how design came about to enable this defuturing.

3.3. ON DESIGN AND DESIGNING

“I am enthusiastic over humanity’s extraordinary and sometimes very timely ingenuity. If you are in a shipwreck and all the boats are gone, a piano top buoyant enough to keep you afloat that comes along makes a fortuitous life preserver. But this is not to say that the best way to design a life preserver is in the form of a piano top. I think that we are clinging to a great many piano tops in accepting yesterday’s fortuitous contrivings as constituting the only means for solving a given problem.”

— Buckminster Fuller in *Operating Manual for Spaceship Earth* (1969, p. 67)

There is always a danger in defining something like d/Design. After all, in the most general sense, 'design' is a universal abstraction—a conscious intention and action towards change. In the natural world, many species will try to shape the environment to suit themselves—many uniquely manifest inspiring forms and aesthetics in objects, artifacts, and built environments in that approach. However, even if one admires a beaver for its dams, a bird for its intricate nests, or an ape for its use of hand tools, can one call each a civil engineer, architect, or product designer respectively?

Paraphrasing the late philosopher Antonio Gramsci, one can think of design as a natural phenomenon, more particular to the human species, since “homo faber cannot be separated from homo sapiens” (1971, p. 9). In *Design for the Real World*, the late designer and educator Victor Papanek would claim that the extraordinary ingenuity of humanity can be seen in what it can design and that because of this innate characteristic, it is often a truism to state that to design is to be human and to be human is to design (1985, p. 3).

Moving on, one could understand what design and designing is by typically looking at what the disciplines of 'Design' do, or are perceived to be. This discussion will look at the disciplinary characteristic of Design, which is often reduced to n/either—art or science. Designers are constantly pulled between these dichotomies, and consequently, the unique identity of design seems overlooked in a strange disciplinary uncertainty where, as Redström points out in *Making Design Theory*, “it seems as if one of the key characteristics of design is to base its very existence on the complexities arising from dichotomies” (2017, p. 1). Thus, I will use terms like design, Design and designing here to support the disciplinary discussion.

Neither general platitudes nor reductive dichotomies give us much to work

with, and it does not get better when design and designing is interpreted looking from the outside-in and applied to traditions of survival and calling it design. Like Fuller's metaphor above, conceptions of design seem to have become too much like piano tops in a shipwreck. One may make a life-preserver out of a piano top to survive. One can surely learn from it as with any other formative experience, but should one consider oneself an expert shipbuilder or navigator after the ordeal of a shipwreck, even if that activity transformed the undesirable situation into a preferred or desirable one?

On the other hand, disciplinarity requires certain stable conditions that allow nurturing for new knowledge that develops a culture of exploration necessary for advancing collective body of lived practises that a given society might need.⁹ This is an essential, qualitative difference between a universal common humanity that allows for designing and the conditions for a disciplinary practice, between fleeting precarity of survival and rigorous, flourishing attributes of disciplinarity—one cannot replace the other. I want to speak of seafaring ships instead of buoyant piano tops.

Such distinctions, therefore, are necessary to begin a discussion on what design is since it is plagued with this often-mystifying confusion between definitions that also seep into design research and research through/by design, in this case Industrial Design, shaped by the forces of industrial capital to reimagine the modern world as we know it. The following pages offer a partial dive into the history of Industrial Design's emergence to explore the socio-political forces that shaped it into what it became.

3.3.1. THE WAGES OF DISCIPLINARITY: UTOPIAS OF THE EVERYDAY

In *Designs for the Pluriverse*, the anthropologist Arturo Escobar argues that design's role externalized the imaginative thinking of the craft traditions to make modernity desirable and universalized through technologies of mass production. Escobar asserts that what eventually became 'consumer' objects were once luxuries or handicrafts made 'within' communities (ontology) and developed autonomously (2018, p. 32). Through the professional rationalization of craft traditions, one could universalize principles of mass production for a consumer class to drive economic growth and away from the irrationalities and uncertainties of place-based community production of goods and services.

9 Here, Gramsci's analysis of intellectual classes becomes useful. Although no human activity can be separated from the intellect; not everyone has in society the function of intellectuals, and while everyone has an intellect to intellectualize, philosophize and design, not everybody who does so is considered part of an intellectual discipline and not all of them have the function of intellectuals (Gramsci, 1971, p. 3).

In *America by Design*, the late historian of technology David Noble notes that in the early 19th and 20th centuries, this process had already transpired for the sciences and the so-called 'useful arts,' which until then had meant technology and engineering in the forms of rational professionalization emerging to serve the commercial ambitions of the rising corporate capitalism as seen in the United States at the time (1977, p. xxvi). Eventually, he argues, the sciences became more empirical and concerned with practical pursuits, while the useful arts became more scientific (Ibid, p. 24).

This fusion of industrial and corporate capitalism allowed for a model of unlimited productive growth through the often tedious and capital-intensive formalization of managerial rationalization, professional specialization of the sciences towards the market-driven economies where processes of production, distribution, and prices could be realized towards a new form of social production (Ibid, p. xxii). Noble suggests that the proponents of these institutions—educators, managers, executives, and engineering professionals in these new science-based industrial corporations viewed themselves to be part of a unified whole, constructing a new vision of a society and, in essence, the rest of the world through technological progress (Ibid, p. xxv).

Industrial Design, it would seem, was a latecomer to this tradition of professional rationalization following in the footsteps of science and engineering, which were meant to have exclusive domain over the so-called useful arts and 'designing' for industrial capital (Ibid, pp. 167–168). For this reason, Industrial Design had a technological foundation, given that it intimately linked to and still relies on professional engineering. On the other hand, the discipline also rested on an artistic foundation. In Europe, Industrial Design education saw the coming together of various craft traditions in the famously successful Bauhaus School, where “students were partially trained as artists by artists” (Redström, 2017, p. 89).

In this transition, Industrial Design fulfilled a social function to creatively manage or broker the dichotomies of applied arts and applied science, addressing creative new applications for technological products and expanding into other domains of expertise. Over time, design traditions would continue to be successful in offering new innovative ways to imagine these technologies and for their marketization as consumer technologies. Accomplishing this required higher-level systemic coordination and planning so that design disciplines could develop their social institutions, cultural and educational training infrastructure, and intellectual traditions (Edeholt & Joseph, 2021 in appendix).

Today, Industrial Design remains closely related to these traditions, even

though it has, in a sense, established itself as distinct from the professional and managerial arts and engineering. But this leads to the more obvious question—why was it necessary to have a new discipline at all? What could it offer to the industry that professional artists, craftspeople, engineers, managers, or even advertising professionals could not? What was the social function of this discipline supposed to be?

As Noble documents, the explicit socio-political goals of social production at the time necessitated the creation of a 'consumer class' to stave off economic stagnation from post-war overproduction through the over-consumption of a high-tech industrial economy and the development of consumer culture (1977, p. xxiii). He notes that this was intended to restructure society and diffuse its "potentially revolutionary energies" by shaping desires and addressing needs and wants for a better life (Ibid, p. xxiii). Since one cannot simply expect mass consumerist desires to match with economic goals or be solely violently enforced, this relationship had to be carefully cultivated in the public mind.

Moreover, these artificial desires of a consumer society still needed to be accessible and fulfilled as promised, requiring their fabrication and making their desires thinkable, doable, livable, and materially embedded in everyday life. If one looks at its historical impact, it is hard to deny that Industrial Design was incredibly successful at this and built a lasting legacy of its domain expertise and its value proposition for industrial capital.

In *More Work for Mother*, historian Ruth Cowan documents the transformations within the household such that by the end of the Second World War, there was a dramatically ironic shift in domestic labor relations in the Global North (Cowan, 2008). While for the rich, the material conditions did not change much, on the other hand, the domestic sphere for the poor and middle classes, with the newfound affluence and civic amenities and appliances, did drastically improve quality of life with the diffusion of modernization into essential parts of everyday life that would have been unimaginable for their forebears (Ibid, p. 195).

Given this context, Industrial Design served a specific ideological function for creating the desire for these utopian futures of the everyday by designing unique objects for everyday consumption. Therefore, creating a mythology of everyday modernity required constructing a preferred reality in the public mind and then fulfilling those desires in both perceived and actual terms. After all, one could immediately 'access' a desirable future if one could afford it; this utopia could easily be bought in the form of 'space-age' appliances—a home vacuum machine, a toaster, streamlined automobiles, microwaves, lightbulbs, and telephones.

In this sense, science fiction realities were diffused into public and private life through the diffusion of affluence in the post-war years through the distribution of appliances and amenities.

This may explain why, as Redström observes, design in the fifties was dominated by consumer research, often joined at the hip with the public relations industry, which has developed methods of psychoanalysis to cultivate unconscious desires and often enthusiastically claimed to have 'designed the user' (2017, p. 77). Industrial Designers like Papanek would scathingly critique Industrial Design for its alliance with the public relations industry which served to cultivate artificial desires and provide solutions to the problems created by capital to be addressed by the very mechanisms that caused them (1985, pp. ix, 30).

In effect, Industrial Design's social function may have been an inversion and co-optation of the more organic, pragmatic traditions of the artisanal everyday crafts that were now mobilized in the process of mass social production and standardization, things that were once internal to community building instead turned on its head—to construct the pragmatic *and* desirable futures of the everyday. Therefore despite its ills, the technological abundance offered by industrial capitalism was presented as the only means to achieve this social progress in the public mind by supporting its institutional development, which implied or rather symbolized a solemn cultural promise for the future.

In *The Utopia of Rules*, the late anthropologist David Graeber discusses how this promise was powerful enough to be outright taken for granted, such that for those born in the 20th century, the sheer physical power of technologies gave them a "sense of history moving forward" (2016, p. 111). This sensibility was cultivated elsewhere too, from popularised science fiction films to corporatized interstellar visions of futures on Mars, to the comics and sci-fi literature imagining transcending even industrial labor with robot factories and the end of work. Graeber would stress that this was not naive utopianism; the rapid pace of techno-social change at that time was such that it would not have been impossible for someone from a century ago to dream of interstellar travel in the year 2001—achievable in one's lifetime (Graeber, 2016, pp. 105–111).

In this mix, even impractical utopian fictions continued to be disseminated to the broader public. As discussed previously, these were called 'diegetic prototypes' that took designed artifacts from within the narrative logic of cinematic fiction and made an imprint on the public mind by imagining them for a desirable alternative future now made tangible for engaging the public mind (Kirby, 2010).

These forms of cultural futuring forged a promise of technological inevitability within a frame of reference in the lived experience, even further reinforcing the cultural expectations of industrial and corporate capitalism and its technoutopian imaginaries as a necessary force for social change. Design was, in part, actively applied in furthering and realizing a constructed mythology in the social imagination of technological progress—a vision of the future that one might want to live in that required thinking about the design of everyday life and making it desirable and cared for.¹⁰

Thus, Graeber observed, those living through this technological abundance could imagine for themselves and their children growing up in the 50s, 60s, and 70s the technological leaps of everyday life to reach profound scales. Thus, over the 19th and 20th centuries, even as capitalism and imperialism generated systemic deprivation, exploitation, and impoverishment of whole communities, they did so with a promise of technological abundance. This promise was appreciated by the system's proponents and detractors, seeing it unleash the 'productive forces' of society through industrial production and its rapid rate of scientific advancements and technological innovations, unparalleled in human history as it would turn out (2016, p. 121).

In so far as it created the conception of progress in everyday life, Industrial Design got the public to genuinely care for these futures. This form of social care was not just limited to purchasing the artifacts of a good life but consenting to the logic, even justifying the inequities and ecological costs that came along with it through consent freely given or manufactured but also 'fabricated' by design as a disciplinary function for industrial society. It was the rich crafts of design and designing that managed to make this image of the future into reality and did it well. While this was the social function of design, in the next section I want to discuss design's disciplinary expertise as different from the other disciplines.

10 Since it is not just the designer who creatively imagines the futures they imagine, and the creative functions in society exist across all strata of society—from idea to concept, to managing its production and distribution of the artifacts, and to the cultures who will care and accept it into everyday life, defining themselves in acceptance or rejection of the artifacts in question. To illustrate the point, one can see any automobile advertisement and see how to be able to make it desirable one must first be able to imagine a world in which the complexity of urban life is reduced to the 'image' of an automobile in mostly empty sanitised urban spaces, and conflating the ownership as a surrogate for better urban life. Here the question of what makes a city 'livable' is different from what a car manufacturer employing designers wants to explore, lest their products become undesirable.

3.3.2. CONSIDERING DESIGN EXPERTISE

What design and designing is to society today spans a broad range of activities and traditions, shaped by the forces of social production and by its disciplinary practitioners—what they do, how they do it and know what they know, and the futures of everyday life they make thinkable. Therefore, for ‘design’ to be called a discipline implies that a professional community has mastered a specific niche and developed its own internal cultures, languages, and traditions. Given this broad range of practices and traditions, it draws on and has developed; design can be acknowledged to have stable and unique disciplinary characteristics (Redström, 2017, p. 93).

While a particular Industrial Design view informs this discussion, I will try to bridge it to a somewhat universal conception of what design and designing is, internal to the disciplinary practitioner and their traditions—how *do* designers know what they know and act the way they do? The late philosopher and professor in urban planning, Donald Schön, famously described design as a reflective practice:

“Design knowledge is knowing in action, revealed in and by actual designing. It is mainly tacit, in several senses of the word: designers know more than they can say, they tend to give inaccurate descriptions of what they know, and they can best (or only) gain access to their knowledge in action by putting themselves into the mode of doing...”

— Donald A. Schön in *Designing as reflective conversation with the materials of a design situation* (1992)

Designers are trained in many holistic practises, to prepare them as they try to address the broad range of their chosen subject matter. For this reason, designers are often considered generalists and might even become so even if one comes into design from another discipline, as is often the case. While all design challenges come with their own unique complexity, designers essentially start from an awareness, if only partial or unconscious, that the given situation needs to change, even if the complexity of the challenge cannot be fully understood in its totality.

For Schön, this design knowledge is primarily tacit, constructed through, and mainly expressed by engaging in the act of designing than in any other form or language (1992). Designers enter an unfamiliar situation, mostly unaware of all the elements of knowledge. In a sense, designers often operate effectively and purposefully within complex open systems that cannot be fully closed to apply

predictive criteria, even when their knowledge is far more limited than the experts.

Despite this, a designer can still manage to generate richly complex and divergent outcomes that seem to be what was needed—a solution. This generative nature of design and designing implies a unique approach to how designers understand complex open systems and still solve them with the limited knowledge they can have. Given the consistency of such solutions, it seems more deliberate than accidental. However, this tendency towards generalization and generative knowledge and action is often confused for professional naivety—that designers do not know what they are talking about.

Thus, this statement that designers know more than they can describe and that their descriptions are inaccurate accounts of what they know reveals the hidden nature of design and designing, which is not necessarily externalized in the design process. However, it remains fundamental for design and designing to operate the way it does, always consciously and unconsciously aware of the limitation of knowledge and action that one can and cannot know when dealing with, say, a complex open system (Cornell & Parker, 2010, p. 30).

This question of inadequate knowledge is interesting for moving forward; how do designers understand what to look for? How designers develop and utilize this internal knowledge is a process worth exploring further. Mostly, these processes are hidden, often unknown to those outside the disciplinary traditions unless they are actively studying them. Here I would like to offer an ecological analogy that might give a better way to think of the complex relationality and creative brokering that design and designing is capable of, which might lead the way to a more practical understanding of the disciplinary expertise of design.

A Mycelial Analogy for Design and Designing

I want to reintroduce the mycelial analogy from 1.4.1 and develop it further. Thinking of design and designing in terms of a mycelial assemblage partially frames this discussion of how designers manage the numerous, at times, disparate disciplinary traditions they may encounter (Figure 16). Much like mycelium thriving in biodiverse forest soils, the richness of the designerly approach to knowledge spaces is enmeshed in the design activity, broadly concealed from view. Similarly, there are research activities, knowledges, socialization, methods, and practices, to name a few, that can be considered nodes in this mycelial complex that are sometimes never even conscious to the designer but nurtures the entire design process. Tsing points out that fungal mycelium stimulates and nurtures other species by exchanging water

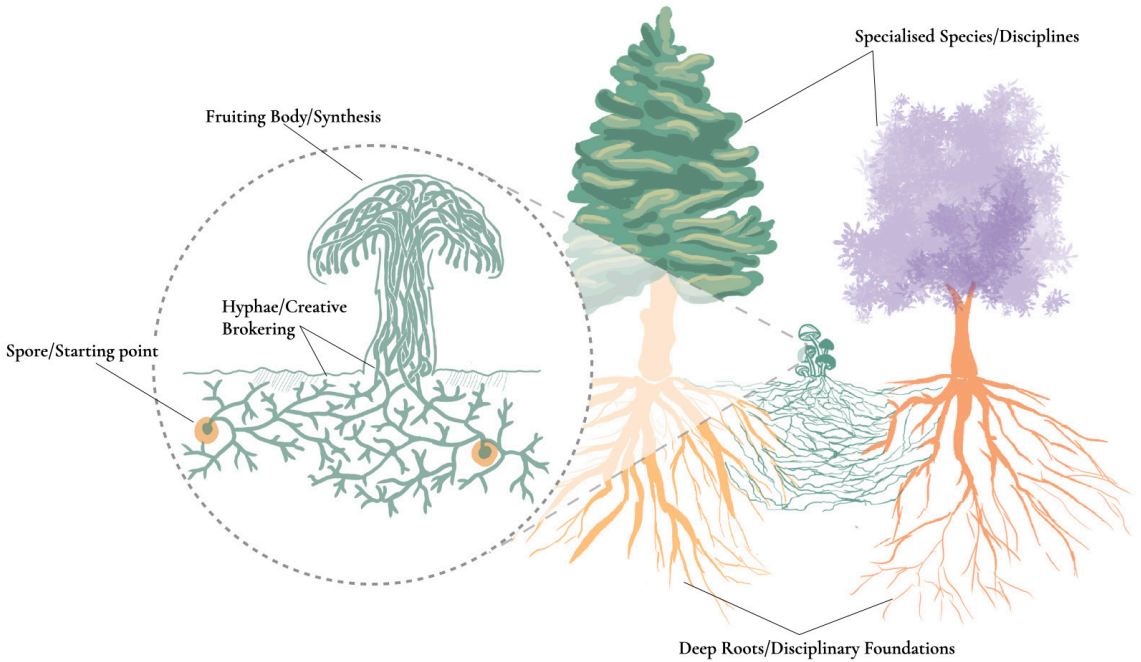


Figure 16. A Mycelial analogy of design and designing: From Mycelial spore growing with Hyphae to matured mushrooms as the fruiting body emerging from a creative brokering of ecological relationships. Illustration inspired by Pandey (2020).

and nutrients through the root systems in the forest soils; it is a relationship mutually beneficial (2015, p. 138).

In terms of the knowledge space, for an individual designer, each organism that the mycelial network connects to is a living disciplinary well of knowledge from which design exchanges nourishment in its practice, an interaction that could be either deep or shallow. Similarly, the collective knowledge within the design traditions also travels far. It can stretch this exploratory framework where other disciplinary species¹¹ connect and share nutrients from which designers often contribute to, learn from, and build up their designerly knowledge pools and traditions. This organic, yet fluid cross-linking, may illustrate why design traditions have been very dynamic and developing over time to find themselves navigating between a type of deep disciplinarity that manifests itself as a broad

¹¹ For example, engineering, social sciences, politics, ecology, psychology, philosophy, sociology, rhetoric, climate science, biology, humanities, history, law, music, and many more disciplinary organisms.

skillset when it is traversing landscapes of contexts and movements, which has made the field creatively complex and divergent in its possibilities.

In an organic fluid way, like a mycelium species, design knowledge navigates the landscape before it (Figure 16), making sense of the world it finds itself in and constructing an understanding of what-is reconfiguring it towards a creative synthesis of what *could-be*. To achieve this, in a precautionary sense, designers often tend to borrow and use methods and tools developed by other disciplines. However, while many tools and mindsets from disparate domains might be borrowed from other disciplines, design expertise differs from expert domain knowledge from where they come from who intimately know these tools better. Thus, for example, a designer might use drawings to convey ideas, but their illustrations are different from that of fine artists. In other cases, designers may practice with materials and technologies to work with design artifacts (digital and physical), but their craft expertise differs from material scientists or engineers. Similarly, within a systemic role, designers may work with climate science or behavioral economic models to tackle complex issues, yet they cannot be considered climate scientists or economists.

In this assemblage, theory became another species to be related to and played with in the design knowledge space. However, this is different from how a theorist develops a theory. Yet, despite this difference in approach, designers richly engage with these domains significantly enough to act in the world through design. Still, to avoid overhasty synthesis, designers first attempt to idealize the world in which their design would live in that they construct in iterative practice as a form of a “reflective conversation with the materials of a situation” (Schön, 1992, p. 5). In this sense, designers might integrate an ecology of disciplinary knowledge to creatively broker its synthetic and generative activities but, like mycelium, are distinct from the other ‘species’ that comprise the forest ecology.

Moreover, as Tsing cautions, not all mycelial relationships in the forest’s soils are harmonious (2015, p. 139). Thus, the knowledge drawn from traditions that designerly mycelium must necessarily draw on for moving forward and synthesizing its fruits must assume that the disciplinary species it encounters is welcoming these relations, and their expertise can be considered trustworthy. This assumption leaves room for flawed methods and assumptions to infiltrate, where designers take up the vestigial issues of the domains it draws upon, unaware of the deep structures and traditions in those disciplinary traditions, which may have been already resolved, or it is still unresolved, polarizing debate.

This is not so much a problem within design practice since there is already a vast body of disciplinary traditions and knowledge to draw upon, and often enough, the client-project context defines specific expectations, so theoretical dimensions are not much of a concern or even necessarily involved in training designers. However, within a research context, as already discussed in 1.4 earlier, given that design research traditions are still relatively new as a mode of knowledge production, things get more complicated, and design research theories can seem more often to be fundamentally unstable and transitional (Redström, 2017, p. 2).

Nevertheless, design processes rarely have enough time or resources to stay current or unpack all those discussions they are not responsible for. Thus, when these relations are employed from a design standpoint, even when 'design probes' are fabricated to make sense of the landscape of knowledge that is unstable, it is to aid in "conceptualizing, articulating, making, communicating, collaboratively creating, and so on, something new and particular" (Ibid, p. 25). This focus on thinking and acting through and by the synthetic turn invites the potential of creative advances, much like the "unexpected bounty" of mushrooms (Tsing, 2015, p. 286).

Staying true to the mycelial analogy, if all one had to study fungi was a mushroom—the fruiting body that it produces on the surface of the forest, one would mistake the species for what it synthesized. Often enough, the fruit can be confused with the organism, and in studying the forest, one can miss the mycelium (and other microbes) for the forests and its trees that are integral to what makes a forest a forest. However, the emergence of the synthetic fruit is impossible without these complex hidden relationships underground (Ibid, p. 137). Similarly, the fruiting bodies of the design process are just one instantiation of the synthetic that designers produce—much of the rich complexity and diversity of the discipline is lying under the forest floor—known tacitly by the living species well versed with these relations.

Unsurprisingly, our understanding of design today remains defined by what it does and has done given its outcomes—design of buildings, products, services, graphics, exhibitions, film, sound, and many more (Redström, 2017, p. 91). Design can also be defined as a disciplinary response to socio-technological shifts—industrial design, interaction design, service design, systems-oriented design, and transition design, among others (Edeholt & Joseph, 2022, p. 12 in appendix). However, Redström cautions against defining design merely by looking at its history in hindsight, of what became, instead of what it is or could be, which risks 'fossilization' (Redström, 2017, p. 66).

If one perceives the disciplinarity of design purely based on what gets produced or how its tools and methods are applied, design and designing will look less like an expertise and more like a naive roleplaying exercise or a confused discipline stuck in the middle of art and science. I argue that this confusion is a categorical error, where one might know what design as a discipline synthesizes and retroactively define design by what it produces as its disciplinarity characteristic. Furthermore, it might be partly because of this that design has no precise definition, and whatever definitions exist are passionately contested on these grounds when it might be a distinct species altogether—one that might possibly imagine or contribute to whole new synthetic worlds for itself and other species.

3.3.3. TRANSCENDING DESIGNERLY REALITIES

In *The Design Way*, Nelson and Stolterman point out that design imagines “a not-yet-existing but immanent reality,” and this view “makes it possible to imagine an infinite number of new realities” (2012, pp. 124, 129). Elsewhere, Schön suggests that the ‘design situation’ in this process is a material one apprehended through “active, sensory” participation and “appreciation of actual or virtual worlds” (1992). These virtual design worlds are not empirical but speculative, based on interpretations of the complex mycelial knowledge gathered in the situation of *what-is*, and changed it to a preferred situation of *what could-be*. Here the two configurations of the virtual worlds are related—the preference towards *what could-be* requires a grasp of *what-is*. If so, what makes a particular synthetic reality preferable over possibly infinite others? Furthermore, what determines how this change happens and what is synthesized? At this stage, the mycelial analogy breaks down in its reductive frame and requires that one pose this question to the self-conscious human designing and seriously playing between these virtual worlds.

The What if

It is worth noting how designers might negotiate this movement between the analytical and the synthetic, which can also go beyond or transcend these domains of reality even as their constituent parts/states of knowledge and action are often moving. One can think of this as the designer ‘seriously’ playing with the virtual worlds of *What-is* and *What could-be*. This might help give a better insight into how designers know what they know and how they know it and synthesize it through and by the situated and embodied designing.

This serious playfulness in the face of instability suggests that designers, in

essence, are always in fundamental acknowledgment of agency; that is, they self-consciously begin with the assumption that what the situation requires is change, and therefore ontology is possible, and the objects of knowledge are real enough for this change to be possible. In other words, designers construct many possible fluid worlds, constantly moving and realigning with *what-is* to realize a desirable world that *could-be*. To move between these two states of reality is so instinctively designerly that one can often miss its relevance—asking the speculative *what-if*. It is important to note that while anyone can ask the question, few are trained to accomplish it well.

This particular creative leap is better explained through the critical realist framing of “retrodictive back-casting,” which is often the case in scientific discoveries, as Bhaskar et al. point out below:

*“Invention and creativity often play an important part here, since we will need to invent a solution to cure something or to ameliorate its effects. To do this, scientists use the logic of retrodiction in a certain way. Typically, retrodiction is the use of established theory to explain how things **must have been** for things to be as they are now. However, to find a cure, scientists use established theory to explain how things **might be** in order to achieve some imagined future good. Retrodiction in this conception is still a logic of the past (hence it is still “retro”) but now the scientists imagine themselves at some future point where the disease is healed and ask what must have happened to have resulted in the healing, using established theory to answer their question.”*

— Roy Bhaskar, Berth Danermark & Leigh Price in *Interdisciplinarity and Wellbeing* (2017, p. 99).

It is important to note that in a professional designer's case, considerable focus is put on new realities of what *could-be*, and much less time and resources are available to investigate in depth how things must have been. This makes design unstable in relation to the stable knowledge of, for example, a scientist in the above quote. Designers are often used to producing many *what-ifs*, practicing a constant fluid movement between the diverse worlds they generate to discover novel solutions to problems and compensate for this instability. However, the logic of retrodiction might still stand since the world imagined is still future solution-oriented and yet to be.

Schön has famously discussed this self-conscious movement of designers¹² and described it as a 'voyage of discovery' through the act of pattern recognition that enables the designer to construct virtual "design worlds" through the very materials and prototypes they produce and often discover intended and unintended consequences (1992, pp. 4,6,8). For an unintended breakthrough to have great significance and relevance and not be simply random, the designer must transcend the knowledges of both these realities—a creative brokering through a studied imagination that is primarily tacit. Eventually, the activities carried out to construct them, that is, the process of designing, are forgotten or rather become tacit and embodied knowledge internal to the designer. Ultimately the infinite possible virtual worlds 'collapse' into a singular instance of what is finally produced or synthesized (Buchanan, 1992).

Furthermore, these virtual worlds are also shaped by design traditions that shape or redirect conceptions of what these designed worlds will be given the influence of social, political, and material dimensions of knowledge in which designers operate. Design's disciplinary expertise as we know it today tacitly developed this explicit ability through training. Designers are mandated to creatively broker these infinite imagined social realities using various tools and methods they practice and make a preferred internal virtual world externalized and made real enough to be acted upon. Therefore, how design acts worldwide is shaped across a broad spectrum, from individual designers' uniquely internal world-building processes to the worlds made by communal disciplinary practices.

Nonetheless, as discussed elsewhere, while one can acknowledge the systemic conditions and traditions, it is still possible for design to transcend domain knowledges altogether for the possibility of new systemic roles that might be deemed necessary, and has done so historically (Edeholt & Joseph, 2022, p. 12, in appendix). I would argue that this tendency of design and designing to transcend knowledge domains is not merely accidental but a core feature of its deep disciplinary practice of intentioned, studied imagination and serious play—in other words, it is the core 'craft' of design.

This possibility to self-consciously transcend knowledge domains of *what-is* to *what could-be*, and at times even its own disciplinary traditions might explain

12 Schön observes that in the case of architects drawing an architectural drawing, the designer "constructs and reconstructs the objects and their relationships" within a design world (1992, p. 4). This construction can be with a particular line, a color choice, a screw that can reimagine the whole design world and change what it could become.

why, until recently, design has been successfully reinventing or transcending its own knowledge domains. It implies infinite tacit, synthetic variations that design can imagine itself being and move into given the right conditions.

However, this vibrant movement and its success might suggest a higher-order disciplinarity characteristic hiding in plain sight.

3.3.4. A DISCIPLINE OF INTERDISCIPLINARY BROKERING

In this section, I want to converge the previous discussions on what design does for society and what design is internal to the design disciplines to discuss what the deep disciplinarity of design might be. This is important for two reasons—firstly, there seems to be a lack of clarity on definitions, as already discussed. Secondly, and more crucially, there have been calls for design disciplines, given the climate crisis and design's responsibility in service of the systems that caused it, to become 'un-disciplinary,' and to become facilitators and mediators rather than experts (Escobar, 2018, p. 34). Instead, I want to explore what the previous discussions might be leading towards—that what we consider design's deep disciplinarity might be that of creatively brokering interdisciplinarity.

To prepare design for this discussion in the context of climate change, I want to use Bhaskar's framing of disciplinarity in relation to interdisciplinarity to try and make a relevant case for why design might fit the description:

“Disciplinarity is necessary for the neophyte to get a grasp on the deep structures and mechanisms which constitute the explanatory objects of scientific knowledge and which provide the critical purchase on the potentially ideologically saturated concepts of everyday life and understanding. Without familiarity with the process of retroduction to deep structures which explain phenomenal appearances, the interdisciplinary research worker may stay at a superficial level of understanding of his or her problem. However, without some familiarity with other disciplines and practice at understanding their own vantage points on a common reality, the putative interdisciplinary research worker may revert to mono-disciplinary dogmatism.”

— Roy Bhaskar in *Contexts of interdisciplinarity: Interdisciplinarity and climate change* (2010, p. 20)

To qualify as successful interdisciplinary research, Bhaskar considers it necessary that research transcend pre-existing cognitive fields of knowledge (2010, p. 5). As already discussed, design and designing take the available knowledge domains (*what-is*) and imagine other ways and worlds of being (*what could-be*). In this practice, designers transcend these knowledge domains by imagining

how things might be otherwise if something changed (*what-if*), which is uniquely singular to the situation and knowledges in say a project or research environment, but also a disciplinary tradition one can be socialized in and trained for.

However, as Cornell & Parker caution, not everything interdisciplinary is good or useful; there is a risk of “over-hasty synthesis of existing knowledge,” which can threaten to dismantle the inquiry and thus requires a precaution in what is synthesized (Cornell & Parker, 2010, p. 31). Designers get around this by practicing a precautionary principle of fabricating ‘mock-ups’ of speculative ideas in the real world. Given the broad mycelial brokering of knowledge and being in any given situation, designers fabricate these virtual worlds by creatively employing and even speculating on models, analogies, and insights from various fields than their own. It is important to note that the virtual worlds and solutions designers might imagine is not merely an additive pooling of knowledges from other disciplines but possibly a genuinely synthetic interdisciplinary integration of other disciplinary knowledges that is being self-consciously played with, even if transitionally so.

Bringing back the mycelium analogy again, in this world-building process, designers can possibly imagine space for diverse disciplinary relations facilitated and interdisciplinary environments shaped for themselves and other disciplinary species, much like mycelium does (Tsing, 2015, p. 138). In effect, design seems to be able to creatively imagine the possible emergence of a different reality transcending *what-is*, synthesized through design with reconfigured levels, structures, mechanisms, and even laminated wholes through its disciplinary practices and conveys it further to other entangled disciplines where even whole disciplinary research traditions could be speculated on which requires some grasp of other domain knowledges.

It should go without saying that there can be no single individual or even a single discipline proficient enough to tackle the range and depth that interdisciplinary work actually requires.¹³ But if these discussions hold any relevance, what one can see is that what Cross has called the fundamental paradox of design's interdisciplinary disciplinarity might not be a paradox at all (1999, p. 8). Design's deep disciplinary expertise might be because of its creative brokering or nurturing of knowledges and methods from other interdisciplinary conditions and reimagining it as tools for imagining speculative, fluid worlds and making the emergence of preferred realities happen through designing.

13 For Hoyer (2010) the IPCC is the closest one can see interdisciplinarity at scale.

This attribute may be considered a studied disciplinarity of interdisciplinary brokering, which might be tuned for possibilities of emergence.

It must also be noted that this discussion presented here is informed and developed by this research and its broad brokering of interdisciplinary fields through/by design and designing. Nonetheless, discounting for absolute co-occurrence or good fortune, this brokering of interdisciplinary domains distinguishes design's ontological and epistemological uniqueness as distinct from other disciplines. Even though not everything can be known about a design situation, it is practically how design practitioners often find the ideal solutions that have a qualitative fit that was unforeseen and a pleasant surprise, possibly transcending beyond what 'hybridity' or cross-disciplinary approaches might achieve.

Although this discussion still does not precisely explain what design and designing is, it illustrates a possible characteristic feature and why design has been dynamic, alive, and successful at moving into many domains over time, developing its foundations. With this discussion, one can begin to start and see how these creative interdisciplinary traits have manifested themselves. The point is to prepare design to articulate a response to its legacy of defuturing. If design has been an agent of defuturing, it stands to reason that it can explore other infinite alternative futures and make real the profoundly sustainable ones instead. For this, I will explore the challenges and possibilities as understood by a particular movement that emerged from within design, which has shown promise in creating a practice that tries to do this by imagining these interdisciplinary alternative futures and attempting to create a new direction for design—Speculative and Critical Design (SCD).

3.3.5. ALTERNATIVE PROVOCATIONS: SPECULATIVE AND CRITICAL DESIGN

Speculative and Critical design (SCD) emerged as a response to the entrenched unsustainability of everyday life, inspired by Critical Theory to imagine alternative futures and to try and reclaim design for what it could be (Malpass, 2017; Tharp & Tharp, 2013). It was intended to challenge and reclaim the imagined future from the narrow commercial design practices saturated with consumer-driven desires and desire-driven consumers to dream up critical alternatives instead. The practice gained prominence as an emerging practice and secured a creative niche within design, with the most widely referenced works of Anthony Dunne and Fiona Raby standing out (2013).

In their work, Dunne and Raby proposed to “dream up alternative futures”

that does away with the traditional modes of designing alternative futures by predicting, forecasting, trend analysis, and extrapolating existing notions of modernist visions in a late capitalist society. By dreaming up alternative futures and posing *'what if'* questions, they showed that design practice could move beyond predicting and forecasting the future based on preconceived notions and trends of everyday modern life (Tharp & Tharp, 2013).

The 'critical' in SCD stands for Critical Theory, which informed SCD's early development and articulation as a form of constructive design research (S. Bardzell et al., 2012). Leveraging critical theory for social good and aesthetic experiences to draw out the criticality of futures has been a welcome shift, given the limited avenues for playing with criticality in design practice. For a while, SCD seemed to have addressed the call for 'critical cultural studies of design,' bringing social theory to design studies (Escobar, 2018, pp. 45–46).

However, what it means to design a critical project remains unanswered (S. Bardzell et al., 2012). Dunne and Raby's framing of SCD tends to be anti-method, focused on creating discourse and cultural meaning through artifacts (2013, p. 290). Their preference is firmly against 'design solutionism,' which they would consider the domain of commercial design instead (Ibid, p. 102). Scholars have pointed out that this lack of a method and its niche positions makes SCD seem more like an 'approach' or an 'attitude' toward provocation (J. Bardzell & Bardzell, 2013).

Although SCD opposes how things are, Business as Usual (BaU), it leaves a lot to be desired when asked to stand for any desirable alternatives. Since it is inherently against a solution-driven perspective that it considers in the domain of commercial design, SCD does not prescribe a method for creating critical objects and does not solve needs. In its rejection of the commercial design practice, it tends to overlook those alternative solutions that could be used to solve the problem it opposes.

Furthermore, the explicit framing of provocation that Dunne and Raby articulate is aimed at exploring possible alternatives to global market-driven futures by, ironically, imagining the future "citizen-consumer" since it is "through buying goods" that reality takes shape (Dunne & Raby, 2013, pp. 37, 49). It seems that the hope for such a practice is that it can function as a tool for engaging with futures that may or may not be desirable, leading to a discourse that leads to awareness for citizen-consumers to act towards changing how things are today.

This irony is not lost on design philosopher Cameron Tonkinwise, who points

out that these otherwise “unthinking, unimaginative” citizen-consumers, therefore, have no agency other than to demand more from industry and society, where our “agency to determine futures lies only in the hands of those with discretionary budgets to spend” and further reinforces the “superior status of technoscience” (2014, pp. 182, 184).

However, pursuing critical futures based on the rejection of commercial design practices that rely on notions of progress and co-optation of utopian visions can also end up rejecting utopianism for its commercial association. Tonkinwise points out this oddity of SCD that wants to avoid the bottom line, mass-manufactured tropes of commercial design, and yet its practitioners also appear to prefer the finish of a commercially designed product to give weight to the provocation (Ibid, p. 175). These choices, of course, unsurprisingly land the provocation in a dilemma for the audience now exposed to the provocations intended for the citizen-consumer can also make certain undesirable provocations more desirable instead.

As artist-researcher Luiza Prado de O. Martins observes, this privileging can be attributed to the history of the practice itself, which originated within the confines of “developed, european countries and practiced largely by a privileged and mostly white, male, middle class crowd” (2014, p. 9). Furthermore, if the provocation achieves anything, it remains in the realms of the aesthetic and the emotional, confined to the senses and awareness as experienced in controlled museum environments where they might remain an ‘elitist mystery’ reserved for a privileged few (S. Bardzell et al., 2012). While these experiences are valuable in themselves, the often dystopian preference within SCD based on such a privileged view is just an everyday reality for those marginalized majority of the world, cultivating future anxieties (Martins, 2014).

Thus, typical SCD projects often rely heavily on dystopian narratives as a trope for provoking certain privileged sensibilities where the promise of utopia is now resigned to history. Today, this tendency has seeped into the popular speculative imagination, as foresight scholar Richard A. Slaughter has observed, expressed as a disappointment with the future and a warning of things to come (1998).

Tonkinwise further points out that without radical politics, the inadvertent effect in SCD is that the alternative futures that get speculated upon are exactly the horrifying futures we hope will never happen to anyone, anywhere (2014, p. 187). It is unsurprising, then, that SCD can never really move beyond the museum (Ibid, p. 178). Here SCD shares the same fate as ‘bio-design,’ which tries to emulate bio-art, yet outside the museum experience, the work quickly turns horrifying (Cogdell, 2011).

The alternative futures that SCD traditions tend to imagine are not merely an innocent exercise but require that one ask the question—who is doing this critical thinking for whom, and to what end? Within academic research contexts, uncritically-critical provocations can end up depoliticizing the struggles for an alternative everyday life and build on perpetuating future imaginaries as commodified spectacles of pain and humiliation of those marginalized and passing it off as new knowledge or research similar to what Tuck & Yang have cautioned about in social science research (2014, p. 223).

Arguably, this further entrenches the hegemonic structures that SCD claims to question and contest, and often one can end up leaving with the notion that despite everything—the alternative is that there is no alternative. Without the means to enact alternative futures in everyday life, critical discourse and provocation can result in recursively creating prolonged anxiety and profound cynicism—effectively dehumanizing the present and the future.

3.4. ON DEHUMANIZATION

“Dehumanization, which marks not only those whose humanity has been stolen, but also (though in a different way) those who have stolen it, is a distortion of the vocation of becoming more fully human. This distortion occurs within history; but it is not an historical vocation. Indeed, to admit of dehumanization as an historical vocation would lead either to cynicism or total despair. The struggle for humanization, for the emancipation of labor, for the overcoming of alienation, for the affirmation of men and women as persons would be meaningless. This struggle is possible only because dehumanization, although a concrete historical fact, is not a given destiny but the result of an unjust order that engenders violence in the oppressors, which in turn dehumanizes the oppressed.”

— Paulo Freire in *The Pedagogy of the Oppressed* (2014, p. 18)

Dehumanization, as Freire points out above, is the distortion of becoming fully human, tainting those whose humanity is stolen *and* those who steal them. This definition is quite loaded and open-ended since it depends on one’s conception of ‘humanity’ to define dehumanization, which can be as diverse as there are humans on the planet. While I focus my discussions here in the modern context, it stands to reason that the peculiarities of humanization and dehumanization are fundamentally entangled. As long as there are humans, dehumanization remains a possibility, making the phenomenon particular to specific individual and universal contexts.

Admittedly, given the broad and complex literature on the subject and the limited scope of this thesis, I can only develop a partial discussion here. The following pages will engage with some critical scholarship constructing the transitional scaffolds and building some essential systemic relations between defuturing and dehumanization necessary to prepare the *What-ifs* and orient for the journey to the *What Could-be*, paradigm P2. The following pages will explore the relationship of dehumanization with defuturing, which has critical implications for understanding the climate crisis, the systemic legacies from which it emerged, and the present-futures it continues to dehumanize.

Let me begin this discussion with what we know about our early human ancestors as the starting point of this discussion.

3.4.1. FROM AN IMAGINATIVE SPECIES TO A SOCIETY AT WAR WITH ITSELF

In bookstores across the world, one can find a popular genre of writing, which despite their variation, tells an all too familiar story—the story of the origins of the human species from naïve hunter-gatherers to civilized modern man with a strong focus on technological development. Such large sweeps of 'big histories' tend to describe a human species moving along an essentially linear and almost predetermined path, where revolutionary technological forces shape society and produce it. Given its popularity, one can perhaps understand its appeal—except the evidence does not support this conclusion. Such stories construct mythologies of human history based on a misreading of, and extrapolating from selective evidence and have even been called 'populist science' (Narayanan, 2022; Weintraub, 2018).

The Fundamental Social Freedoms

In *The Dawn of Everything*, David Graeber and the 'comparative' archaeologist David Wengrow bring forward the latest evidence from archaeology and anthropology and claim that early human societies were neither static nor primordial (2021). Early foraging societies were routinely moving and constantly experimented with social and political arrangements, sometimes coming together in vast complex configurations and dispersing into smaller units, radically fluctuating with the seasonal variations (Ibid, p. 125). Such a feature of early human society, as the authors assert, was "necessary for the kind of seasonal demographic pulses that made it possible for societies to alternate periodically between different political arrangements, forming massive congregations at one time of year, then dispersing into a multitude of smaller units for the remainder" (Ibid, p. 125).

The authors assert that such "seasonal and demographic impulses" were also available to individuals who were routinely on the move, intimately linked to the practice of one's personal freedoms. More importantly, the authors identify the types of freedoms taken for granted in early human society and put into practice: "(1) the freedom to move away or relocate from one's surroundings; (2) the freedom to ignore or disobey commands issued by others; and (3) the freedom to shape entirely new social realities or shift back and forth between different ones" (Graeber & Wengrow, 2021, pp. 519–520). They discuss the archaeological evidence from the Upper Paleolithic period (approx. 50,000 and 12,000 years ago), revealing that in this period, people did not merely imagine new social orders but may have consistently lived out these diverse

arrangements over sustained periods (Ibid, p. 502). In practise, a person could even have different name and even be a *completely* different person with each social arrangement.

These fundamental “forms of social liberty” made it possible to negotiate and prevent any relation to arbitrary forms of power and domination from becoming permanent. These freedoms, the author posit, would explain the “mixed composition” of the many early foraging societies (Ibid, p. 125). Early humans, thus, may have been far better travelers, more deliberate in their social arrangements, and more culturally dynamic than previously thought.

The practice of these freedoms was also relevant in how cultures engaged with the idea of ‘nature.’ It would seem that Nature was understood not as something to be dominated but needing ‘persuasion,’ and even leisurely ‘played’ with (Ibid, p. 239). This characteristic of leisurely play and given social and personal freedoms meant that one could also transform the realities one wanted in the material and social sense, knowing that other realities were just as possible. Contrary to familiar narratives, this recent evidence suggests a more inventive and imaginative human species than previously assumed. In a contemporary sense, one may imagine them role-playing as characters of these new worlds and moving through them, remaking their social and technological realities as they saw fit. Seen this way, imagining alternative realities seems like a fundamental feature in early human development.

Neolithic Science and Zones of Ritual Play

Given this new evidence of their social and cultural porosity, the authors assert that early Neolithic societies (10,000–4,500 BC) and their social imagination had a deep correlation with their technological inventiveness. It seems that for most of human history, the authors point out, “the zone of ritual play constituted both a scientific laboratory and, for any given society, a repertory of knowledge and techniques which might or might not be applied to pragmatic problems” (Graeber & Wengrow, 2021, pp. 500–501). These zones of ritual play, it seems, were central to social experimentation as a leisurely, playful activity where nature was persuaded to do much of the labor (Ibid, p. 239). When these Neolithic scientists traveled between these zones, they effectively moved into entirely new worlds, pasts, and tangible futures.

Throughout human history, it would seem in these zones of ritual play, the future became real and could be lived in or rejected. For the authors, such a ‘concrete’ approach toward social and technological playfulness was “undeniably science” and led to humanity’s most significant scientific discoveries. Most

astonishingly, these inventions were all first discovered and applied to forms of ritual play well before any of these inventions became applied to their eventual industrial uses—from the invention of agriculture (first as play farming), to ceramics (for figurines), to mining (for making pigments), to wheeled transport (for children's toys), to steam engine archetype (for theatrical illusions in temples), and more famously gunpowder (for fireworks) (Ibid, pp. 239, 499–500).

Furthermore, the authors argue that this social and technological creativity may have been positively correlated with women's freedoms in these societies. They conclude that these early Neolithic scientists were mainly women, now written out of history, engaging in ritual play such that innovation in these societies was based on these social experimentation sites where a collective body of knowledge accumulated and would pass on over centuries, mainly by women (Graeber & Wengrow, 2021, p. 499).

These zones of ritual play, their inventiveness and their correlation with women's participation was not limited to the Neolithic period but could also be seen even in the Middle Ages of Europe. In *The Religion of Technology*, David Noble points out that the 'useful arts' were identified as much with women as with men, and women were engaged in almost all aspects of technological practice (1997, p. 211). In *The Death of Nature*, philosopher and historian of science Carolyn Merchant too documents how in preindustrial capitalism, women had diverse forms of participation in everyday social and productive industries like handicrafts, gardening, farming, soap making, spinning and weaving, and craft and trade guilds as essential players in the domestic spheres of production, which reflected their status in a hierarchical class (1980, pp. 149–150). Women were very much central in these activities and were always actively involved in the advancements of these 'useful arts' or as we might call crafts and technologies today (Noble, 1997, p. 210).

Merchant's work showed how in this period, the image of Nature and Women were often associated with each other (Merchant, 1980, p. 127). In *Caliban and the Witch*, the feminist Marxist scholar Silvia Federici builds on this work and argues that nowhere was this association more intimately evident than in those who practiced witchcraft (2014). For Federici, it wasn't so much the validity of the practice itself but what the figure of a “witch” symbolized and embodied—an organic philosophy and a sacred, magical view of Nature. She further points out that the “basis of magic was an animistic conception of nature that did not admit to any separation between matter and spirit, and thus imagined the cosmos as a living organism, populated by occult forces, where every element was in “sympathetic” relation with the rest.” (Ibid, pp. 140–142).

The practice of witchcraft helped women assert political autonomy—an exercise of the first freedom—to disobey. Federici argues magic was, in essence, getting what one wanted without work or “a refusal of work in action” and a rejection of arbitrary coercion, lest one invite the wrath of occult forces, and was seen commensurate with women’s role as the embodied manifestation of an organic, magical philosophy (Ibid, pp. 140–142).

One could also see this embodied, mystical relationship in prevalent conceptions of Nature and Society were popularly engaged through the alternative visions for societies called Utopias. These utopias often presented a relational, holistic ecological image of Nature aligned with an Organic Philosophy. Merchant describes three tendencies in these organic philosophies and how they viewed society. The ‘hierarchical’ and ‘communal’ movements justified and naturalized existing social structures like hierarchies and monarchies, or they could be ‘revolutionary,’ as “ideals for the transformation of those structures” (Merchant, 1980, pp. 69–70). Those crafting these utopias¹⁴ were not merely visionaries, according to Merchant, but activists, who wanted their visions to change the community at large, consistent with the philosophies of science and the integrity of the natural environment and human equality (Ibid, p. 95).

The revolutionary potential of these Organic Philosophies was informed by a holistic view of Nature, Society, and Women as integral to a holistic view of the world. Consequently, the utopian imaginaries they helped shape were concerned with some form of return to an organic society as “a political and religious response to the breakup of the community taking place under sixteenth-century commercial expansion and continuing feudal disintegration” (Merchant, 1980, p. 92). Thus, if they sought to offer Organic Philosophies that placed people within Nature, it was in response to the mechanistic domination of Nature, represented by the growing influence of the Mechanistic Philosophy.

They envisioned communal societies instead of domineering hierarchical ones, holism instead of atomization, labor that was creative and leisurely instead of alienating and drudgery of industrial capital, communal sharing of resources instead of the enclosure, and the liberated status of women from all classes (Ibid, pp. 82–83).

¹⁴ Merchant discusses three particular utopian fictions, two of them egalitarian, Tommaso Campanella’s *City of the Sun* (1602) and Johann Valentin Andrea’s *Christinaopolis* (1619), contrasted with a third, *The New Atlantis* by Francis Bacon (1627) which undermined and transformed the concept of an organic utopian community (1980, pp. 79–80).

Even though the revolutionary utopias were not without their flaws,¹⁵ they still offered hope for a new social order and represented a response to the real needs of seventeenth-century struggles of the poor and marginalized for change—offering authentic alternatives to existing social conditions. This might be considered a practice of the third freedom from earlier—to imagine alternative social realities. To understand the alternatives they imagined, it's also important to know that these utopias were set against the backdrop of violent, ongoing social and ecological transformations within European society, from the crisis of feudalism to modern capitalism and globalization through colonialism.

A War on Nature, Women, Body and the Mind

In *A History of the World in Seven Cheap Things*, Raj Patel and Jason W. Moore point out that while the conception of 'Nature' and 'Society' as separate predated capitalism, what capitalism achieved, was turning this distinction into an organizing principle for Society (2017, p. 51). One can trace this fundamental worldview of capitalist societies as it emerged from the radical subversion of utopian ideals and the transformation of the entangled relations between Nature and Women, a correlation that would have drastic consequences.

In the turmoil of crumbling feudalism, Federici argues, since magic seriously threatened the capitalist rationalization of work, it had to be necessarily eradicated (2014, pp. 140–142). Merchant traces out the direct relationship between how Women and Nature oscillated between dualities as Merchant points out:

“The virgin nymph offered peace and serenity, the earth mother nurture and fertility, but nature also brought plagues, famines, and tempests. Similarly, woman was both virgin and witch: the Renaissance courtly lover placed her on a pedestal; the inquisitor burned her at the stake. The witch, symbol of the violence of nature, raised storms, caused illness, destroyed crops, obstructed generation, and killed infants. Disorderly woman, like chaotic nature, needed to be controlled.”

— Carolyn Merchant in *The Death of Nature* (1980, p. 127)

Merchant documents how the adherents of the Mechanical Philosophy, like

¹⁵ The utopias of Campanella and Andreä, as Merchant points out, had several shortcomings, most notably their dependency on clerical traditions (heaven-hell dichotomies) and even believed in eugenics strongly to maintain the sanctity of these societies (1980, p. 94).

Francis Bacon, tended to view Nature as a force to be dominated and regarded Society in hierarchical and patriarchal ideals and favored the market economy (1980, p. 80). She discusses how Bacon explored this domination based on this reductive dualism in vivid, disturbing metaphors—an unruly, savage Nature had to be bound, constrained, molded, and enslaved and 'her' secrets uncovered (Ibid, p. 169). For Merchant, these social transformations were built with a core ideological premise—“of passivity and control in the spheres of production and re- production,” which implied submission “to the controls of the experimental method and technological advance” (Ibid, p. 149).

Elsewhere, Federici argues that the Mechanical Philosophy offered the promise of a violent conquest over the seeming irrationality of Nature which was embodied by the Witch, which capitalism had to destroy (2014, p. 11). She points to this particular moment where the modern conceptions of labor as separate from the 'Body' was also constructed, transitioning from the idea of a 'mystical body' as was understood in the medieval world (Ibid, pp. 140–142). Her assessment of capitalist accumulation in this period looked at this transition transforming the social position of women and the production of labor power created by first relegating women to the new sexual function for the reproduction of the workforce—“into a machine for the production of new workers” (Ibid, p. 12). Eventually, these transformations of women's status would transcend class relations themselves, where even middle and upper-class women would have to submit their reproductive function for social production (Federici, 2014, p. 14; Merchant, 1980, pp. 149–150). In Federici's words, the Body was not only reduced but rather “destroyed” and transformed into labor power (2014, pp. 140–142).

Since the Witch was the embodiment of Nature and the Organic Philosophy, the degradation of Nature became synonymous with the persecution of Women in Society. Thus, in a perverse sense, the embodied magical view of Nature and Women was now degraded through torture and death to pursue new reductive conceptions of life in the service of primitive accumulation under capitalism, to transform life—nature, women, and human labor into the capacity to work. (Ibid, p. 16).

Although the mystical yet holistic worldviews of Organic Philosophies were replaced or overpowered by the reductive Mechanical Philosophy, it also led to many counterhegemonic breakthroughs. The Age of Reason and Enlightenment ideals were undoubtedly instrumental in philosophical and scientific breakthroughs that shook the foundations of the political and social structures with searing critiques of the established social order and questioned the legitimacy of many of the institutions of domination that existed then

given new insights on the ideals of equality, fraternity, freedom, and justice. However, Bacon's conception of 'Knowledge becoming Power', according to Federici, was only possible if it was enforced through "initiative by the state" and criminalizing whatever could be termed "irrational" in the Age of Reason (2014, pp. 140–142). It is thus hard to ignore the bitter irony that Federici points to, where the basis of this seemingly rational shift was also simultaneous with a "genocidal war" against women (Ibid, p. 14).

More crucially, one gets a fuller context of the worldview or the cosmology that informed the political developments of capitalist globalization as it emerged from this war. The economic and scientific order of 16th and 17th century Europe that emerged from this war was "forged through an alliance between the Church, the nobility, and the bourgeoisie and founded on a war against women, peasants, and urban working classes" (Basu, 2022). Seen as a political transformation, one can see these transformations in a better light. Such compelling feminist analyses of primitive accumulation around this period crucially complements and departs from a Marxist view that only looked at the waged male proletarianization and commodity production (Federici, 2014, pp. 12–13).

With their removal from active social life, even from wage work as economic participants, women were relegated to ever narrower domains of households to engage with care work, what Patel & Moore term a period of "The Great Domestication" (2017, p. 117). Given this context, Noble asserts elsewhere, a world without women did not simply emerge; it was rather constructed as a conscious human endeavor (1992, p. 43). Furthermore, Federici's analysis lays out the broader connections between the persecution of witches and vagabonds, the slave trade, and enclosures of land, which were central to the accumulation practice and the formation of the modern proletariat in Europe as it expanded into the colonized worlds (2014, p. 14). Patel & Moore point out that the disintegration of feudalism forced the ruling classes to scramble for more novel solutions to restore their wealth through global conquest in search of new frontiers for accumulation (2017, p. 49).

Effectively, in the transition to modern capitalism, this internal war would travel the world interacting, collaborating, undermining, and intersecting with social arrangements elsewhere. Federici asserts that the mechanization of the world was preceded by and premised on the mechanization of the Body (Federici, 2014, p. 191). Furthermore, Patel & Moore discuss how the mechanization of the Body also meant the mechanization of the Mind, which relied on the separation of the Body from the Mind, and the thinking from the thinker where "the era's ruling elites saw most human beings—women, people

of color, Indigenous Peoples—as extended, not thinking, beings” (2017, p. 52). Thus, the right of domination now encompassed land, flora, and fauna that even included humans who were never fully human (Ibid, p. 51).

In essence, what got constructed was a social reality, essentially conditioned on the subordination and subjugation of Nature, Women, the Body, and even the Mind since its expression was denied to most, where the death of each was entangled with the death of others—a society at war with itself. It is perhaps at this juncture that the profound heaviness of the late evolutionary biologist, Stephen Jay Gould’s statement becomes apparent:

“I am, somehow, less interested in the weight and convolutions of Einstein’s brain than in the near certainty that people of equal talent have lived and died in cotton fields and sweatshops.”

— Stephen Jay Gould in *The Panda’s Thumb* (1992, p. 151)

3.4.2. THE CALCIFICATION OF THE IMAGINATION AND THE CRISIS OF CARE

In the context of the climate crisis, this system is not a mere vestige of history but a present-day operating principle; as Ghosh asserts, “the global hierarchies that were then put in place persisted well into modern times and were in many ways constitutive of modernity” (2021, pp. 217–218). Yet, the Indigenous Aymara/Bolivian scholar Silvia Rivera Cusicanqui reminds us that the colonial project was also resisted, reimagined, reinvented, reclaimed, and responded to with diverse and contradictory projects (2012). What one can learn from these indigenous perspectives is that colonialism was not inevitable or straightforward, and its history is vastly more complicated and counterintuitive:

“Although it is true that modern history meant slavery for the indigenous peoples of America, it was simultaneously an arena of resistance and conflict, a site for the development of sweeping counterhegemonic strategies, and a space for the creation of new indigenous languages and projects of modernity.”

— Silvia Rivera Cusicanqui in *Ch’ixinakax utxiwa: A Reflection on the Practices and Discourses of Decolonization* (2012)

What is worth exploring a bit here is how many indigenous cultures saw colonialism as a project born out of an ongoing social and ecological apocalypse

back in Europe, often describing it as a form of social malaise¹⁶ and knew what it would mean if it took root in the indigenous world and thus chose to resist and critique it. This is best revealed when Graeber & Wengrow discuss the “indigenous critique” of European settler society (2021, p. 62).

The Indigenous Critiques

Graeber & Wengrow document indigenous intellectuals of present-day North America who would openly challenge the ephemerality of the colonial project and point out contradictions that confounded their European settlers. These popular but scathing Indigenous critiques were quite unsettling and embarrassing for the European colonial society in two crucial aspects. Firstly, they could not believe that those they considered ‘unthinking beings’ could offer sophisticated analyses since only fully civilized human beings were deemed capable of complex thought.

Secondly, according to Graeber & Wengrow, the most confounding critique was how the indigenous described European settler society as being “neither generous nor kind” (2021, pp. 37–44). The authors discuss how the indigenous intellectuals visiting Europe saw the exploitation of the most vulnerable and ritual spectacles of public torture of those *within* the community, even within households, to coerce and maintain social cohesion. This intensity of violence for the indigenous was usually reserved only for their external enemies, so they concluded that what they witnessed was an ‘internal war’ (Ibid, pp. 512–514).

The critiques themselves were a blow to the seemingly noble intentions of carrying the so-called burden of civilization and that they were mere “temporary vehicles to speed up their subjects’ march to civilization” (Ibid, p. 62). Despite these counterarguments, the power of the critiques shook 18th-century European intellectuals struggling to justify the inequality and the profound contradictions of their age.

After many intellectual debates, the authors point out, the European intellectuals in this political struggle found a creative loophole. They would construct an argument that the more advanced forms of freedom and equality

¹⁶ When seen from a worldview that considers non-humans as relatives, a person who exploits one's natural and social relations and ‘consumes’ them not for fulfilling needs but purely for accumulation and endless consumption can be considered to have a distorted sense of their humanity. See Forbes (2010) for further discussions that links this indigenous view with Freire's conception of dehumanization. Furthermore, this malaise is not limited to individuals; it can apply to whole societies, institutions, and systems. See Kimmerer (2013, pp. 304–309) for a more contemporary discussion in relation to the climate crisis.

enjoyed in the indigenous cultures they were decimating were not a sign of superiority to be emulated by a European society deprived of these freedoms. It was argued to be a sign of inferiority, to be pitied because it was a primordial society lacking ambitions of modern technological civilization (Graeber & Wengrow, 2021, pp. 60-62). Thus social progress was redefined as a society's ability to be technologically advanced. The authors assert that the innovation in such arguments was to reductively conceive of material economic progress and project it onto a general theory of history and, in effect, creating the notion that advanced societies were also advanced technologically, and inevitable given the complex division of labor in an advanced "commercial civilization" (Ibid, p. 60).

Graeber & Wengrow unpack the most famous of these proclamations, which came from the French philosopher Jean-Jacques Rousseau. They explore how Rousseau would speculate on humanity's 'fall from grace' from a primordial state of Nature, 'fumbling' into the chains of civilization where bureaucracy, hierarchy, and inequality resulted from the complexity arising from the advent of agriculture, which was necessary for the civilizing process (Ibid, pp. 64-65). The authors argue that these were the very ideological origins of what today we consider particular notions of civilization, evolution, and progress—constructed as a direct response¹⁷ to the power of indigenous critiques (Ibid, p. 62).

While many societies outside of Europe were far more advanced even in this sense, and the evidence from history available at the time could have upended many of these assumptions, it is worth pointing out the ingenuity of such a construction in how it adapted to such contradictions. In effect, the upending of the indigenous critique created a linear, technological structure to notions of progress, ultimately calcified in a preordained dualistic state of human society (Figure 17).

On this axis, one could construct hierarchical and staged mythologies of an idyllic past and future. To choose progress and civilization was to prefer Worldview B (Figure 17 right). This way modern civilized society represented by the colonists was at the peak of civilization, headed on a path to an Edenic *utopia*, and therefore had the natural, divine right to claim lands, people, and knowledges for itself, through its sheer ambition of industry and military prowess. On this side of the split were the modern enlightened humans who

¹⁷ The critiques themselves according to Graeber & Wengrow, were influential on the development of Enlightenment ideals where the egalitarian values of freedom, equality, and justice emerged from these dialogues. However, over time, the movement also erased the many contributions and influences from many non-European intellectual cultures at the time. (2021, p. 492).

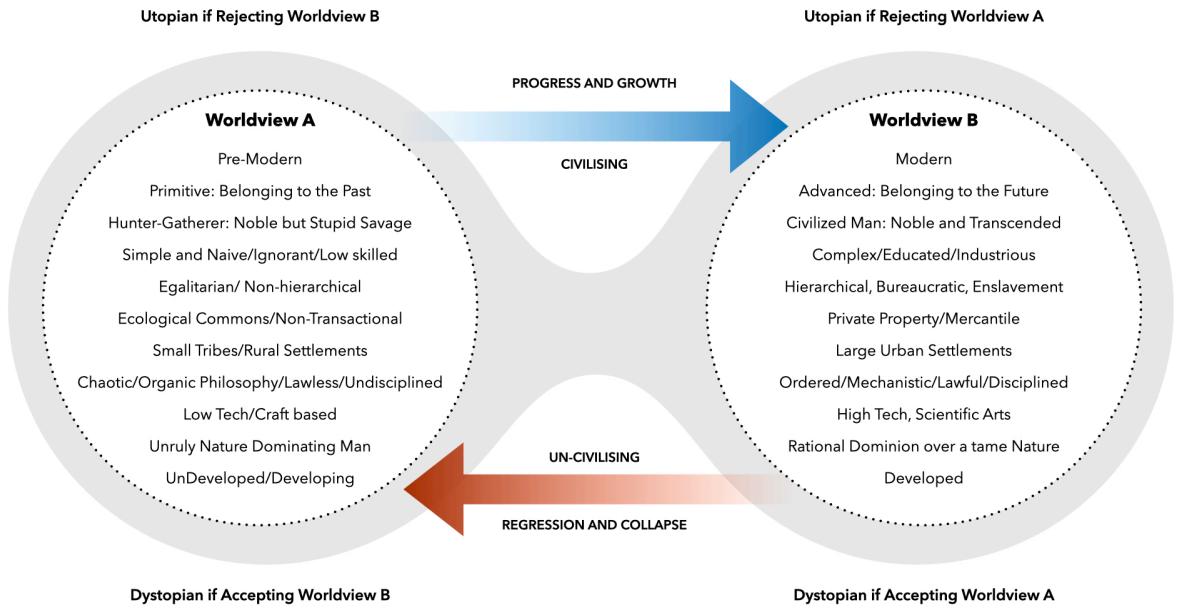


Figure 17. European Intellectuals inventing a linear conception of civilization and progress, utopia and dystopia in response to indigenous critiques. Illustration based on discussions by Graeber and Wengrow (2021)

were simply 'burdened' with the civilizing mission for all. On the other hand, the colonized were catching up and had to stage their progress in the footsteps of history or regress and collapse towards the *dystopia* of worldview A (Figure 17 left).

Nevertheless, even if one were to consider rejecting Worldview B for its ecological and social ills, one was inevitably 'stuck' on this inevitable axis. Thus the only reasonable option seemed to seek a return to a primordial utopian state of Worldview A and necessarily giving up on modern technological abundance. On this end of the split was an imaginary, primordially innocent species—represented by indigenous peoples who were 'stupid' even if 'noble.' Thus it implied that while one could sympathize with the plight of the indigenous people being decimated, they were somehow stuck in the past, willingly or unwillingly, unable to see the future. In their company were also those wanting to revolutionize the oppressive social structures of feudal, colonial society, who were also stuck in trying to return to a primordial state which was a recipe for total social collapse that Europe had supposedly overcome.

At its core, this creative construction was a political and ideological breakthrough—it effectively placated the crisis of legitimacy of the European colonial project being challenged from both within and outside it. This conceptual dissonance was seen in how utopian stories were co-opted to justify

colonialism both within and outside of Europe. Utopias once bestowed with the revolutionary hopes of the marginalized seeking change in their societies were, in a bitter sense of irony, twisted to imagine an ideal future state of civilization based on domination, as Ghosh astutely observes:

“In the seventeenth century, even as conquered territories like the Bandas were being violently emptied of their inhabitants, it was becoming fashionable for intellectuals in Europe to imagine perfect societies, or Utopias. This early form of science fiction was another companion genre of colonialism, in that it imagined alternative worlds built on supposedly “empty” spaces...The irony of these utopian imaginings is that they date back to a time when Europeans were actively engaged in constructing new societies, in lands where the native populations had been effectively eliminated.”

— Amitav Ghosh in *The Nutmeg’s Curse* (2021, p. 217).

Confusing Domination and Care

The consequences of such ideological constructions continue to calcify the social imagination—defining social progress as necessarily technological and the technological implying social progress. To imagine anything else beyond this dichotomy or playing between these two conceptions was and still remains conflated with breaking some sacred law of human nature. However, Graeber & Wengrow suggest that early human history was far more complex than such calcified dualisms and instead ask that we consider these ancestors as our intellectual peers. Their discussions also challenges another reductive view of human history—the primordial innocence of man.

Despite the ideological mythologies of European colonization that erased many histories and knowledges, it is hard to ignore a pattern of history that seemingly repeats itself—capitalism, colonialism, slavery, warfare, patriarchy, class systems, feudalism, inequality, or ecological catastrophes they cause are not uniquely European, or exclusive to the modern era. These are *not* the only systems of domination that exist or have ever existed in the world.¹⁸

¹⁸ For example, in South-East Asia, the highly rigid caste system even predates the European patriarchal system, where an upper caste both others and marginalizes while maintaining a strict purity of genealogy within one's own group—ensured by endogamy and extreme control over bodily autonomy ensured through patriarchal dominion (Rege, 2018). Furthermore, in the modern age, some of these tendencies also borrow from and amplify each other. See Wilkerson (2020) who draws on the similarities between the South-East Asian caste system with the racialised social order in present day North America. It is possible that as more intersectional questions come to fore, a fuller view of this pattern will develop.

Recall then the imaginative ancestors from earlier (see section 3.4.1.). Given the time scales of human social development involved, our ancestors, having traversed numerous social configurations, would find themselves in dehumanizing arrangements for a while. Graeber & Wengrow point out that while systems of slavery and warfare were prevalent in human history, they were also frequently abolished (2021, p. 523). What they conclude with this astonishing fact is that even that after having been abolished these systems, they kept 'stubbornly' recurring. One seems compelled to ask: why would this once imaginative species, simply not practise the social freedom to play with its social realities and just disobey, move away, or even reimagine such systems of dehumanization—why did these dehumanizing systems of social reality re-establish themselves in cultures even after they were long abolished?

For Graeber & Wengrow it seems that this calcification of the imagination emerged from the gradual loss of fundamental social freedoms at a unique moment in human history—beginning with the introduction of arbitrary external violence and dominion that became internalized in the most intimate, domestic social relations of care and transformed women's status in the home (Ibid, pp. 510, 513, 521). They conclude that this confusion between internal care and external domination transformed social relations and meant that many who were once whole persons in 'caring relations' eventually became non-persons to be dominated.¹⁹ The tragic reality of this social entrapment makes it more relevant to understand how domination and care became entangled in a revealing excerpt:

“The captive as slave becomes trapped in the role of ‘caring for others’, a non-person whose work is largely directed towards enabling those others to become persons, warriors, princesses, ‘human beings’ of a particularly valued and special kind..

... if we want to understand the origins of violent domination in human societies, this is precisely where we need to look...

Mere acts of violence are passing; acts of violence transformed into caring relations have a tendency to endure.”

— David Graeber and David Wengrow in *The Dawn of Everything* (2021, p. 191)

¹⁹ Today, we might call this social death (Králová, 2015) and also why Federici uses the word genocide in her assessments—the enslavement of women and the enslavement of people as a process of social death—of total dehumanization.

The authors note, that with this transition followed the slow loss of the fundamental freedoms. Thus those who sought refuge in other places whenever their freedoms were threatened although initially welcomed as sacred beings were gradually debased and began to be exploited, eventually trapped in these caring relations now built on domination (Ibid, pp. 518–519). They argue this confusion slowly eroded the first fundamental freedom, to move away or relocate, followed by the loss of the second freedom to disobey arbitrary orders, and further eroded the third, the ability to imagine new social worlds and live them.

What they suggest is that it is not so much that dehumanization occurs but that it becomes the operating principle of social relations and institutions and eventually becomes normalized such that relations that were once negotiable and flexible become fixed or calcified and the social imagination eventually atrophied (Ibid, p. 514). They argue that over the course of human history, it seems that this mix-up or confusion became further institutionalized, and with it, the “progressive division of the human social universe into smaller and smaller units,” losing the social diversity of relations that the species once enjoyed (Ibid, pp. 519–520). The authors assert that the confusion between domination and care became coded into social institutions.

Given this new understanding, one may also read the upending of the indigenous critique by European intellectuals as an effort to ‘carefully’ craft moral arguments to justify a worldview premised on domination. This might also explain why the domination of Nature, Women and their Bodies was presented as a force for the social good of all, to rationalize and control an irrational and unruly nature, since it was the righteous thing to do if one claimed to care for the improvement of the entire human species (Merchant, 1980, p. 169; Patel & Moore, 2017, p. 54).

More insidiously, this calcification of the imagination was so powerful that even when the evidence from history presented itself, it was assumed to be an anomaly (Graeber & Wengrow, 2021, p. 502). One might argue that what we came to call civilization today became practiced through the domination of Nature, Society, Body, and the Mind, and this domination was justified as caring for civilization.

3.4.3. CARING FOR A CIVILIZATION OF DOMINATION

What I want to explore next and lift up is how this confusion between care and domination along an arbitrary axis of progress and regress has had lasting consequences for us today. The following pages will explore these consequences

in the 'cultural disappointment' with the present-future when technological creativity without the complementary social imagination eventually runs out of steam in service of a civilization that dominates Nature, Society, Body, and the Mind. Finally, I will discuss how the future looks when these conditions are uncritically extrapolated far into the future.

Optimism of the Intellect: The Religion of Technology

Given the developments in the past few centuries, there is no denying that technological leaps have been helpful to society, despite their ills. With the Scientific and Industrial Revolutions, the Mechanical worldview was a powerful tool for reinventing Nature and Society, offering the promise of technological abundance. The Baconian traditions, which subverted the organic philosophies of magic and witchcraft, also gave rise to the scientific method and helped revolutionize the 'technological arts.' Merchant documents how Bacon's prescribes the role of a 'natural magician' as operating *within* the organic order of nature, as a manipulator of parts within that system, but more crucially, in service of bringing its mystical, "heavenly powers to the earthly shrine" (1980, p. 169).

It was this underlying belief of such other-worldly perfection through technology that Noble famously termed the "religion of technology," partly because of the monastic clerical associations of the technological arts, which proclaimed salvation through technology, but also because it was necessarily ingrained with an elitist expectation, which excluded or marginalized most of the world (1997). To accomplish this, however, the technological crafts and other practices had to be wrestled away from those who actively engaged with the 'useful arts' themselves integral to their everyday activities—the so-called laboring classes (as discussed in 3.4.1).

Until then, Noble observes, these useful arts and, by association, the technological realm did not warrant much attention from elite men and had been disdained and disregarded for this part-female association (1997, p. 211). Thus, these otherwise banal, everyday 'worldly' human activities of the useful arts were to be ideologically elevated for the 'other-worldly' pursuits of transcendence which required the removal of women to be replaced with their eventual masculine association (Ibid, p. 212).

Noble would discuss this in the context of how often many in these technological spaces of the late 20th century tended to view Nature and the Body, stripped of its 'irrationalities' where each could be forced into new states or as mere passive receptacles for modes of production and reproduction (1997,

p. 227). Despite the claims of other-worldly perfection of technology, he notes, was built upon the subordination and marginalization of the laborers (Ibid, pp. 201–202). Thus, capitalism utilized “the machine,” as the late philosopher of technology Lewis Mumford famously declared, “not to further social welfare, but to increase private profit; and as mechanical instruments for the aggrandizement of the ruling classes” (1934, p. 27).

Despite such supernatural visions, however, women remained active and essential agents of significant technological and social inventions, and it wasn't until the most recent developments in professional engineering that this masculine association was realized in practice (Noble, 1997, p. 212). To illustrate this point, recall Gould's quote about the weight of Einstein's brain from earlier (see section 3.4.1), the context of which is quite revealing. He wrote those words commenting on a preoccupation of some seemingly reasonable and established scientists that confounded him. They were trying to establish a causal relationship between the size of the human brain and its cognitive abilities—seeking to justify the superiority of male geniuses over females and white Europeans to other races (Gould, 1992, pp. 145–159). Try as they may, as Gould points out, the scientific evidence showed no correlation, yet such irrational ideological pursuits persisted.

It is important to note that while these assumptions seem innocuous and antiquated, they still continue to operate and inform how national and international conceptions of labor and household relations are structured in practise today. It is worth recalling here how the industrialization of household goods and the modernization and diffusion of affluence within everyday life were imagined by the Industrial Designers (see section 3.3.1.). In *More Work for Mother*, Cowan reveals how daily domestic productivity for poor families drastically improved thanks to appliances and amenities. The spread of such affluence and diffusion of amenities, however, did not increase leisure for ‘housewives’ but instead increased the quantity of work that needed doing, and appliances that allowed for higher levels of productivity created more work for women and children, even in privileged households (Cowan, 2008, pp. 192–193).

Furthermore, Cowan argues that though modern technological systems allowed for the homogenization of housework, they were also premised on the assumption that women remained at home (Ibid, p. 196, 201). This ideological invisibility of women continues today, even in our digital infrastructures (Criado-Perez, 2019). Given the globalized nature of these systems this assumed invisibility seems rather baked-in, which might take advantage of global inequalities as working women in the Global South are ‘taxed’ more doing both productive, caring, and socially reproductive labor (Bhandare, 2018).

The Cultural Disappointment with the Future

Nevertheless, one cannot help but wonder, what happened to the promise of technological utopia? As both Federici and Noble argue, today, instead of the promised 15-hour work week, people seem to work longer and harder for lesser wages, while the abstraction and regimentation of labor carried out along with it more absolute ambitions for transcendence for a few and alienation and desocialization for the rest (Federici, 2019, p. 192; Noble, 1997, p. 207).

As previously touched upon by Graeber (see section 3.3.1), until the 1960s and 1970s, there was a sense of inevitability of technological progress palpable in everyday life. However, he points out that towards the latter half of the 20th century, the technological imagination of the modern age, which once fueled capitalist expansion, began to stagnate, and never materialized in the same manner in later years. This lack of a lived utopian abundance in everyday life he would describe as a form of ‘cultural disappointment’ with the future—breaking a promise that was never explicit but implied (Graeber, 2016, pp. 105–111).

In this period, there was, according to the author, a fundamental shift coinciding with the neoliberal era of capitalism that upended its own basic assumptions about creating technological abundance, which was abandoned to pursue more political goals, choosing to forgo economic imperatives and instead sought the regimentation of labor (Ibid, p. 129). It would seem that around this time, there was a fundamental switch in the nature of technologies that were being developed. The once grand visions of, what Graeber terms, “poetic technologies” promising abundance with interstellar travels and flying cars were abandoned to develop “bureaucratic technologies” for the regimentation of the economic order, and thereby also calcify the global social order (Ibid, pp. 140–142).

This calcification would persist even when substantial alternatives were offered from deep within socially and ecologically destructive industries like the weapons industries. Arguably, the most famous example is the Lucas Aerospace Combine Shop Stewards Corporate Plan, which in the 1970s created an alternative plan to convert industries of war for Socially Useful Production.²⁰ Their proposal was ultimately rejected not for lack of public support but by

²⁰ It was a radically different sort of industrial plan as it called for a new way of producing sustainable high-tech production developed in the weapons programs and adapted for social needs instead. It attempted to reimagine technology for a new, profoundly equitable, and just sustainable society and was ultimately rejected by company management. Had it not been rejected, that may have led to an entirely different opportunity for industrial reorganization and socially useful renewables. See Cooley (1987) and Smith (2014) for more.

corporate management because the alternative was unthinkable.

The consequence of this attempt at calcification was a drastic shift in what kinds of technological developments were being funded for further research, which according to Graeber, replaced the once poetic visions with more sophisticated ways to ‘simulate’ them instead of achieving them in everyday life (Graeber, 2016, p. 110). One of these forms of simulation seemed to have been the promise of digital abundance through internet technologies which today stands relegated to advertising and mass surveillance as a tool for capital accumulation (Zuboff, 2019). One might also see parallels to this in how the design disciplines developed in response to such shifts, making these technological developments desirable in their early stages—from industrial design to interaction to service and systems-oriented design (Edeholt & Joseph, 2022 in appendix).

Today the legacy of this religiosity and cultural disappointment is even more palpable and unsettling when seeking urgent and necessary climate solutions. If there was ever a time for technological breakthroughs, it would be now. However, technologies themselves seem suspiciously lacking in both scale and urgency. The IPCC reports admit that “digital technology supports decarbonization only if appropriately governed,” the signs of which we are yet to see, failing which they could potentially undermine the SDGs themselves by “increasing electronic waste, negative impacts on labor markets, and exacerbating the existing digital divide” (IPCC 2022, AR6 WGIII, SPM-13).

Today, one can see the remnants of the religion of technology and the confusion between domination and care apparent in the technological cultures that readily confer more-than-human sentience to artificial intelligence (AI) algorithms (Metz, 2022; Ongweso Jr, 2022). In perhaps another example of confusing domination for care, the proponents of such systems might assume people as passive objects²¹ to be molded and dominated for social good and

21 See Dyett & Thomas (2019) and Piper (2019) for discussions on the problematic framing of ‘overpopulation’ as rhetoric that marginalizes those least responsible for the crisis. The authors argue that such conceptions are founded on sexist and racist tropes that see reproductive bodies as a means to fulfill demographic objectives and in this rhetoric, those marginalized today can be simply written off as ‘surplus’ or ‘disposable.’ See Sultana (2022) for a discussion on such heavy legacies of climate coloniality. This question has become more concerning as the rapidly advancing assault on civil liberties, the erosion of social contracts worldwide, the rights to bodily autonomy, and the dehumanization and lack of hospitality shown to refugees fleeing war, climate breakdown, and oppression.

supported by an extrapolative moral philosophy.²²

At the same time, it may easily forget to confer the same sentience to the 'invisible' humans in the Global South whose intellectual labor is the backbone of developing and training these algorithms (Mehrotra, 2022). Nonetheless, these movements seem driven by a form of utilitarian ethics that rather generously assumes the primacy of the inequalities that exist and project them in the far future and continue the colonization of space, of nature, of people, and their distant futures as far as the next million-billion years (N. J. Robinson, 2022; Torres, 2022).

Given the earlier discussions (see section 3.4.1.), these might as well be the legacies of the war on Nature, Society, the Body, and the Mind to force it to produce new life. Yet, from a systems point of view, Merchant asserts a fundamental flaw underlying the pursuit of artificial environments and synthetic life. These technologies, useful as they may be, tend to prioritize the mechanized control of the holistic systems of nature at the expense of quality of life (Merchant, 1980, p. 291). Based on this conception of technology, it would be more apt to understand that purely technological forms of transcendence would mean a near-total escape from the human condition, not its liberation (Noble, 1997, p. 207). This view of technology is concerning since it quite explicitly projects onto technology a supernatural, redemptive quality and, in the same breath, also holds a deeply skeptical view of humanity that creates and cares for it—even the technologists themselves.

Given this precarity of present-futures, one could paraphrase Mumford's famous declaration and say that we may have reached a point where there are hardly any "virtues of the machine" that capitalism can promise or take credit for anymore, and yet "the machine" and those who care for it continue to suffer for the sins of capitalism (1934, p. 27).

Cynicism of the Will: The Ending of all Worlds

With the continued "breakdown of modernity," Fry claims, every human body, in some sense, is now rendered structurally unsustainable, where @ defuturing becomes a fact of everyday life (2020, p. 152). It is not hard to think of this dehumanization literally. We have reached an unprecedented precipice where the relations between Nature, Society, the Body, and the Mind can also

²² For further discussions, refer "Effective Altruism" and "Long-termism" and similar ideological movements which aim to "colonize space, convert planets to giant computer simulations and create unfathomable number of digital beings" (Torres, 2022).

be seen breaking down in near-universal terms.²³ Such dehumanization, Fry argues, cannot be solved by reifying and blaming capital but by a crisis of “what we have become and of what we are, the agent of the defutured crisis of the unsustainable—the history of humanity tells us that we are a world-ending animal” (Ibid, p. 174). Thus many might reach the same misanthropic conclusion, similar to Fry, that the crisis is characteristic of an inherently self-centered, destructive species (Ibid, p. 152).

With neither the social nor the technological yielding much creative direction, the future looks quite bleak. These calcified frames narrow the window of imagination (Figure 18), as the opportunities for possible futures in these limited frames become ever narrower the further one looks. One could imagine the present climate breakdown as a consequence of the present-future possibilities colonized by the past.

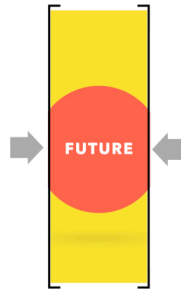


Figure 18. Defuturing as narrowing and negating the possibility of other possible futures, further colonizes and impoverishes futures and dehumanizes even those who colonize futures.

Extrapolating a future humanity from this dehumanizing standpoint of domination requires seeking ever “open spaces” as new frontiers for accumulation through conquest or escape—as open spaces to conquer and colonize, a ‘terra nullius.’ What is clear now is that if the structural conditions do not change, it would be reasonable to say that a society at war with itself and its lived environment might find itself stuck repeating the same cycles of the

23 From the polluted air we breathe that impairs cognition (Lu, 2020; Vohra et al., 2021); to the ‘forever chemicals’ in rainwater contaminating freshwater allegedly everywhere on the planet (Cousins et al., 2022; Persson et al., 2022); to the microplastics now found in human blood, placenta, and organs (Carrington, 2020; Leslie et al., 2022; Ragusa et al., 2021); to the structural violence of racism, sexism, war and poverty exacerbated by global disinformation, global heating and global pandemics (Ball, 2018; Miller, 2022; Millward-Hopkins, 2022; Sidik, 2022; Sultana, 2021); to the crisis within our global socio-political systems that are now precariously oscillate between climate surrender and climate fatalism in a final scramble for dominance (see section 3.2.3 earlier).

past where the future is also at war with itself.

Furthermore, given the confusion between care and domination, one can imagine an inversion of Gramsci's famous statement—'pessimism of the intellect and optimism of the will,' where now optimism of intellect through technology and its eventual disappointment ends up in the cynicism of the will. In this sense, one might outright dismiss the possibilities of a different imagination. Seeing this perhaps, Fry has often pointed out that utopian design might recruit and even co-opt the rhetoric and institutions of humanism while refusing recognition of life itself, living in the shadows of constant dehumanization (2020, p. 174).

However, defuturing here can now be better understood as a consequence of a calcified social imagination where the critiques without serious alternatives now seem to invoke a profound cynicism for, and the necessary ending of, all other possible worlds, even those desirable and feasible. Thus, I suspect that what lies behind such proclamations is a more profound crisis of cynicism passing off as realism, which may stem from the normalization of what Freire has called the "fear of freedom" that emerges precisely in response to the very notion that desirable humanized worlds might be possible. Freire describes this as:

"The oppressed, having internalized the image of the oppressor and adopted his guidelines, are fearful of freedom. Freedom would require them to eject this image and replace it with autonomy and responsibility. Freedom is acquired by conquest, not by gift. It must be pursued constantly and responsibly. Freedom is not an ideal located outside of man; nor is it an idea which becomes myth. It is rather the indispensable condition for the quest for human completion."

— Paulo Freire in *Pedagogy of the Oppressed* (2014, p. 21)

However convincing and dire world-ending proclamations might be, they remain, according to Graeber & Wengrow, a way of representing the species "as decidedly less thoughtful, less creative and less free than we actually might turn out to be" (2021, p. 523). With this new understanding, and considering the relevant evidence available, it seems then that we are only beginning to understand that the species might be far more sophisticated and elegant than we thought we knew (Narayanan, 2022).

This way of looking at possibilities reframes this entire discussion around defuturing and dehumanization, which indicates a stymied and atrophied humanity, even if, in some sense, it manifests itself as self-centered

anthropocentrism of a few.²⁴ Therefore, to decalcify the imagination might involve remembering, reclaiming, and reimagination for *re*-humanization.

3.4.4. DECALCIFYING THE IMAGINATION

What I hope to have brought across in this albeit dense and verbose discussion is a sense that, much like climate change, dehumanization is also a systemic phenomenon, not merely an oddity of history or an inevitable cost of civilization, but a story that is constantly being written, confused and forgotten, but it could always be written differently. The following pages will develop this position and prepare the conceptual ground for the 'possibilities of freedom' within the *What-is*, to decalcify the confusion between domination and care so that design can ask better '*what-ifs*.' I will try to illustrate how radical hope might be possible *even* within seemingly insurmountable, calcified conditions.

On Transcending Dichotomies and Reductive Worldviews

Given the previous discussions, one may understand dehumanization as causing structural schisms manifesting across at the laminated levels—the Mind from the Body, the Body from Society, human Society from non-human Nature, the Mechanistic from the Organic, and the Future from the Past. Critical Realism (CR) might remind us (see section 1.2.1.) that all such constructed dichotomies are fundamentally reductive, and while they can impact the world, there is a 'real' world that cannot be reduced to these dichotomies.

With that said, reductive dichotomies can be helpful as epistemic and analytical tools to play with. To attempt a 'decalcification' of the imagination, I want to briefly explore the logic of the schisms themselves to try to go beyond it and develop the speculative *what-if*. For this task, I would like to do a simple thought experiment and introduce the term 'schismogenesis'—a concept that denotes the creation of a division or a split into opposing factions.²⁵ To explain a phenomenon, one can construct a schism of A-B, as illustrated in Figure 19.

24 Since our conceptions of what it is to be human already stem from distortions and how little we know of what it is to be human, it stands to reason that the question of a 'post-' or 'transcended' human can *barely* even be formulated, let alone answered.

25 Graeber & Wengrow discuss the anthropological concept of 'cultural schismogenesis' which has been integral to how human cultures have structured and built an understanding of the world.—a form of cultural comparison where human societies consciously reject and borrow from each other to define one's own culture. It is, as they describe it, a form of 'mutual' self-definition in relation to the values of the other, whereby cultures creatively change by rejecting in opposition and sometimes borrowing from the other, as "self-conscious political projects" (Graeber, 2013; Graeber & Wengrow, 2021, p. 504).

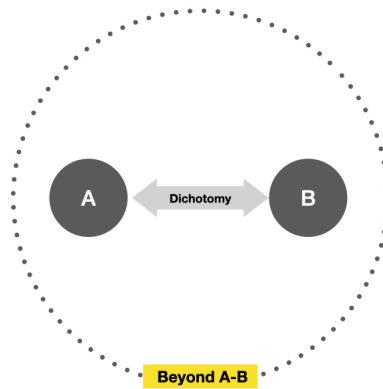


Figure 19. Going beyond calcified dichotomies.

While A and B each remain a distinct entity, they are also entangled with each other, which crucially requires a deeper understanding of ‘absence’ as “constitutively necessary for being” (Bhaskar, 2010, p. 15). Thus, A is not B, B is not A, and each depends on a mutual definition in relation to the other—but they also relate to those outside such distinctions. However, what may have become illustrated in these discussions is not that such schismogenetic structures exist but when these relations become parasitic on the other and, crucially, get calcified or fixed in place with no way out. Given the discussions here, it might be obvious to point out the human dimension of ‘care’ that sustains this schism. Consequently, the calcified split overpowers the imagination of those who care for it and eventually marginalizes and conceals all other possible views except itself.

Eventually, what may get lost is the ability to understand that such schism could only ever be reductive and begins from a distortion of the real. Nonetheless, even when these artificial schisms become calcified, there always remains that permanent and ever-immanent possibility of moving ‘beyond A-B’—to envision other ways of being (Figure 19). Therefore, this calcification is a crisis, fundamentally of the imagination, since the real world cannot be contained by them. If the point is to transcend these relations, the conceptual movement needs to be able to *imagine* beyond this calcification—the *what-if*; having known *what-is*.

While one can always move outside of ‘A-B,’ not everything beyond A-B’ is desirable or necessary. Moreover, going ‘beyond A-B’ is not the same as finding a ‘middle ground’ or obliterating all dichotomies to be forgotten altogether and get calcified again. Thus this reclamation of the imagination is possible through

a seriously playful, studied imagination and constitutes the case for deliberate change—from *what-is* to *what could-be*.

With that said, one can finally begin to disentangle the self-conscious species from the system of domination it cares for. I want to establish this crucial point starting with the famous words of the late cybernetician Stafford Beer:

“The purpose of a system is what it does. This is a basic dictum. It stands for a bald fact, which makes a better starting point in seeking understanding than the familiar attributions of good intentions, prejudices about expectations, moral judgments, or sheer ignorance of circumstances.”

— Stafford Beer in *What is cybernetics?* (2002)

The System is The Crisis:

Regardless of the name, this so-called ‘system,’ can be understood by what it does. Since it continues to operate and drive the climate crisis and in so far as it obscures and mystifies its systemic legacies, it is, in its totality, necessarily defuturing and dehumanizing. In her book *Braiding Sweetgrass*, Potawatomi bryologist Robin Wall Kimmerer points out, one can detect the system in the trails it leaves behind, which becomes glaringly obvious once one knows where to look (2013, pp. 304–309).

Federici asserts that as a socio-economic system, it is “necessarily committed to racism and sexism” and denigrates the nature of those it exploits and claims to care for (2014, p. 17). Patel and Moore reveal how the system must necessarily and constantly expand and redraw its frontiers to continuously seize ‘cheap’ things—nature, money, work, care, food, energy, lives, and futures of human and non-human natures, to be mobilized, coerced, and dominated in the ultimate transfiguration of ecological relations into “circuits of production and consumption” (2017, p. 22). To this list, one might even add that it must confuse and calcify the social imagination, as Graeber & Wengrow might describe it (2021, p. 514). This calcification and confusion help it mystify itself and its functions sufficiently to obscure reality, such that it may perpetuate itself—it must also necessarily colonize the imagination and cheapen futures of the majority world for the minority world—ultimately dehumanizing both.

Nonetheless, such systems, not being sentient, cannot come about on their own, and as Bhaskar would argue, it requires human creativity and care to do what it does in known and unknown ways (Singh et al., 2020, p. 164). In essence, Bhaskar observed that even while the ‘system’ demonstrates its parasitism and is

constantly collapsing under the weight of its own contradictions, it is effectively being cared for. This system is being cared for across the many laminated layers in which it functions, often in full knowledge of the harm it causes, while its proponents passively hope for change. The system and its parasitism are continually reimagined and sustained by the creative energies of people, institutions, and disciplines such as design, among others.

It must be mentioned that resistance, repair, recycling, upcycling, and regeneration practices are essential to help ameliorate the system's ills. However, it has reached a point that the system's insatiable capacity to degrade Nature, Society, Body, and Mind far exceeds what these regenerative survival capacities can mitigate.

This understanding has implications for how sustainability and sustainable design must be understood beyond what it has come to mean today, which tends to be marginally less unsustainable. Within a profoundly unsustainable paradigm—to be more-or-less sustainable also means somewhat sustaining the unsustainable. This type of sustainability, thus, while pragmatic and necessary, is inadequate for the task and creates a sense of what Freire might call “false generosity” (2014, p. 18). Although systems thinkers like Beer might argue that “there is after all, no point in claiming that the purpose of a system is to do what it constantly fails to do.” (1985, p. 99).

It would be remiss to ignore the disciplinary role of design and designing, which has been active in perpetuating the unsustainability and dehumanization of everyday life—by normalizing relations of extraction and domination and presenting them as a caring worldview. Unsurprisingly for this reason there are calls for design to “undesign” itself (Fry & Nocek, 2020). This framing of design as dehumanizing is a necessary wake-up call. However, there is nothing inherently dehumanizing about design. Even if it were true of what it became, it says much less of what it could be. It is easy to forget, then, that design's framework was never meant to account for what is or what became; it was only meant to be a 'scaffold' for what could be (Redström, 2017, p. 66).

Whatever may become or un-become of design in the future, it must introspect on its historical legacy and attempt to imagine possible rehumanized and refutured systemic roles (Edeholt & Joseph, 2022 in appendix). At the very least, this means that sustainability requires an understanding of far more holistic terms beyond the binaries of sustainable and unsustainable consumer choices and for fulfilling needs and sustaining human freedoms instead (Edeholt et al., 2021; Sen, 2013). Thus to call on design to un-discipline itself and in this crucial moment seems somewhat misplaced since it is far easier and more likely to

simply reclaim it—as a transformative praxis of concrete utopianism.

For a Concrete Utopianism

Today, Ghosh points out, “humanity is in an era where many different axes of time interpenetrate and exist alongside each other”; where the indigenous land and water defenders may be profoundly more “advanced in the understanding the planetary crisis than an academic in a tranquil Western university town” (2021, p. 229). One might also comprehend the wisdom in choosing to see such schisms between the past and the future in a different light and to be played with. It is an understanding that is not mystical; as Cusicanqui points out, “the indigenous world does not conceive of history as linear; the past-future is contained in the present.” (2012).

Modernity understood this way, as the Neolithic ancestors did, allows for moving through different worlds as if they were “a stadium or a theater,” an open field that one could walk into (Cusicanqui, 2012). Going beyond and playing with such artificial schisms of time, one might open the possibility of pluriversal worlds in the here and now.

If it were possible to move between worlds this way, what kinds of futures would we care to move into? Beyond the imaginary schisms of time, could one play with utopias and even dystopias as places one could simply walk into and out of? In this particular moment in history, it seems that there is not much else one can learn from dystopian futures that are not already manifesting in reality or dehumanize further. It would seem that utopia is what remains.

While utopias can be banal and naive for some, one might want to remember Bhaskar's insightful response to the traditional critiques of utopianism, which have “failed to notice that what is, is only one possible world and that it, moreover, always presupposes the possibility of other worlds” (Bhaskar, 2010, p. 23). This conception of a critical realist ‘concrete utopianism’ is grounded in human endeavor, conscious of the existing structures (realism), not merely an extrapolation, but a radical reclaiming of the imagination through “progressive practice and hope” (Frank, 2010, p. 102).

Thus while questions of dehumanization and humanization present us with what became of the human species (*what-is*), one is yet to uncover what could become of it and thus requires that we decalcify this limiting schism between the two and go beyond to re-humanize in preparation for what *could-be*. Therefore, contrary to cynical proclamations, it might be more relevant to say that humanity is fully capable of world-ending and world-building and has

merely forgotten the freedom and practice to do so. This possibility of other utopian worlds makes it more interesting from a design point of view.

Taking this radically hopeful point of departure from the defuturing and dehumanizing paradigm P1 of *What-is*, I will move on to the next phase of Act II and speculate on what design might need to reclaim, remember and reimagine itself to become a transformative praxis that rehumanizes itself and the concretely utopian future P2, the *What Could-be* it might care for—by speculating the designerly *What-if*.

4. The What-if: Rehumanizing Design

This second phase of Act II is concerned with ‘*What-if*.’ This brief discussion serves as a conceptual bridge and a radical point of departure between the two paradigms—the *what-is* (P₁) and *what could-be* (P₂). Given the profound predicament of defuturing and dehumanization today, it is self-evident that alternative worlds are both essential and urgent. For Industrial Design to support this imagination, it must also reimagine itself in preparation for traveling to this alternative world. For this task, I will explore three brief but critical ‘*what-if*’ provocations and set the stage for what design *could-be* by reimagining and reclaiming itself to refuture and rehumanize the worlds it envisions.

Provocation 1: What if design’s ability to care for new social realities is a fragment of the scattered remains of the third social freedom hiding in plain sight?

The evidence from history suggests that the third social freedom—to imagine and experiment with different social realities is innately human. However, with the profound loss of this third social freedom, this characteristically imaginative human species may have also lost the ability to both imagine pluriversal social realities and move through them freely. Moreover, with the confusion between care and domination, it might be that this ability to care for new realities was also eventually co-opted and used as a tool for caring and sustaining institutions of domination, further calcifying the social imagination such that this ability was disdained, subdued, and eventually forgotten until it atrophied.

Nevertheless, if caring for new social realities is a species-specific characteristic, could this ability ever be truly lost? What if, instead, it was fragmented and scattered across different cultural areas and isolated into deep atomized pockets of disciplinary domains of knowledge and action? If so, could one consider the emergence of design and its potentiality for caring for alternative futures in the everyday through designing as manifestations of this third social freedom being

rediscovered and professionalized with the so-called creative disciplines?

Might this explain why design remains universally human and yet is particular to its diverse yet siloed professionalized traditions having emerged the way they did? What if, much like the Neolithic scientists and their zones of ritual play (section 3.4.1), these disciplinary sites are the repertory of knowledges, practices, artifacts, and research that are generated, cared for by persuading the material and social 'natures' to change towards preferred states? If so, it might imply that Industrial Design today is a particular manifestation of this complex, higher-order interdisciplinary totality concealed from view, reduced to what it produces and the traditions from which it emerges (Figure 20)?

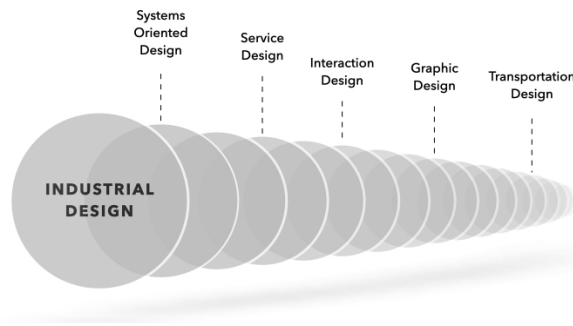


Figure 20. Industrial Design one instantiation of a higher-order totality called Design and part of a spectrum of the creative disciplines.

While this may not be a novel observation, it might account for the confusion when design is considered intellectually unstable as a research practice or a fluid amalgam of art and science when in fact, like the mycelium analogy, it may possess meaningful disciplinary traits beyond what it gets reduced to when studying how and what it produces from both inside-out and outside-in. It might just be that design, since it is only allowed a limited capacity to know and act in the world is also defutured, and as it stands, is left to reminisce a fossilized past instead of reinventing itself.

Provocation 2: What if design can be considered a discipline of interdisciplinary emergence?

Although it is a truism that it is impossible to predict the future, it is still possible to investigate it with the right conceptual tools for the task. If designers are expected to offer alternatives to what exists, the synthetic turn requires navigation beyond the known-knowns. While there may be

expectations from the design traditions shaped by the social and material conditions in which designers operate, the creative turn designers practice is not merely deterministic. Furthermore, not everything ‘designed’ is intentioned or necessary but instead emerges in engagement with one’s actions in an indeterministic, real world. Despite this indeterminacy, one must presuppose agency, such that intentioned change toward a preferred situation is always possible, and why design could exist as it does, with its transitional methods shaped for this task.

This tendency to change *what-is* to *what could-be* brings into view the self-conscious beings and the disciplinary traditions situated within this process who are trained to engage deeply with the negotiations between the realist, actual, and empirical domains of knowing the unknown or even critically speculate the unknowns as known (*what-ifs*)—acting as though they were ‘true.’ Whatever creative breakthroughs might occur would need to go beyond the sum of what is partially known, self-consciously playing with the epistemological and ontological levels of reality until a preferred synthetic reality emerges in an alternative now. This is a question of deep disciplinary knowledge and action.

Here, design research might creatively broker this process by investigating these unthinkable worlds that *transcend* knowledge domains in transitional and diegetic ways, communicating the synthesis across disciplines effectively and making them thinkable and doable. These could be critically grounded in the levels of reality where other interdisciplinary ecologies of knowledge and action might be possibly invited to aid in that transformation—towards a speculative interdisciplinarity, emergence grounded somehow by its holistic, irreducibly complex levels and nested structures. In this fluid praxeology of a studied imagination, there remains the possibility of navigation towards the unknown-unknowns, crystallizing through the tacit, the situated, the embodied, and the intuitive new knowledge and action that move beyond and transcend these dualistic domains (Figure 21).

This ability to judiciously pursue a non-dualistic movement, as seen in the ‘split’ between the two nested systems (Figure 21, right), serves as the inspiration for the cover illustrations of each of the texts. The illustrations represent this ever-immanent possibility that pluriversal, even unthinkable worlds, can always be imagined and transformed into, different from what came before (denoted by their distinctive colors) and may be hiding in plain sight (the split). These are the foundations for a transitional theory of ReFuturing—to “refuture” that which has been defutured; by reclaiming, reimagining, rethinking, and rehumanizing the dehumanized and defutured present (P1), such that the future is profoundly different when we arrive in it (P2).

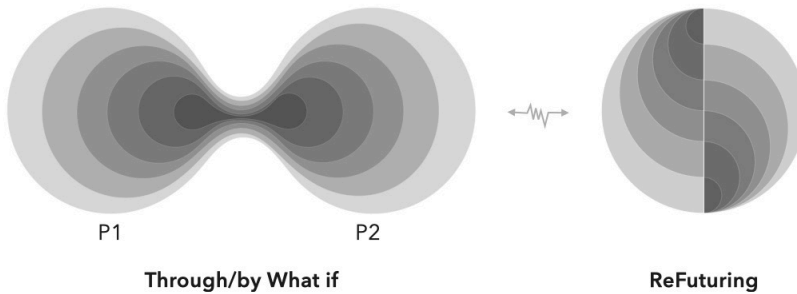


Figure 21. Worm-holing from what-is to what could-be through/by what-ifs to transcending knowledge domains. The non-dualistic construction (right), representing the decalcification of the imagination as an always ever immanent possibility for travelling between worlds.

Provocation 3: What if design could refuture and rehumanize that which is defutured and dehumanized by decalcifying the social imagination?

It is now apparent that the magnitude and urgency of the climate crises require acknowledging and confronting the systemic defuturing and dehumanization that renders any alternatives unthinkable. One cannot expect different outcomes from a system that is inherently incapable of achieving them (the purpose of a system is what it does). On the one hand, it coerces an outright rejection of preferred utopian futures for being too naïve or unrealistic and finds comfort in climate dystopias (cynicism of the will). On the other, it is cared for to continue as though what exists must necessarily exist, even though the evidence says otherwise (optimism of the intellect). However, the point is to decalcify the social imagination and consciously change what purposes and systems one imagines and cares for.

Suppose one could imagine a change towards a preferred alternative reality in the face of such a colossal existential threat. Would it not make sense to apply a playful yet studied imagination for visionary worlds that are desirable and necessary for more concretely utopian possibilities? It stands to reason then, that what became may not have been inevitable—neither the third freedom is irrevocably lost nor is design irredeemably resigned to defuture. However, given this rather nested and entangled relationship between the two, what if it was possible to imagine the conditions where reclaiming one might reclaim the other and move to a social reality where to refuture is to rehumanize and to rehumanize is to refuture?

To explore the implications of this, the next phase will focus on *The What could-be* as articulated in the *The Open Journal of ReFuturing*, from the year 2131, the digital copy of which you will find in the Appendix. It is important to read it before proceeding to the next chapter.

5. The What Could-be: ReFuturing & Rehumanization

This third and final phase of Act II is concerned with *What Could-be*—the paradigm P2 as articulated in fictional design research, *The Open Journal of ReFuturing* from the year 2131, taking its point of departure from the *what-ifs* discussed earlier. At this point, it is essential to have read the journal accompanying this thesis. If not, I hope what follows might pique curiosities enough to do so. The journal has been written as an indigenous critique looking back from the future to today, speculating on what an indigenous view from the future might say when looking at human society in 2022. The following pages have been informed by the generative research outcomes from the journal and the artifacts for a concretely utopian future of P2 through rehumanized design and designing.

While many alternative social realities are possible, the journal explores the reality of fossil abolition, climate reparations, and societal transformations for climate adaptation reimaged in the everyday. Furthermore, climate reparations here are not only monetary but a systemic acknowledgment of the harm brought to the planetary and social ecology and then pursuing fundamental transformation of the structures that caused the damage in the first place. Given the stakes, scale, and urgency of the crisis, it is not even a new proposal since they are already serious suggestions to tackle the climate crisis (Hertsgaard, 2021; Monbiot, 2021b; Táíwò & Cibralic, 2020).

Although it is essential to know what is being moved away from (P1), it is still unclear what it will become, so much so that it might as well be a strange land. For how this world might transpire, I will let the design journal and the artifacts speak for themselves. The following pages will discuss and lift a few essential discussions and attributes of this unknown alien future, as described in the journal, where civilization based on domination is reclaimed to care for Nature, Society, Body, and Mind.

5.1. A CARING CIVILIZATION WORTHY OF THE NAME

“They leave Omelas, they walk ahead into the darkness, and they do not come back. The place they go towards is a place even less imaginable to most of us than the city of happiness. I cannot describe it at all. It is possible that it does not exist. But they seem to know where they are going, the ones who walk away from Omelas.”

– Ursula K. Le Guin in *The Ones Who Walk Away from Omelas* (1973)

The imaginary city of Omelas, as the late science-fiction author Ursula Le Guin described it in her short but powerful story, is a perfectly happy and ideal utopia where its citizens enjoy all the benefits of civilized society and the fullness of social life. However, there is a dark secret behind the joys of such a society. The happiness of the entire community relies on the necessary destitution, degradation, and dehumanization of one child locked in a basement cellar. Most who participate and celebrate such a society are conscious of the suffering of that child locked in the basement. This knowledge motivates some to humanize themselves, to be profoundly well-meaning and kind; some even sympathize and offer the child solace and comfort.

Nevertheless, none ever liberates that child; it cannot be done. Doing so will collapse that perfect society. Upon this constant dehumanization of one unfortunate child, all the pleasures, fulfillment, and humanization of that utopian society rests. Those are the rules. Nonetheless, there are still the very few who simply choose to walk away from the promise of perfect societies but ultimately built on the foundations of indescribable suffering, and as the quote says, knowing full well that they head into the unknown never to return. Yet, no one ever forgets that child, neither the ones who live and leave this utopia nor the reader.

What, then, can one say of the unnecessary, unspeakable misery inflicted upon the majority world upon whose domination the pleasures of the imperfect contemporary world are sustained? While one might even care for this suffering, imagining it as legitimate and justified, the conditions for such society necessarily taint this utopia for each (see sections 3.4.3 & 3.4.4). The journal begins by taking Cusicanqui's assertion as a point of departure—without a decolonizing practice, there can be no theory of decolonization or discourse of decolonization (2012). Decolonization, therefore, is the essential precondition to 'walk away' from P1 towards the first century of climate reparations in the paradigm of P2, which the journal discusses.

5.1.1. THE FIRST CENTURY OF CLIMATE REPARATIONS

The Open Journal of ReFuturing is divided into three main chapters, each exploring climate reparations across three holistic themes—energy, soil (terrestrial ecosystems), and water (freshwater and marine ecosystems). Each chapter in the journal explores these themes in a world where the science of climate change is taken seriously and imagines the actions taken based on the 'reality' of its urgency and magnitude. The first theme looks at carbon emissions and the transformation of the energy sector by abolition and non-proliferation of fossil fuel institutions considering the total weight of their responsibility for the crisis, implying that fossil fuel institutions and their benefactors are finally held accountable for their actions that caused the crisis and delayed the response to it. Fossil abolition is simultaneous with a radical reduction in global energy use with the abolition of unnecessary industrial sectors and the essential infrastructures shifting to fully renewable energy grids while also ensuring energy justice.

In the second and third themes, the terrestrial and marine ecosystems, decolonization, and climate reparations become instituted as a lived practice, and the Indigenous Land and Water defenders fighting for Indigenous sovereignty and climate reparations ultimately win. Thus, decolonization and climate reparations assume the true spirit of what decolonization asks for, which scholars of Indigenous studies Eve Tuck & K. Wayne Yang have famously pointed out, is the return of indigenous lands and reparations (2012). With indigenous stewardship, there is a massive reduction of environmental pressures and biodiversity, and ecosystems are regenerated with rewilding and regenerative practices that bring about the extraordinary revival of ecosystems, as seen in the Climate Resilience Zones (terrestrial) and the Blue Reparations projects (freshwater and marine).

Furthermore, the task of climate reparations is intended to be a world-building project intent on rehumanizing the present, and thus the journal discusses the transformation of social life both in the Global South and the Global North. The journal imagines the emergence of new social and material freedoms from these actions where reparations allow for other ecological cascade effects of restoration, regenerating other social and climate-positive feedback loops. Since the ecological damage already done is epoch-shifting; hence, reparations must also be adequate for the task. These actions only speak of the first century of climate reparations—the beginning of the beginning.

However, from a long-term point of view, the journal also addresses how these caring practices are not lost or forgotten with new cycles of domination and

extraction. Even if one imagines societal transformations, it is essential to ask how one achieves them given the present conditions of P_1 and how one could prevent the stubborn patterns of domination from recurring. Furthermore, if these patterns return, what breaks them such that the cycles of domination of Nature, Society, Body, and Mind do not get calcified again? Here a more crucial question of the confusion between care and domination needs to be addressed.

5.1.2. RECLAIMING INSTITUTIONS OF DOMINATION FOR CARE

A caring civilization worthy of the name would also need its caring institutions to be designed to achieve those goals. While some of these caring institutions are newly initiated, the journal also imagines reclaiming institutions of domination by transforming them into institutions of care. Understandably, even the most sympathetic ear might instinctively flinch at the very suggestion that our current social, economic, and political institutions of domination, built over centuries, can ever be transformed into institutions of care. Moreover, history is witness to the numerous attempts at setting up such caring institutions, becoming co-opted to dominate instead. So, the proposition to reverse it can seem an outlandish notion.

This institutional reclamation can be imagined through a combination of plural strategies that repurpose the social, political, and economic institutions of domination that we have become accustomed to today towards functions of care or dismantled and abolished if they cannot do so. The journal explores the possible ways this might happen for institutions and infrastructures like fossil fuels, industries of war, media disinformation networks, global legal and monetary frameworks, and industrial production, to name a few.

For instance, the journal speculates that the abolition of fossil fuels directly transforms and reconfigures how holistic human well-being is fulfilled once fossil energy becomes expensive and inaccessible so that alternatives emerge to redefine socio-economic policies and support infrastructures to compensate for this shift. At the same time, quality of life shifts where measures of well-being move away from high energy, fossil-fueled, polluting, and unsustainable lifestyles denoting living standards, move to low energy, renewably powered, long-term sustainment as measures of quality of life.

Thus, it might be possible to have a profoundly better quality of life based on a low-energy lifestyle which is also desirable, where the social and material 'development' takes a much more ecological regenerative route, with a substantial transformation to conditions of poverty, inequality, and hunger. These changes are not purely hypothetical either; they have been imagined based

on studies available today, and the references are available in the journal. The journal takes these ideas seriously and speculates on their everyday actuality.

Celebrating Social Freedoms

The consequence of these institutional transformations helps jumpstart the process of regaining, in some sense, the three fundamental social freedoms, the kinds suggested by Graeber & Wengrow from earlier (see section 3.4.1.), where the freedom to imagine new social realities and move through them start to allow for other freedoms to emerge (2021, p. 525). The remembering of the three freedoms is envisioned as a virtuous cycle where the freedom to imagine a full spectrum of essential social freedoms—to disobey (abolition and reparations), to move away (climate refugees or anyone really, can freely travel to safe places knowing well that one will be welcomed and cared for); and the freedoms are institutionalized to dream of alternative social arrangements and practice them (to freely reinvent ecological actions).

With the expansion of these freedoms, one sees a fundamental shift in social relations needed for climate action, where institutions begin to regard people not as passive objects to be changed, reduced to their carbon footprints, but as the very agents for spontaneous, radical social transformation which scholars have pointed out is vital for staying within the 1.5°C thresholds (O'Brien, 2018). One may even discover that infinitely more geniuses emerge from these conditions, wise enough that they might reinvent society in the breakthroughs they create, similar to Einstein as Gould spoke of earlier (see section 3.4.1.). There is also the possibility that many might refuse to participate altogether. Regardless, the journal speculates the socioeconomic conditions which might make it possible. Along with a drastically shortened work week, the journal also explores the independence from wage labor for those who would prefer, and this is where the imagined Universal Living Income programs come in.

This dignified income is paid to individuals because their Society cares for their well-being and is, in turn, cared for by its people. Moreover, it would be a strategic investment to have people freed from wage labor and exercise their care for their relations with Nature, Society, Body, and Mind. It is also conceived that one is free to disobey (the first freedom) and could reject the idea of labor and not participate, reducing unnecessary emissions and avoiding causing social or ecological harm. These social freedoms upend and transform our current economic conceptions of labor and value as the ability to turn nature into a resource; and resources into goods and services for consumption. Instead, it turns this premise on its head and imagines the consumption of

essential needs and the production of technologies and commodities founded on the principles of care. In hindsight, it should have been called a Universal *Caring* Income instead.

In addition, the fiction also articulates the expansion of high-quality essential social services that fulfill essential human needs. This renewal of the eroded social contracts creates more radical social involvement in climate action and allows for new forms of social participation that we might not even be able to imagine today. In a world where ecocide and rampant fossil exploitation are abandoned, the formerly cheapened and dominated things now find renewed significance by creating regenerative abundance instead of artificial scarcity.

Thus, these everyday practices of care and generosity also free communities to regenerate for each other, the abundance made available to them. For indigenous scholars like Kimmerer, this abundance can also be a strategic remedy for the social malaise of greed and excess consumption, which ultimately leads many into seeking self-destruction and the 'end of all' (2013, p. 376). In a world where one's essential social and material needs are met with a well-managed social abundance, other forms of civic participation might emerge and flourish within education, healthcare, citizen science, research, social care, and regenerative practices like rewilding and regeneration festivals. In other words, despite a world ravaged by climate and social upheavals, the journal still imagines a dignified celebration of the everyday.

5.1.3. EMERGENT TECHNOLOGIES OF CARE

In a world of P₂, having undergone such radical societal transformations, diffusion of essential freedoms, and its celebration in public life, one can also imagine a different kind of technological creativity emerging in paradigm P₂, seen in its artifacts and technologies. Thus, when institutions of care design technology, it is in the service of care for Nature, Society, Body, and Mind. In this case, the technologies of domination are transformed and rehumanized to care by regenerating the planetary biosphere for high-quality public infrastructures that fulfill essential social needs for care and leisure. These technological shifts are tacit in the diegetic artifacts from the design fiction and as fabricated here and now, possibly making these futures imaginable, sense-able, and do-able today. I would call these 'Technologies of Care,' which I have also alluded to elsewhere (Joseph, 2021 in appendix).

These Technologies of Care are *emergent* since they are generated by using existing scientific papers and studies from paradigm P₁ and speculating them for radically different purposes beyond what their authors may have intended

informing their diegetic technological developments within paradigm P2. This speculative reading of the technical papers grounding these technologies are both old and new, some high-tech, some low-tech, either labor-saving, labor-caring, even labor-intensive but labor owned, some based on modern science, and others based on indigenous knowledge systems and practices. This practice creatively generates and critically grounds the scaffold of the conceptual wormhole between the diegetic worlds of P1 and P2.

Some of these technologies are 'low-hanging' fruits and can be seen in some diegetic 'experiments' inspired by these speculative interpretations (Figure 22). These technologies are imagined for social and ecological abundance, emissions reduction, and carbon capture, changing some of the fundamental operating mechanisms for technology. In fact, contrary to the culture of critique, what the journal illustrates is that solutions do have a place as the right tools for the right job, and many, if not all are feasible today if one reimagines how they are produced.

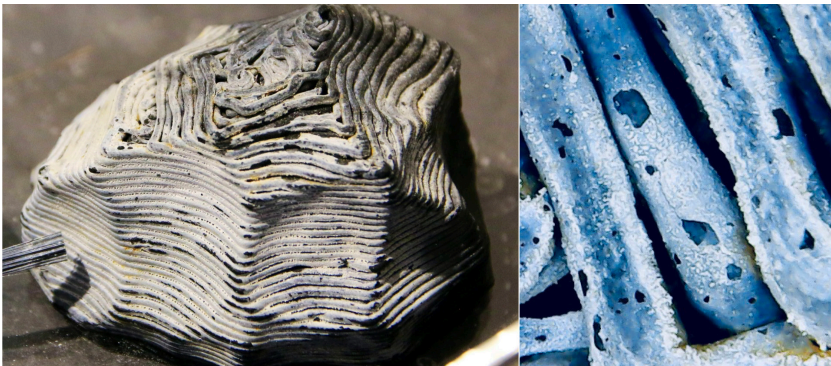


Figure 22. Electrolytic deposition of seawater minerals on 3D printed conductive structures as a precursor to carbon negative composites reefs for slowly fabrication coral sea walls. See (Ch. 3, p. 95 of *The Open Journal of ReFuturing*) for concept in context.

Therefore in describing P2, the journal also discusses perspectives on how these technologies in a new climate reparations paradigm are produced and cared for strategically while also de-commodified and decoupled from emissions and ecological harm. These technologies and goods are imagined to be locally produced, distributed, and consumed for fulfilling essential needs. These fabrication programs are scaled-out rather than scaled-up, federated industrial institutions for Socially Useful Production manufacturing essential

technological goods that fulfill essential needs through ecologically regenerative practices. If essential large-scale production is ever necessary, it is meant to be in limited batches and might even be 'slow' or 'seasonally' fabricated for high-quality technologies, but like all essential infrastructures designed to be climate resilient and to last generations, reducing cumulative mass consumption.

Moreover, technological proliferation unfolds rather quickly under these seemingly restrictive conditions. Thanks to their open knowledge provisions of the climate reparations programs, open technology transfer legislations open alternative pathways for adopting climate-resilient infrastructures. Integrated with transforming, reusing, repairing, and upcycling existing technological infrastructures now powered by carbon-negative energy and materials ecology, there is a sharp decline in emissions and ecological impacts of these systems.

Nevertheless, whatever global movement of production and consumption does happen, it is to equitably scale-out resources and fabrication technologies and is reflected in various speculative climate policy frameworks in the journal. The journal also looks into the ecological fabrication of material cultures, requiring a deeply situated community and indigenous cooperation. This cooperation manifests in how the citizen science movements contribute to expert knowledge as active participants in shaping the technological foundations and leading to profound breakthroughs. The expansion of social freedoms has an added benefit of a profound shift in the proliferation and diffusion of critically playful cultures of inquiry and other ways of knowing.

Under these circumstances, technological creativity is seen as synergistic with social creativity, and one can shift the conversation from calcified dichotomies of techno-determinism or techno-pessimism, low-tech or high-tech, slow or fast fabrication, to a more techno-realistic future that allows for a creative play between them in a precarious climate future. Under these conditions, an abundance of artifacts and inventions is still possible when directed toward care and regeneration and become tools for opening portals to other preferred realities. These synergies are interesting to discuss as they imply that the necessary climate-resilient technological solutions are already available and can be made today with relative ease, making it possible to integrate carbon-negative technologies into everyday life, giving rise to a *lived* carbon-capturing culture. However, where these technologies go from here is an open question, and more research is required.

In the following pages, I will showcase some of the possible product archetypes that illustrate these emergent Technologies of Care as they appear in the journal and, with it, conclude Act II of this thesis.



Figure 23. Citizen Science community in Sao Paulo demonstrating an early version of the biomA organic battery fabrication device (2052). Concept Rendered by: Author.

BIOMA

Volumetric Fabrication Device for Organic Energy Storage

The Open Tech society and the Citizen Science movements in Sao Paulo develop biomA, a 3D volumetric fabrication device that ‘grows’ organic batteries and supercapacitors from algae and chitosan biopolymers instead of violently mining minerals for batteries. The system sequesters carbon dioxide from the atmosphere by ‘nurturing’ *Cladophora* algae which then are precision levitated ‘acoustically’ as a high-resolution 3D volumetric point cloud using an array of ultrasonic transducers. The algae ‘seeds’ are then sprayed with a chitosan binder, and each layer is formed using a UV laser that cures the biopolymer. The combination of the chitosan-coated algae in a computationally generated structure makes for highly versatile, closed-loop, carbon-negative, and ecologically regenerative batteries. The advantages of such volumetric fabrication methods would be applied to many other high-tech production possibilities for scaling out renewable energy infrastructure, such as transparent optical solar structures.

Reference: Page 21 of Chapter 1, *Glocal Energy Cultures: Realising 22nd Century Radical Indigeneity and Beyond* in *The Open Journal of ReFuturing* (2131).



Figure 24. Transparent 3d printed optical solar structure fabricated using the biomA (2052). Concept Rendered by: Author.

VOLUMETRIC SOLAR STRUCTURES

Morphogenetic Photovoltaic solar cells

Volumetrically fabricated solar structures become possible with the development of biomA fabrication systems. These new types of morphogenetic solar cells directly convert the thermal and visible spectrum of solar radiation with the help of optically tuned structures coated with photovoltaic perovskite aerosol inks. These cells are also contained within a thermally insulated volume of phase-change solutions that extend their thermal efficiency by infinitely cycling through thermo-electrical conversion cycles without much loss in power or degradation of materials for energy storage and transfer. This helps redirect captured solar radiation for adequate purposes when possibilities of incident solar energy are low, such as at night-time or in the winter sun. With this, the urban envelope becomes a net generator of renewable power coupled with drastic declines in overall energy consumption.

Reference: Page 22 of Chapter 1, *Glocal Energy Cultures: Realising 22nd Century Radical Indigeneity and Beyond* in *The Open Journal of ReFuturing* (2131).

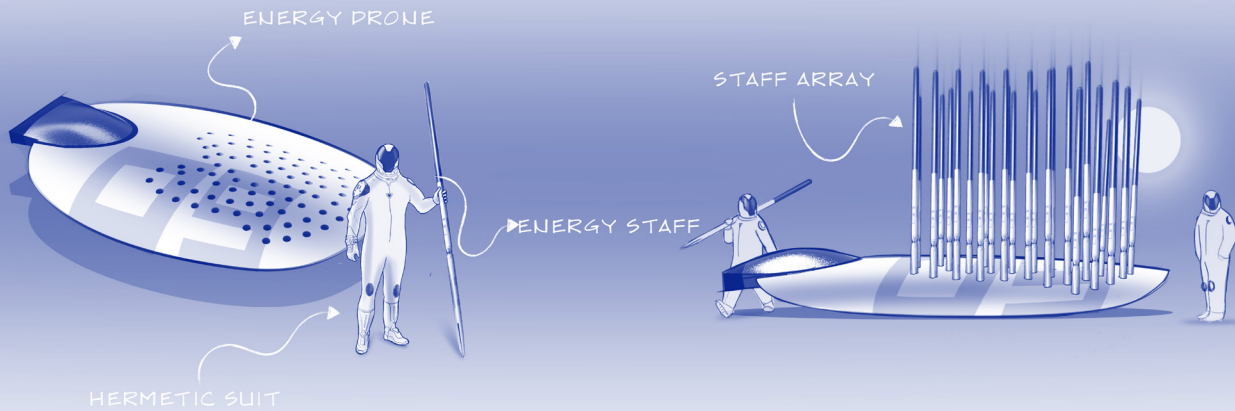


Figure 25. A sketch of the artefacts used by the Masisi for their energy rituals (2109). Concept Rendered by: Author.

MASISI ENERGY CULTURES

Energy Rituals of the Masisi People

The indigenous traditions in energy cultivation of the Masisi people are based on the technical adaptation of integrating fiber optic solar cells coated with graphene and a fungal microbial fuel cell (MFC) that ‘feeds’ on radioactive soils. The mycelial properties are also applied to their radiation shielding suits. The cell structures of the staff and the arrangements are based on ‘hierarchical biomimetics’ inspired by natural optical structures, such as the glass sponge and the optically transmissive hair of polar bears. This indigenous community focuses on applying mycoremediation to clean up the radioactive soils in their regions, and the mycelium can also remediate radioactive soils and produce valuable by-products such as energy.

Reference: Page 24 of Chapter 1, *Glocal Energy Cultures: Realising 22nd Century Radical Indigeneity and Beyond* in *The Open Journal of ReFuturing* (2131).



Figure 26. Guerilla agroforesters gathering to embark on establishing the Mombasa Climate Resilience Zone (2064). Concept Rendered by: Author.

THE WALEZI WA MSITU

Guerrilla Agroforesters of the Mombasa Climate Resilience Zone

Climate Resilience Zones (CRZs) first emerged in Mombasa as practiced by guerrilla agroforesters. They use forest seeding devices that make 'seed balls' that use a carbonized biochar medium 'supercharged' with biologically sourced nitrogen and phosphorous and inoculated with selective mycelium spores native to old-growth forests. The mycelium aids in re-establishing healthy root-soil microbial relations, enhancing the availability of nutrition, and rejuvenating the soil microbial health for these old growths to flourish. These seeding operations are spread in randomized patterns using 'creative' and resilient forms of seeding old-growth forests for faster biodiversity recovery with the forest seeders. Over time, these CRZs regenerate the terrestrial ecosystems, complementing conservation efforts, including biomass production from agriculture and forestry, storage, filtration, and transformation of nutrients and water, biodiversity habitats, ecologically sourced material resources, and carbon sinks for a long carbon drawdown. On a long enough timeline and with its global reach, the development of CRZs starts to blend into each other, eventually transforming into Pan-Indigenous Autonomous Zones.

Reference: Page 54 of Chapter 2, *Becoming Terrestrial: Of Climate Resilience Zones, Symbiotic Fabrication and Ecosystem Regeneration in The Open Journal of ReFuturing* (2131).



Figure 27. Regeneration Festivals popularized as everyday social renewal and often can be seen using autonomous seeders (2108). Concept Rendered by: Author.

FIREFLY (螢火蟲)

Autonomous Forest Seeders deployed at Regeneration Festivals

Over time, Climate Resilience Zones (CRZs) get expanded using autonomous seeding devices called Fireflies. The citizen science groups in the Hong Kong CRZs, inspired by the *Walezi wa msitu*, take the concept of old-growth ecology seeding to the next level with automation practices that are also more useful where more delicate regeneration strategies are needed. These autonomous seeders are cheekily called 'fireflies' (螢火蟲) in a period when insect declines coincide with continued 6th mass extinctions. Under exacerbated and unpredictable climate cycles, these assisted seeders offer the possibilities for migrating and regenerating vulnerable terrestrial ecosystems to suitable climate zones by restoring soils and freshwater ecosystems through human efforts in the various regeneration festivals that have become widespread. In the 21st century, these 'fireflies' are busy planting new old-growth ecosystems in regions where the heat death of forest ecosystems has occurred. However, this is only done under desperate attempts to preserve biodiversity and relieve these ecosystems of climate stressors, as disruptive climate patterns disrupt ecosystems worldwide.

Reference: Page 55 of Chapter 2, *Becoming Terrestrial: Of Climate Resilience Zones, Symbiotic Fabrication and Ecosystem Regeneration in The Open Journal of ReFuturing* (2131).



Figure 28. Community members carrying out maintenance of a SymFab Pod in the Hong Kong CRZ (2093). Concept Rendered by: Author.

SYMBIOTIC FABRICATION PODS

Symbiotic Mutualism in the Pan-Indigenous Autonomous Zones

The SymFab pods are designed for localized, ecological forms of hi-tech production and consumption of advanced composites employing “symbiotic manufacturing.” The carbonization of organic matter and fibers are applied to create effective alternatives of high-performance composites from organic sources for socially useful fabrication systems, which are carbon sequestering by integrating into local industrial production for advanced technological applications. When processed as bio-composites, the pyrolytic carbonization of these natural fibers is produced from organic fibers with in-situ processing of plant-based resins that can even be used to create high clay-based ceramic electrodes. Much of this is possible with new discoveries in symbiotic computing interfaces termed ‘symbitronics.’ These interfaces mediate the interactions between these fabrication infrastructures to maintain and nurture the ecological processes.

Reference: Page 57 of Chapter 2, *Becoming Terrestrial: Of Climate Resilience Zones, Symbiotic Fabrication and Ecosystem Regeneration in The Open Journal of ReFuturing* (2131).



Figure 29. Biomineralisers remediating historically contaminated mining sites and symbiotically refining mineral with microorganisms (2118). Concept Rendered by: Author.

BIOMINERALIZERS

Symbio-metallurgical Devices for Biomining

Biomineralisers become a means to refine rare earth minerals from their ores using biological processes of biomining and bioleaching. Biomineralisers also apply these methods combining them with wastewater electrolysis for bioremediation of contaminated effluent sites left behind after centuries of mineral exploitation. Together with biochemical processes of microbial growth, the bioactive carbon medium provides a proven, effective, and cheap means to clean up nitrates, phosphates, and heavy metals from freshwater ecosystems. The yield quantities are low but are in sync with the need for slow fabrication processes that have become the norm for producing many rare-earth-dependent high-tech goods. Certain strains of fungi and species of plant organisms known to biologically leach minerals from ores are applied here, working together with metabolic systems. In addition to copper and gold production, biomining can also be operated on local scales to refine elements such as cobalt, nickel, zinc, and uranium. Biomining has also been applied in processing sulphide and uranium ores, showing remarkable opportunities for remediating soils and water bodies.

Reference: Page 89-91 of Chapter 3, Beyond Vaporware: Remembering the Blue Reparations Programs in *The Open Journal of ReFuturing* (2131)

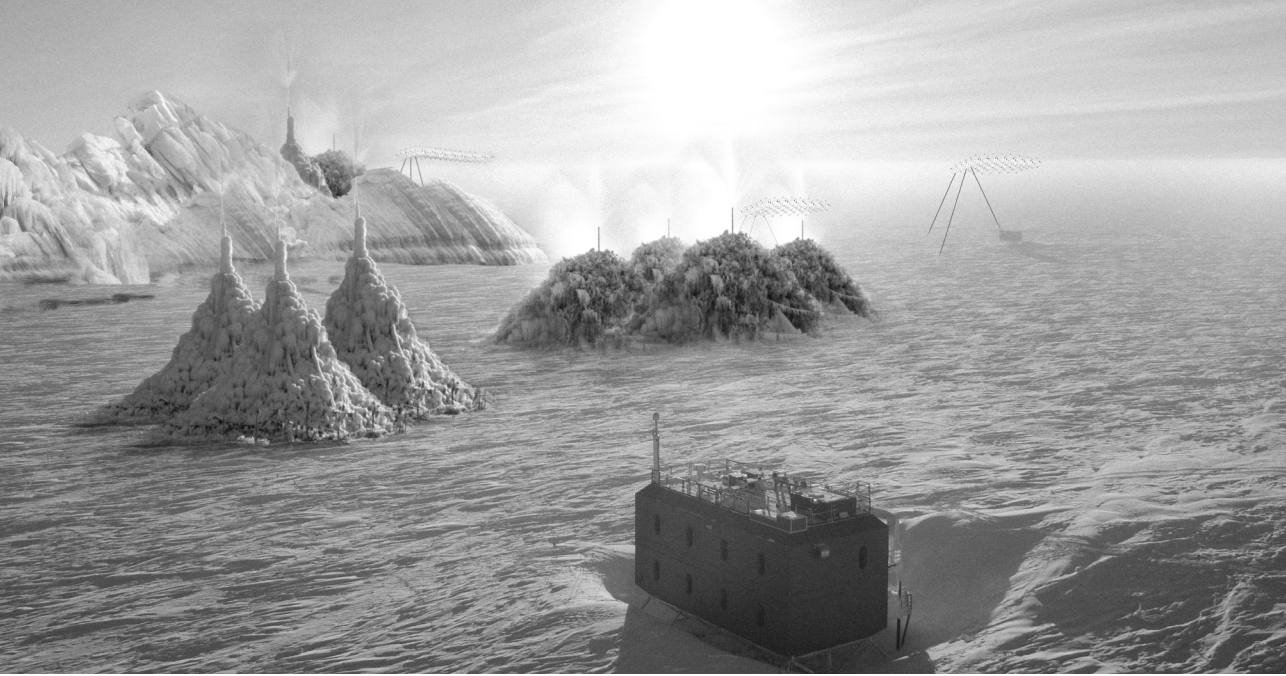


Figure 30. Rainmakers being used for fabricating Artificial Glaciers (2121). Concept Rendered by: Author.

RAINMAKERS

For Harvesting Atmospheric Rivers and Nucleating Artificial Glaciers

Rainmakers are structures composed of autonomous, modular, and woven structures acting as moisture accumulation devices that work on solar radiation alone. They are meant to offer a last-ditch effort to harness moisture from atmospheric rivers and redirect it to provide access to freshwater where it might be needed as rainfall becomes precarious for agroforestry needs and even used to build receding glaciers and polar ice caps with Ice Stupas. These Ice Stupas are implemented in the Himalayas, offering glimpses of possibilities given new cultural practices of replenishing and expanding endangered glaciers could emerge were they to be incentivized and linked to community action, which may be better suited for local resilience. Rainmakers advance these practices with advanced biological fabrication methods and materials, tuned for using biomimetic principles and even some techniques of harvesting water from these atmospheric rivers and electric field propulsion for navigation.

Reference: Page 92-93 of Chapter 3, Beyond Vaporware: Remembering the Blue Reparations Programs in *The Open Journal of ReFuturing* (2131)

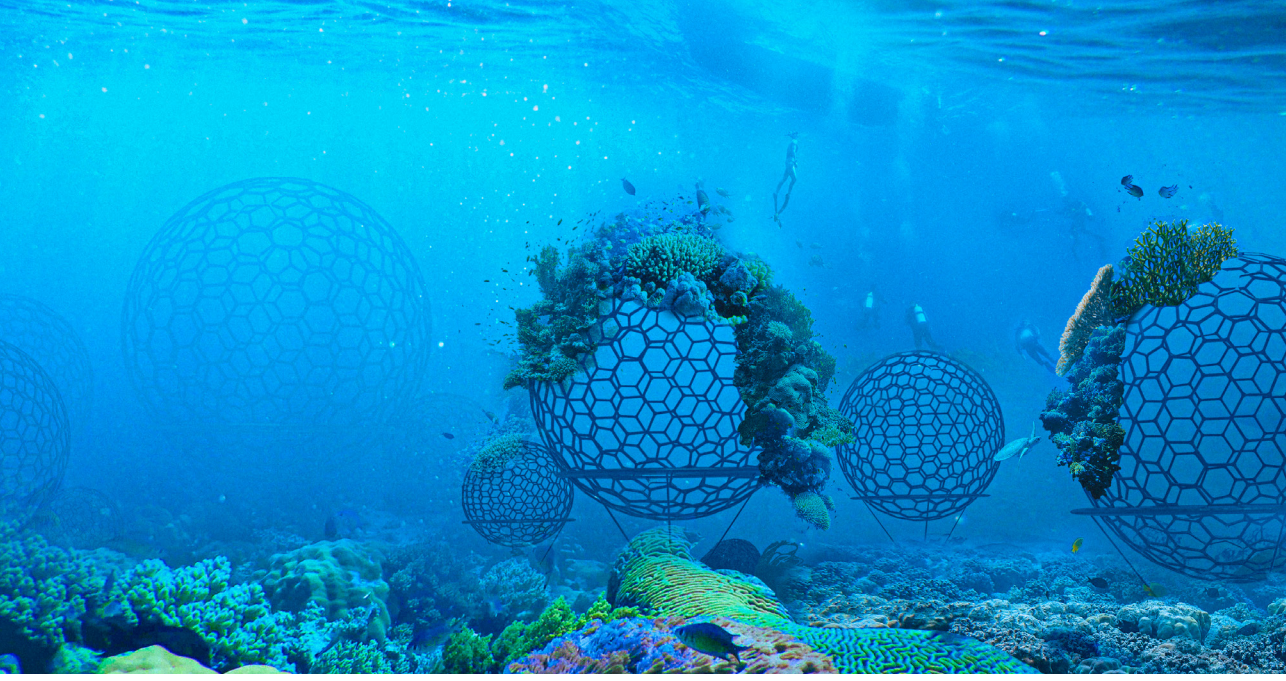


Figure 31. Electrified, Carbon Negative coral reefs creating underwater sea walls and coral marine regeneration zones (2087). Concept Rendered by: Author.

KALO PROBAL (BLACK CORAL)

The Electrified Composite Reefs of the Sundarbans

These electrified carbon-negative composite coral reefs get their name from their distinctive carbon-black structures made from the carbonization of organic fibers that behave as electrodes for the cathodic aragonite deposition of seawater. Known as the “biorock” method, it is also used for making carbon-negative structural composites or socially useful production. As a regenerative strategy, it shows possibilities for recovery of coral reefs at incredible rates, even if damaged beyond repair, by combining with traditional ‘seeding’ and coral nurseries and aiding in their rapid recovery, making possible highly resilient and accelerated artificial reefs to also be scalable. These mangrove-coral sea walls are designed to protect from intense hurricanes and more energetic storm seasons in regions most vulnerable to climate extremes by absorbing the energy and the subsequent storm surges and sea level rise. These reclaimed ecosystems, like the climate resilience zones (CRZs) on land, are meant to rehabilitate coastal communities by stemming storm energy but also provide sanctuary for corals to survive bleaching events, revive fisheries and sustenance to coastal communities while also reviving marine biodiversity.

Reference: Page 95-99 of Chapter 3, Beyond Vaporware: Remembering the Blue Reparations Programs in *The Open Journal of ReFuturing* (2131)

ACT III

The Journey Back in Preparation for Voyages Elsewhere

6. The Implications of ReFuturing

In the winter of 2021, a reviewer's copy/prototype of *The Open Journal of ReFuturing* was first presented to the public at the 75th Jubilee celebrations of The Oslo School of Architecture and Design. Since then, the journal as a designed artifact has traveled the world to some encouraging responses from scholars, activists, and everyday people.

While one can always discuss the feedback from these interactions, I believe the following pages are better spent on seeing how this speculative research fares in the here and now and what can be learned from it today, regardless of whether one prefers the speculative paradigm P₂ or not. Having made the journey 'back' to the present paradigm P₁, the following pages discuss what can be learned from this ReFuturing and its implications in designing for long-term sustainability in the journey to more preferable futures elsewhere—to change P₁ into an 'alternative now.' For developing this alternative now, I take stock of what this generative synthesis has brought forward for climate action, design and designing, and the discussions around the visions this research has helped rethink long-term sustainability.

In early 2022, the launch of the fictional journal coincided with the release of the third Working Group (WGIII) Report on Mitigation and Adaptation of the IPCC Assessment Report (AR6). Given their common themes for action, I will start this discussion by comparing how a speculative journal and its artifacts fare with respect to some of the overarching findings and conclusions of the report. It should be clear that one cannot compare the two documents or their positions in any absolute sense and nor is this an exhaustive evaluation.

6.1 REALITY CHECK WITH THE IPCC REPORTS

While this is just a brief discussion, it might help ground and evaluate the speculations with the realism of recommendations of the IPCC. With that said, it would seem that many of the journal's propositions have aligned well with the WGIII recommendations, and, in some instances, the journal speculates on ideas beyond them, revealing some concerning challenges. The following discussion takes stock of some of key discussions in WGIII I believe has resonated and then move on to explore the dissonances with the journal's speculations. Here I will mostly use what the IPCC says, assuming the Journal has been read in full.

6.1.1. THE RESONANCE

Firstly, the WGIII report calls for an acceleration of just transitions, far more ambitious on action than ever. Given the time frames, the report calls for urgent, effective, and equitable mitigation actions through “synergistic policies, equitable partnerships, and integration of adaptation and mitigation within and across sectors” (IPCC 2022, AR6 WGIII, SPM-52, 55). To this end, the report states “ambitious mitigation pathways imply large and sometimes disruptive changes in economic structure, with significant distributional consequences, within and between countries” (Ibid, SPM-56). Furthermore, the report tries to balance inevitable trade-offs of such actions with equity. The report calls for mitigating these trade-offs through “intra- and inter-sectoral interactions, cooperation between countries and regions, the sequencing, timing and stringency of mitigation actions, governance, and policy design” (Ibid, SPM-52).

These proposed shifts aim to fundamentally “improve the well-being of people” even if development priorities reflect the different starting points and contexts of nations and communities (Ibid, SPM-56). The report lays out the clear but entangled links between sustainable development, vulnerability, and climate risks that might require sustainable urban planning and infrastructure design (Ibid, SPM-55). Crucially these calls for equity will be necessary to dramatically increase climate resilience, especially for vulnerable countries and communities, and equitably support those in need (Ibid, SPM-56).

The report outlines the disparity and inequality of emissions between countries, and states that approaches to development pathways towards increased sustainability will also need to be designed for impact over the transition period from high to low emissions activities (Ibid, SPM-56). Furthermore, the report calls for equitable sharing of benefits and burdens of mitigation pathways which

will have distributional consequences within and between countries. Within countries, it suggests that the inequalities in the emissions distribution and the effects of mitigation policies would need to account for social cohesion and the acceptability of mitigation and other environmental policies through equity and meaningful participation in decision-making at all scales for building social trust, which further support transformative changes. (Ibid, SPM-56).

The report also acknowledges the “meaningful participation of Indigenous Peoples and vulnerable populations” (Ibid, SPM-52). The report points out the urgency for “maximizing synergies and avoiding trade-offs pose particular challenges for developing countries, vulnerable populations, and Indigenous Peoples with limited institutional, technological and financial capacity, and with constrained social, human, and economic capital” (Ibid, SPM-52).

Many of the journal's imagined transformative global climate and abolition treaties, such as the Treaty of Universal Climate Justice and Mutually Assured Thriving (MAT), are similar in their assessment but go on to discuss their continued impacts on transforming society if they were instituted. The speculations go further in imagining climate action by civil society being led by and in collaboration with Indigenous Peoples, establishing institutions that exercise decolonization and climate reparations and returning Indigenous Lands and Water. These regenerative practices are discussed in how these ecosystems flourish and later become sites for Climate Resilience Zones and for practicing the Blue Reparations programs (see chapter 2 & 3 of journal in appendix).

6.1.2. THE DISSONANCE

What the journal imagines seems politically impossible today, even though the IPCC calls for the same. However, there are some stark dissonances too. For instance, only once does the WGIII report mention the word 'disinformation,' acknowledging that more research is required on the links between disinformation and public trust about climate change (IPCC 2022, AR6 WGIII, FGD). This seems a troubling oversight given the earlier discussions (see sections 3.1.2 & 3.1.3.) on how seriously ingrained in the public discourse climate denial and delay are, which fundamentally undermines much of climate science in the public mind.

Furthermore, the word abolition only appears once in the report in the context of fossil fuel subsidies (IPCC 2022, AR6 WGIII, FGD). This is remarkable given how fossil fuel companies, given their planned output, are projected to exceed the global carbon budget and derail climate goals within the coming decade (Carrington, 2021b; Carrington & Taylor, 2022).

Even though the IPCC speaks of the political challenges of climate action and cooperation, it tries to consider a diplomatic, politically neutral tone. Given the many spectrums of political thought spread across its member nations, it has to do so. Unfortunately, it is in this space where the dissonance *within* the IPCC's working reveals itself most—between the publicly disseminated summary reports and the more detailed scientific assessments of the full report.

The environmental journalist Amy Westervelt reports that the development of the WGIII reports was embroiled in an unusually long and contentious approval process following the complicated geo-political negotiations that ultimately influenced how the summary report was disseminated to the public (2022). She reports a curious disparity between the summary for policymakers (which must be approved by 195 national governments) and the full report, the chapters written and controlled by the scientists themselves. This may be why neither disinformation nor abolition of fossil fuel subsidies is mentioned in the Summary Report, but it is not limited to these issues.

For example, the report calls for facilitating shifts in development pathways toward sustainability and briefly mentions concepts like Degrowth concerning consumption reduction in the full report (IPCC 2022, AR6 WGIII, FGD) and then never again in the more popular summary report. Instead, seemingly neutral-sounding phrases like “increased economic activity and employment” are presented as viable development options that suggest more cumulative growth, not less (Ibid, SPM-52). This call for mitigation of trade-offs stresses capacity building, finance, governance, technology transfer, investments, development, and social equity considerations. However, one might also ask what these trade-offs are, who is expected to pay for them, or if the same historical and present-day institutional structures remaining unchanged decide this, having given rise to them in the first place.

Moreover, this is also clear when the report speaks of solutions for carbon capture. For instance, the report states that soil carbon capture programs are considered potentially highly beneficial but also call for caution surrounding their uncertainties about potential benefits due to their limited application today (Ibid, SPM-53). However, this precautionary principle is discarded when speaking of mythical carbon capture technologies and storage, which is generously mentioned in the same summary, accompanied by watering down language on the calls for urgent shutdown and curbs on fossil fuel production (Westervelt, 2022).

Unsurprisingly, these seem like the telltale signs of vested national and supra-national influence of fossil institutions in trying to overtly and covertly

negotiate and obscure their responsibility. It can be understood that given these geopolitical maneuvers, these institutional actors also see themselves as part of the solutions and therefore justify their willful interference with climate negotiations, tainting the perceptions of what should be the foremost authority on the science of climate change. Westervelt concludes that the IPCC reports also make it abundantly clear that hindrance to climate action is not being held back by scientific knowledge or technology but by entrenched power structures and the absence of political will (2022).

Despite this, the scientific assessments of the IPCC AR6 and the synthesis in this research both reach the same fundamental conclusion—there is nothing inevitable about climate action or inaction, and radical structural changes are required to address the crisis. No matter how narrow, there remains a possibility that even the seemingly unsettling, unthinkable, or unimaginable acts of climate reparations can be made thinkable and doable today.

6.2. THE RESPONSIBILITY OF DESIGN

“We can only attempt to understand that of which we become a part. That understanding is the result of integration, while knowledge has been the result of detachment. That understanding is holistic, while knowledge is fragmented. At least we have reached a point in which we are finally becoming aware that knowledge is not enough, and that we have to learn how to attain understanding in order to achieve the completeness of our being. We are, perhaps, beginning to realize that knowledge without understanding is hollow, and understanding without knowledge is incomplete.”

– Manfred Max-Neef in *From Knowledge to Understanding* (2009)

In this crucial decade for climate action, it is essential that one acknowledge the responsibility design and designing if the necessity of societal transformations and decarbonization is taken seriously. As the late ecological economist Max-Neef’s quote from above asserts, it is not enough to simply know these futures and expect the task of climate action to be complete. This call for synergizing the knowledge and understanding with its appropriate action also comes at an opportune time for design which seems fossilized with its foundations stagnating (Redström, 2017, p. 66). The journal offers a pragmatic vision to understand design’s alternative systemic roles and responsibilities that call for it to transcend its disciplinary knowledge to secure the necessary transformations for long-term sustainable futures (Edeholt & Joseph, 2022 in appendix).

I will briefly reflect on the implications of ReFuturing in design based on an understanding that this speculative research helped developed over the course of this investigation. I will briefly investigate the consequences of this work in this reclamation of design and designing to prepare it for these new systemic responsibilities and look at the conditions that may be needed for this to happen. I will do so through provocations directed at the significant levels of disciplinary traditions of education, professional practice, and scholarly research.

6.2.1. DESIGN EDUCATION AND PROFESSIONAL PRACTISE

In the neoliberal era, an incredible assault on public education has resulted in its defunding and gradual privatization over the past few decades. One result of this has been the narrowing of design education to a few privileged minorities who can afford it, and if other marginalized groups ever do make it, it is by taking on tremendous debt burdens or competing for the dwindling education grants. These are pragmatic concerns shaped by one’s expectations of an ideal

professional life, from which design students come.

Should it be surprising that design graduates land in practices that continue Business as Usual (BaU) since denying and delaying climate action offers more lucrative career pathways? What alternative opportunities for criticality and refuturing are there within the professional practice where young design professionals can develop their critical faculties with in-depth professional training and the development of disciplinary foundations? Should one be split between artificial choices of profound criticality and the everyday practice of their deep disciplinarity, and should choosing one imply the necessary atrophy of the other?

Interested design students concerned with sustainability and climate crises might engage with these topics, only to be told that these early explorations might be (understandably) reductive and techno-utopian for the reasons already discussed. At the same time, critiques expecting realistic complexity can often overwhelm and end up upending worldviews. Without a more profound practice of radical hope through/by design, critical discourse can become so overwhelming that climate despair and the heaviness of climate coloniality can amplify their anxieties (Joseph, 2021 in appendix).

One might wonder if we are asking way too much of design students to engage in a critical practice that has come to imply the erosion of professional skill sets. Thus, while it is true that design practices defuture, without alternative sustainable professional pathways, their career choices are made for them. Even if, on a rare occasion, a few individuals manage to break through these barriers and retain both, one must still acknowledge that there might be certain cognitive limitations within a problem-solving approach in dealing with matters of such scale and importance (Dorst, 2019).

Thus, one response has been to simply not teach students the severity of the crisis since it is unsettling and stick to one's own disciplinary traditions and repeat them since the situation is beyond one discipline anyway. These continued disciplinary tunnel visions can also be found beyond design. Scholars have pointed out that when it comes to the climate crisis, in many education programs, there is a lack of interdisciplinary integration in the classroom, which further becomes a barrier to developing the deep interdisciplinary perspectives needed to tackle such complex issues (Næss, 2010, p. 81). Often students more inclined towards criticality might look towards design research for these opportunities missing in professional engagements.

6.2.2. DESIGN RESEARCH AND SCHOLARSHIP

Even if one ignores these structural challenges, there are other more profound questions of research that remain. Tuck and Yang point out that what we call ‘research’ is just one form of knowing (2014). For them, one of the many problems within Western academia today is that while being particular and privileged to a very narrow set of best practices, it presents itself as universal and standard. In its haste, it might even ‘rediscover’ the many secrets of nature that indigenous peoples have known for a long time¹ and might even claim these new-old knowledges for itself. In this sense, the authors conclude that it often eclipses, occupies, erases, and ultimately colonizes other, more profound ways of knowing (Ibid, p. 237).

This marginalization of other ways of knowing is palpable in design research too, where there is confusion about what a Research through Design or Research by Design is, not fitting certain expectations of what research is supposed to be, useful though these approaches have proven to be. One can see how these other ways of knowing in design research are disseminated. The culture of dissemination within design and designing, as Redström reminds us, was never intended for the realms of the purely written word (2017, p. 42). If the only possible way to judge research outcomes is through the written, one can miss the designerly mycelium for the fruits it produces.

Furthermore, the written word doesn't really give us a good grasp on what is and isn't good research—it is possible to write well about flawed design research, and sound design research can be miswritten too. Both produce new knowledge, but there is a qualitative difference between the two forms relevant to the development of the foundations of design research. This has consequences such that in justifying their academic knowledge production as legitimate, a design researcher might lean towards the practices of knowledge production on the assumption that all knowledge needs to be explicit. If not, there is an implicit notion that design scholars might not be considered rigorous enough unless the knowledge produced through these other ways of knowing is not translated into languages, methods, and practices that resemble more like ‘serious’ and legitimate academic practices of the sciences and the arts.

1 More evidence has been mounting in the recent years that many Indigenous Knowledge systems have a uniquely situated and complex map of the natural world now corroborated with genetic mapping (Gardner et al., 2022). See (Kimmerer, 2013; Rosiek et al., 2020; Watson & Davis, 2019; Whyte, 2017) for more discussions on the relevance of other ways knowing in diverse in Indigenous knowledge systems.

While writing can be critical for certain forms of research dissemination, it remains one tool among many and is only occasionally focussed on when trained in many design traditions or even necessary. While a lot of the knowledge about design and designing requires some written component, one can also lose in the written word other more profound designerly ways of knowing and being, expressed and developed across various practices beyond the written word. With particular privileged modes of dissemination alone, it might be like expecting mycelium to behave like trees. The result is that design gets further alienated from developing its disciplinary foundations through research.

Furthermore, while design research occurs across many cultures and languages, what one considers legitimate knowledge in design can end up privileging specific languages, discourses, and expressions over others. This can end up obscuring the diverse tacit, situated, and embodied languages, rituals, and cultural contexts where design and designing happen. Recent scholarship has suggested that there are entrenched linguistic biases in academic reviews against researchers for whom English is a second language, resulting in their work being assessed to have lower scholarly quality (Politzer-Ahles et al., 2020).

Still, research remains one of the few spaces dedicated to human curiosity and inquiry, and for this reason, Tuck & Yang call for preserving it and expanding further to nurture other 'nonresearch' ways of knowing (2014, p. 237). Not all that calls itself new knowledge is necessary or beneficial, and there is an opportunity to refuse research and to understand "the wisdom in a story, as well as the wisdom in not passing that story on" (Ibid, p. 244). In recent years, there have been calls for transforming knowledge systems to 'slow' academic life to pursue much more meaningful scholarship (Mountz et al., 2015), to necessary transformations in response to planetary ecological breakdown (Fazey et al., 2020).

This is a question for how we care for other ways of knowing and disseminating research that flourishes rather than stagnates deep expertise. To change these conditions is to reclaim scholarship and research beyond what it became to what it could-be. The journal thus speculates on pluriversal languages and cultures of academic life emerging from these transformed intellectual traditions. What then is the vision that these transformations build towards?

6.3. THE INDIGENIZATION OF EVERYDAY LIFE

With the rising calls for action and the continued atmosphere of institutional delay, the general sense of disappointment and anger at the institutions is at an all-time high. While many of these forces are maladaptive, there has been a surge in civil disobedience movements calling for adaptation and resilience in response to the escalating climate crisis. In response to climate justice movements demanding action from their governments, one has seen instead a disproportionate criminalization of climate protests and extreme repression of these democratic rights globally. In these struggles, however, one might heed a simple call of those Indigenous Land and Water Defenders who have had for centuries faced these forces:

“Accomplices not allies.”

— Indigenous Action (2014)

This relatively straightforward provocative call to action encapsulates a rather profound question and a choice—one can either become an active, engaged accomplice in the now increasingly criminalized climate struggles, or one can practice passive allyship as a sympathetic observers-in-waiting which is another form of climate denial. This provocation can be deeply unsettling; however, as history is witness, it is the only way transformative social change has been achieved, even when it is unthinkable at first. Therefore, there remains a possibility, however minuscule, that one can try to reclaim the discourses and forces of denial and delay and reclaim them instead for possible, informed actions for climate reparations (Figure 32).

Demystifying climate reparations as a feature of everyday life might open the space for other regenerative and caring practices to flourish, where one also sees transformative ecological revival along with the social. Therefore, for Industrial Design to play a role in this, it seems inadequate to simply speak of the sustainability of everyday life. The goal of this particular speculative decalcifying exercise has been to illustrate how calcified the social imagination and how profound the alienation of defuturing and dehumanization is, which have created deep schisms and ruptures within and between Nature, Society, Body, and the Mind.

At the very least, it sets the stage for what is a step toward a more profound shift that opens the field of direct participation in the planetary ecology rather than alienation from it—reuniting nature with its people.

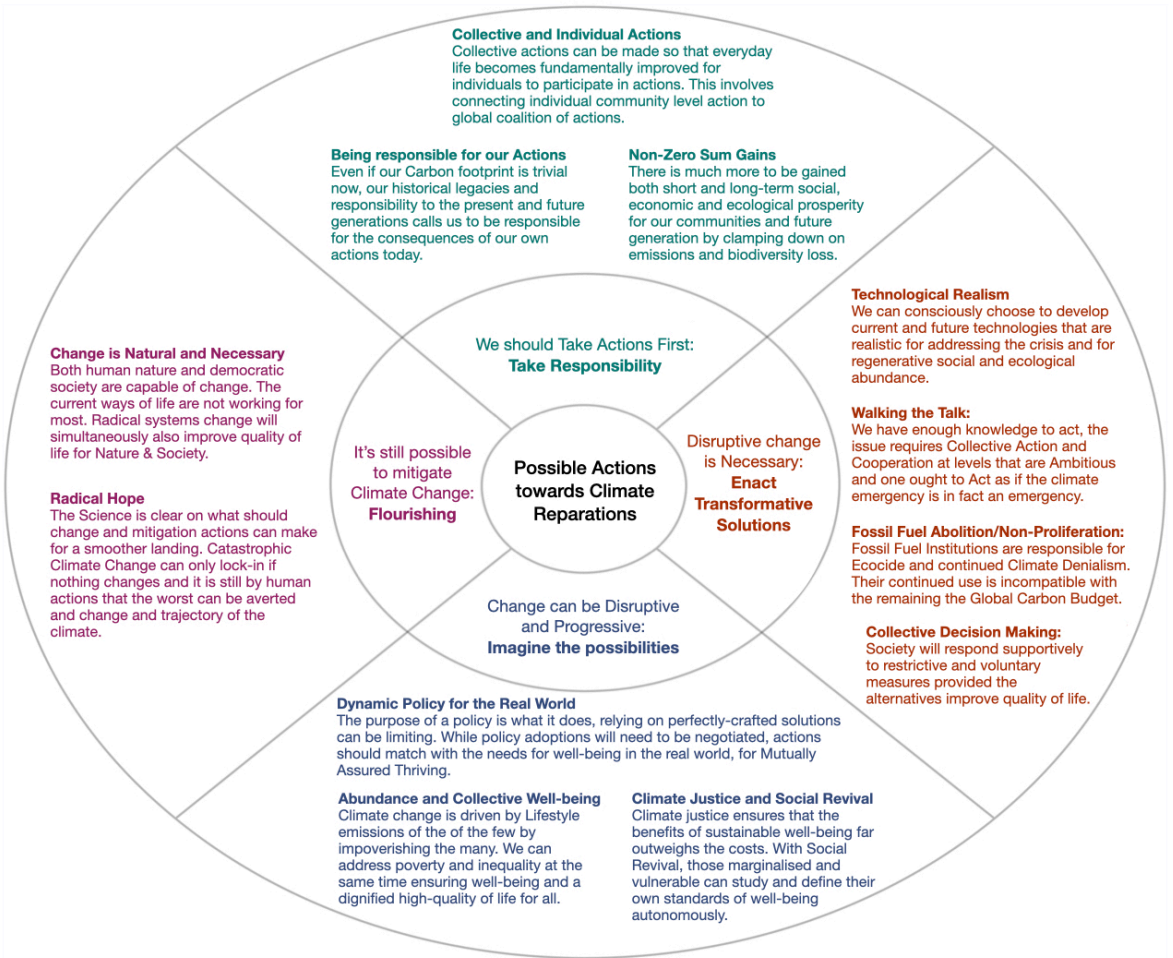


Figure 32. Possibilities of Actions for Climate Reparations today. Illustration adapted from (Lamb et al., 2020) as discussed in section 3.1.2 in this thesis.

One may think of long-term sustainability instead as a pit stop towards a more critical vision—of a species becoming indigenous to the planet. This may be a strange prospect since, as already discussed earlier (see section 3.4.2), much of the contemporary notion of indigeneity is contested and entangled politically but also presented as a mythical construction of a mystical, unruly or harmonious nature intertwined with either a primordially innocent or brutish humanity.

Nonetheless, this indigenization is not merely a superficial adornment of regalia or caricaturing of indigenous knowledges and practices. Furthermore, given the harm done to the biosphere, whether this indigenization is possible is anyone's

guess. However, this work tries to suspend disbelief for a moment and seriously consider this proposition, this call for being an accomplice as a plausible route for rehumanizing design and designing for the realistic and essential social transformations required today, remembering this renewal and reclamation as a place called the 'alternative now' one could simply walk into.

Moreover, the pathways towards indigenization of everyday life are rather more specifically imagined for those of us non-indigenous as a means of social renewal—a *responsibility* that calls for a profound *remembering* and *reinvention* of one's relations and obligations to human and non-human others, learning together with and from indigenous knowledge systems and reclaiming the imagination for what might yet become.

This is ultimately the purpose of ReFuturing Studies through/by Design.

7. Reflections: An Invitation to ReFuturing Studies

This final chapter of Act III brings an end to the long and arduous journey that has seen us traversing whole worlds—from the *what-is* (P1) to the *what could-be* (P2), worm-holing through/by the transitional *what-ifs* in a generative, designerly way. I would like to briefly reflect on what this project achieved, given what it set out to do over the various activities pursued and where it might go from here.

As is tradition, one may ask what became of the research question and its sub-questions—“How can industrial design enable the imagining of more radically hopeful futures in the context of long-term sustainability?”—unfolding with all the discussions until this point. As mentioned, the answers to this question are spread across this thesis—in the *what-is* (P1), the *what-if*, and *what could-be* (P2). These answers are explicit and tacit in the many discussions, activities, and artifacts developed throughout this project. Admittedly it was also possible to ask more precise questions that could have been answered in a less convoluted manner. Although one also risks other problems like reductionism and landing into mono-disciplinary dogmas, not to mention how much more fun it was to do it this way for my own designerly engagement. Given that the question itself was designed to aid in the generative activity, it also, in my view, generated the possibility for rather intriguing answers.

In essence, this thesis illustrates that *if* Industrial Design could answer the question, it would need to reimagine itself simply by acting as if it already could and reimagine a world in which that was the case and discovering the ways to move through that world in the here and now. This self-justifying problem-solution conundrum is taboo in many disciplinary traditions that might err on the side of caution. However, as already discussed, the peculiar transitional and playful nature of Research Through/by Design can make for some exciting speculative journeys through a seriously playful and studied imagination.

This work, therefore, is not interested in predicting the future or what the future would be if we do not change, but rather what it could be if the present were reclaimed such that the future was profoundly different when one arrived in it, as though it were a place one could simply walk into. It is also essential to state that this moving between realities was only possible through/by designing the artifacts over a wide range of generative activities—from the written word, design fiction, fabricated tangible artifacts, and exhibitions. These artifacts, even in their transitional solutions spaces, thus illuminate and propose grounded, concrete alternatives for a world reimagined and make them thinkable and doable.

Admittedly, for this reason, one can also see this project as having done what it critiqued Speculative and Critical Design of doing—being confined to exhibition spaces as speculative artifacts. However, beyond the limited scope of this research, one could think of these research outcomes as spores of mycelium, having the potential to travel further and generate, unfold, and mediate actions beyond what it did so within this research investigation. By negotiating the analytical towards the synthetic, this investigation has generated something radically hopeful in its incompleteness. If it were complete and specific, there would be nothing to build towards or care for.

Caring for Radical Hope in Times of Climate Breakdown

In pursuing this investigation, I found myself repeatedly split between two paradigms; the one that exists and the one that could be if things changed, one that I could just walk into through/by design. On the return journey, I find myself back in this urgent decade of climate action, the weight of which has been building up for centuries, even millennia. The coming few future generations might wonder about this period like we examine the times of our forebears and the opportunities they missed. Although it is not hard to imagine what these generations might say, they are already alive today and desperately engaged in civil disobedience for climate justice. And so, the question remains—what kind of ancestors would we be remembered as? What kind of present-futures do we want to care for?

On many occasions in the past year, I have had a chance to talk about this research and the urgency of the climate crisis with diverse groups of people. Often to claim this work was building up an unapologetic, concretely utopian future and laying out a roadmap for global climate reparations made for exciting and welcoming conversations from those who found this future desirable. It also invited curious forms of trouble. “It would be nice to live in a

utopia, but the reality of the world dictates otherwise...” was a typical refrain from those unsettled by these attempts at concrete utopianism. This made me realize that climate dystopia was so normalized that the possibility of utopia seemed dull and readily discarded for not being “realistic” enough. Thus, while viewing any alternative possibilities of a long-term sustainable paradigm from the logic of the one that exists, one may find one’s own social, economic, and technological mythologies unsettled by the alternatives.

It would seem that a far heavier burden of proof continues to be placed on the speculative imagination and those pursuing any serious alternatives, something that is easily justified, accommodated for, assumed, and unquestioned for those advocating for the existing paradigm (P1). This seemed hardly fair, but as discussed earlier, such is the crisis of the imagination that one might readily provide the crucial creative, intellectual, and caring labor for these systems of domination often enthusiastically and call it reasoned critique.

While one is always prone to some biases about how a preferred future ought to be, it would be a grave error to underestimate or downplay the forces of public disinformation that continue to distort realities and sustain the capture of the social and political imagination in everyday life. It is only now becoming clear how insidious and successfully detrimental the forces of climate disinformation have been to climate action, further entrenching climate denialism, inaction, delay, and doomism.

Moreover, such resistance to adaptation and change can be seen in the turmoil and scramble for resources as the world marches on to be at war with itself. Nevertheless, these actions are ultimately maladaptive for climate action since such zero-sum games can only offer false hopes and temporary reprieve to the few. It is becoming increasingly clear, now more than ever, that there might never be climate peace in a world without climate justice. It is clear that to believe that the systems of accumulation can continue the same seems not only naive, but at this moment, it is also just science denialism.

It is hard not to describe such developments as a war on the social imagination where the seemingly straightforward task of global decarbonization, which is always immanent but never arriving, is being rendered unthinkable for the lack of political will, supposedly for the ‘greater good.’ However, given the discussions in this thesis, these forces might be better understood as the weaponization of care for desirable futures, calcifying the social imagination, all for sustaining the unsustainable but ultimately emerging from the confusion between domination and care.

It is hard to find many reasons to believe that a society founded on, organized, and sustained on the everyday dystopias for the many, for the momentary utopias of the few, is necessary or desirable and can even continue to do so indefinitely. As things stand, reality may have caught up with whatever climate dystopias could be imagined. In this overwhelming assault on the imagination and the future, it is easy to miss the simple cybernetic dictum—the purpose of a system is what it does.

For this reason, this thesis and the fictional journal go to considerable lengths to map how troubling and unsettling the climate crisis is. Admittedly, while this work devotes a lot of time and energy to engaging with the historicities, coloniality, magnitude, and urgency of climate change, it only offers a partial view. Nevertheless, this partial, structured view of the colossal magnitude of the climate crisis allows for a speculative synthesis that is critically utopian, remarkably realistic, and achievable socially, technically, and economically.

Recent studies suggest that mitigation and climate reparations are possible while simultaneously achieving human well-being and justice. Our institutions and cultures of progress and civilization could be reimagined and reclaimed from their functions of domination of Nature, Society, Body, and Mind to care for them instead. It is this responsibility that the fictional design journal explores and makes explicit, which is written to discuss and reframe the existential issues we face collectively and talks of the next century of appropriate climate reparations along with fossil abolition since we seem to have crossed the thresholds of climate action alone, it would seem.

Yet, in the face of such overwhelming evidence, one may ask—how much knowledge does one need before acting on this fundamentally existential issue? With a growing pile of new evidence, the justifications for maintaining this social reality now exist on thin ice. The science remains undisputed on the necessary radical changes to be realized within this decade. The fact that there are justifications might suggest that we are at the precipice of constructing the possibility of radical hope in the knowledge that this social reality, while it seems calcified and unyielding, is far more malleable than we thought we knew. In this sense, this research illustrates that it is far easier to imagine other alternative worlds than to imagine the collapse of the biosphere by continuing Business as Usual (BaU).

Design and The Ecology of Disciplines

What, then, can design do from here? Often, one tends to be biased about one's position in research. I acknowledge that some of what I have argued

for here might seem to overstate the importance of design and designing as I have engaged here. However, if the discussions about design's dehumanizing and defuturing have any relevance, it is that design has been a successful tool for doing 'wrong-things-right.' It remains unknown what design might do or become if it could rectify these wrongs and begin to do the 'right-things-right.' Therefore, working towards rehumanizing design is also grasping what traditions genuinely need to be cared for, remembered, refused, reclaimed, reimagined, and reinvented.

This is where the exciting opportunity for a transformative praxis grounded in critique comes in, where design might start to reclaim the third fundamental freedom that seems to have been lost yet is hiding in plain sight—the innate human ability to reshape our social realities and the worlds we make and move through with the many means and tools available. As this investigation hopefully illustrates, Industrial Designers have more than just the responsibility to do this; they might already have the necessary disciplinary traits to offer different ways of knowing and being for interdisciplinary emergence, navigation, and movement towards these preferred alternative worlds.

However, even if one can imagine the most desirable future, it cannot come about independently. Thinking like mycelium, one can see this work as building new hyphae and inviting new species to come and participate in an essential interdisciplinary 'ecology of disciplines' for just climate action. The thesis, the publication, and the artifacts illustrate a speculative case study for where those choices and alliances might lead us. This is not to claim expertise of, or to be subsumed by, other domains of knowledge but to offer something unique that might help transcend these domains. This distinction is crucial to understanding the crisis of critique and imagination regarding climate inaction and what happens beyond that. For this work to go beyond speculation, it needs to be coordinated with other accomplices.

ReFuturing, therefore, is an invitation to imagine the seemingly impossible and realize the unthinkable—from whole systems change to climate reparations to the rehumanization of everyday life.

Will there be Dancing?

I will end this thesis by discussing finding radical hope within climate despair through dancing and play. While one may think of it metaphorically, the dancing was literal. It illuminated and negotiated with creative forms of synthesis that, in hindsight, were simply hiding in plain sight. This tacit understanding significantly enhanced and oriented the generative outcomes

in this research. If this project could ever claim a breakthrough, it was by practicing this playfulness that inspired my own process in this journey of creative remembering, responsibility, and reinvention. This seems obvious, given how designers enjoy playing with materials, artifacts, tools, and fabrication methods, but it is also easily forgotten and thus needs practice.

It must go without saying that playfulness often invites others, and many would often heed the call. Thus, this dancing was a personal and collective practice of radical hope for the everyday. In its myriad ways, this research illustrates that such forms of collectively dancing with social possibilities might be the most appropriate strategy for social and ecological abundance—a present-future worth celebrating. Fortunately, thinking in terms of such abundance is also the most regenerative, leaving room for future generations to explore other forms of social play, where other more humanized worlds and futures are possible and beyond.

One might wonder what other worlds and futures await once this atrophied and stymied human capacity to dance with other realities is rehumanized through/by design—to practicing an audacity to reinvent and reclaim to care collectively and celebrate these ecologies of action in the everyday. This is ultimately the ambition for ReFuturing Studies, an open invitation to reclaim and reimagine the many hopeful and human futures yet to be as though it were an open field one might simply dance our way into.

Summary of Publications

Below you will find a summary of the Publications and Artefacts generated throughout this study. For the sake of clarity, these are documented here rather than upfront to keep the narrative flow. The following gives an outline of the artifacts and articles and clears up how these relate to the thesis and the project in its totality. This dissemination was carried out over 2018-2022.

Publication 1:

The Open Journal of ReFuturing Spring 2131

Speculative Design Fiction: Prototyped and Presented at the ReFuturing Exhibition and Seminar Series, November 2021

Main Author/ Lead Designer

Manuscript Submitted to be considered as Part of this Thesis

This speculative design fictio is attached alongside the thesis in the second phase of Act II in this Thesis—the *What Could-be* of paradigm P2. It is recommended to read this journal before Chapter 5 and the rest of the thesis. The fictional research journal explores an ‘indigenous critique’ of the 110 years of climate reparations looking back from 2131 to 2031, a world completely transformed.

Publication 2:

Critical Futures Today: Back-casting speculative product design towards long-term sustainability

Conference Paper: LenS World Distributed Conference, Milan, June 2019

Main Author

Proceedings Published (2019)

This paper discusses a solution-driven Speculative and Critical Design (SCD) method exploring a ‘designerly’ reimagining of existing technologies as a “back-casted” design solutions into the present—a 3D printed optical solar cell. The solar cell is proposed as a possible, speculative alternative for existing solar cells exploring the “what if” possibilities of technological forecasting in a futures-oriented practise, ways in which product design can contribute to climate

action today.

Publication 3:

ReFuturing Studio: Designing Long Term Sustainability for the Biosphere

Conference Paper: ACSA Teachers Conference, Presented June 2021

Main Author

Paper Presented in June 2021, Awaiting Final Proceedings Publication

This paper presents the case for a “refuturing”— to reclaim that which is defutured and dehumanized, beyond the homogenizing and hegemonic futurism of Business as Usual (BaU) by re-imagining, rethinking and ‘re-humanizing’ through a ‘designerly knowing’ of the yet unknown long-term sustainable futures. This article discusses these tendencies based on observations and discussions with design students in a workshop called “ReFuturing Studio” which attempts to engage young designers to confront the urgency of climate breakdown and long-term sustainability.

Publication 4:

Walk the Talk: An approach to ‘designerly’ transformations and knowledge building towards ecological futures

Conference Paper: Cumulus Conference, Presented June, 2021

Second Author

Proceedings Published (2021)

This paper outlines a framework to rethink sustainability as well as both human and design agency and explores a simple heuristic model that is termed as the “Walking the Talk” model, where both the ‘walking’ and ‘talking’ are discussed through the different approaches, or ‘standpoints’, leading to different strategies. The potential actions are mapped for both (i) established and (ii) more alternative approaches with three speculative product concepts which illustrate how shifting focus to more alternative approaches can effectively address the challenges that the traditional approaches which the paper points are dominant in our quest to address climate change. It explores how design, as

a profession, instead of promoting an “anthropocentric Business as Usual” can counteract it by making the seemingly unthinkable not only thinkable but also desirable and necessary.

Publication 5:

Design Disciplines in the age of Climate Change: systemic views on current and potential roles

Conference Paper: DRS Conference

Second Author

Proceedings Published (2022)

This paper focuses on the tension between what designers tend to do for sustaining the present system vs. what designers could do to support transition to a radically different system and why the latter is so hard to achieve but still so urgently required. The article establishes design disciplines as a distinct entity apart from design and gives an overview of how different disciplines have emerged as 'answers' to how societies, have developed and finally suggests a model for how to address climate change through disciplinary cooperation.

Artifacts from The Open Journal of ReFuturing Spring 2131

Designed Artefacts: Presented at the ReFuturing Exhibition and Seminar Series 2021

Lead Designer

Documented in the Journal, and this thesis (Chapter 5)

These are the artifacts that live in the world described by *The Open Journal of ReFuturing* and explore the technologies of Care for the biosphere and ecological regeneration.

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IPCC 2021, AR6, WGI:

IPCC, 2021: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, In press, doi:10.1017/9781009157896.

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IPCC, 2022: *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. In Press.

IPCC 2022, AR6, WGIII:

IPCC, 2022: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla, J. Skea, R. Slade, A. Al Khouradajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926

Appendix

Research Publications and Artifacts for Consideration

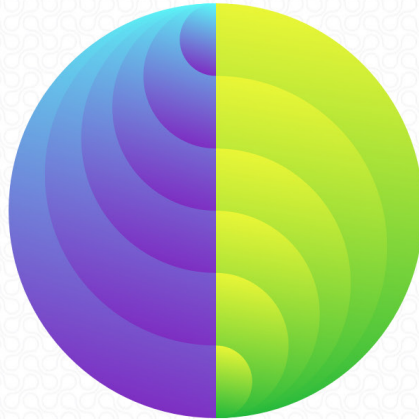
Research Artifact/Publication 1

Joseph, J. (2021). *The Open Journal of ReFuturing* Spring 2131 Centenary English Edition.

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978-2-3798-4166-8



FOR REHUMANIZING FUTURES BY DESIGN

The Open Journal of ReFuturing

CENTENARY SPECIAL ISSUE

SPRING 2131

OPEN DESIGN SOCIETY, OSLO

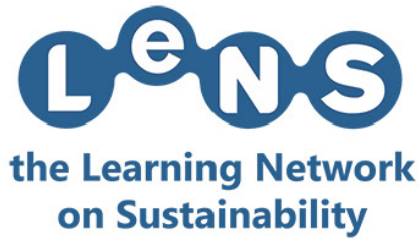


PDF

(Download from BOX Drive)

Publication 2

Joseph, J. (2019). Critical Futures Today: Back-casting Speculative Product Design towards Long Term Sustainability. *Designing Sustainability for All*, 3, 904–909. <http://www.lensconference3.org/images/program/VOLUME3.pdf>



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CRITICAL FUTURES TODAY: BACK-CASTING SPECULATIVE PRODUCT DESIGN TOWARDS LONG-TERM SUSTAINABILITY

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ABSTRACT

The age of climate breakdown brings with it an uncertain future, even within our collective imagination we are presented with increasingly dystopian visions of the future. This tendency towards dystopian futures can also be seen in Speculative and Critical Design (SCD) process which emerged as a disciplinary response to challenge commercial design by envisioning radical futures scenarios and artefacts that so far has been limited to museum exhibits. This paper suggests a solution-driven SCD method exploring a ‘designerly’ reimagining of existing solar technology as a “back-casted” design solution into the present—a 3D printed optical solar cell. The solar cell is proposed as a possible, speculative alternative for existing solar cells exploring the “what if” possibilities of technological forecasting in a futures-oriented practise, ways in which product design can contribute to climate action today while still looking towards visions of better, more thriving paradigms of futures beyond ‘business as usual’.

Key Words: Future, Speculative Design, Climate Change, Sustainability

1. INTRODUCTION

With the onset of cataclysmic climate breakdown and the sixth mass extinction, organised human life is presented with a bleak future. Anthropocentric climate change brings with it an existential threat—an unquantifiable hyper-object (Morton, 2016) that has sent ecological systems into a tailspin. There is enough compelling evidence¹ that much of this pervasiveness is an unleashing of the primal forces of nature only responding to the violent systems of extraction sustaining modern human civilisation², triggering the sixth mass extinction³, melting the arctic ice cover⁴ and degrading soil fertility⁵ due to industrial activity on a global scale. According to the latest IPCC reports⁶, we have 12 years to act in order to limit the global average temperatures to 1.5°C—if we want to avoid triggering irreversible feedback loops. Even if we manage to reduce our carbon emissions, we will end up failing to meet the targets of the Paris agreement which is projected to result in a 2.7°C increase⁷.

While clean energy for a clean civilisation means a shift to ‘clean’ renewables from ‘dirty’ fossil fuels, it is important to understand that technology alone will not create the change we hope to see. Even when alternatives are introduced it is found that it is bound in a paradox—increasing the capacity for further growth and even more consumption (York, 2017). The shift to renewables such as solar is inherently dependent on depleting global reserves of several crucial minerals⁸ such as copper and lithium (García-Olivares & Solé, 2015). Further, even when it comes to our cultural imagination of the future in science fiction, climate change creates echoes of dreadful dystopias, as a comfortable “warning of things to come” (Slaughter, 1998). If we are to avoid these self-fulfilling “mythical path dependencies of dystopias” (O’Brien, 2018)—we need alternatives to avoid a “defuturing” (Fry, 1999) of human civilisation itself. Insofar as the future is not yet determined, better visions of the future are not just required, they are essential. How we humans envision futures, is very much in the domain of design (Margolin, 2007)—a form of “designerly way of knowing” (Cross, 1999) the future.

Designers could possibly be trained to conceive a wicked subject of climate change, and in the attempt at concreteness take the “wickedness” out of the problem (Buchanan, 1992). This paper looks at how speculative product design can make concrete the alternative design solutions of long-term sustainability today through “designerly ways of futuring”. Speculative and Critical Design (SCD) as a practise attempts to “dream up alternative futures” by posing “what if” questions, in order to open up alternative future visions—not how things are but how they could be (Dunne & Raby, 2013). However, SCD as design research is under-articulated as a methodology (Bardzell et al, 2012) and offers little to no insight about how to make things⁹.

The claim that SCD engages in “problem finding” as opposed to “problem solving” inadvertently leads to the provocations depending heavily on dystopian narratives, leaving the audience helpless and without a vision for action. This paper proposes an SCD method for a solution-driven, ‘rigorous’ imagining for long-term sustainability in the case of a 3D printed, optical solar cell as a speculative concept vision for climate action.

2. SPECULATIVE METHOD FOR ‘DESIGNERLY’ FUTURING

Foreseeing radically different futures beyond ‘business as usual’ depends on being able to visualize a future that doesn’t yet exist. Designing for such a future context depends on garnering valuable foresight that through certain design tools can help create a vision both desirable and feasible. The premise of this SCD process explores an iterative method that combines future studies, design fiction and product design to create speculative future artefacts that are focussed on creating a design solution; in this paper this solution is focused on creating a solar cell. Design fiction is explored here for a focused and creative way to think about possible future scenarios that broaden the solution space through designed artefacts. In this case, it is used to deliberate on the “real” possibilities of near and far future technologies of solar cells through narrative fiction. These fictional accounts create the “what-if” scenarios

¹Terms like “biological annihilation” and “insect apocalypse” have often been used. In essence, it is the collapse of whole ecosystems as a result of variations large or small in climate patterns that organisms cannot adapt to and perish.

²The extractive forces that create our cities, infrastructure, industrial systems of agriculture, manufacture, etc. are all dependent on scouring the natural world of “resources. Resources that are in fact being shifted on continental scales. “Earth’s ‘technosphere’ Now Weighs 30 Trillion Tons, Research Finds.” n.d. Accessed April 22, 2018. <https://phys.org/news/2016-11-earth-technosphere-trillion-tons.html>.

³“Plummeting Insect Numbers ‘threaten Collapse of Nature’ | Environment | The Guardian.” n.d. Accessed February 13, 2019. <https://www.theguardian.com/environment/2019/fcb/10/plummeting-insect-numbers-threaten-collapse-of-nature>.

⁴Resnick, Brian. 2017. “We’re Witnessing the Fastest Decline in Arctic Sea Ice in at Least 1,500 Years.” Vox. December 12, 2017. <https://www.vox.com/energy-and-environment/2017/12/12/16767152/arctic-sea-ice-extent-chart>.

⁵Watts, Jonathan. 2017. “Third of Earth’s Soil Is Acutely Degraded Due to Agriculture.” The Guardian, September 12, 2017, sec. Environment. <https://www.theguardian.com/environment/2017/sep/12/third-of-earths-soil-acutely-degraded-due-to-agriculture-study>.

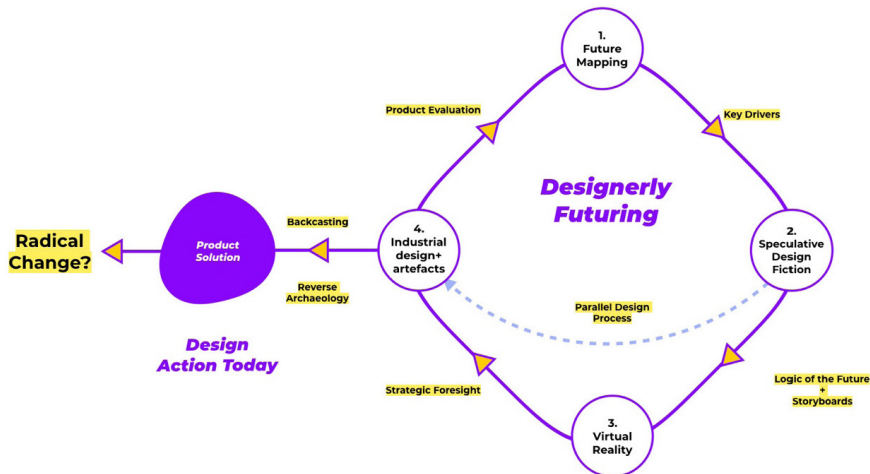
⁶Irfan, Umair. 2018. “Report: We Have Just 12 Years to Limit Devastating Global Warming.” Vox. October 8, 2018. <https://www.vox.com/2018/10/8/17948832/climate-change-global-warming-un-ippc-report>.

⁷Schwartz, John. 2018. “Paris Climate Deal Is Too Weak to Meet Goals, Report Finds.” The New York Times, January 20, 2018, sec. Science. <https://www.nytimes.com/2016/11/17/science/paris-agreement-global-warming-ica.html>.

⁸Mulvaney, Dustin. “Solar Energy Isn’t Always as Green as You Think.” IEEE Spectrum: Technology, Engineering, and Science News, November 13, 2014. <https://spectrum.ieee.org/green-tech/solar/solar-energy-isnt-always-as-green-as-you-think>.

⁹Bardzell et al. observe that SCD uses Critical Theory for the provocations and thus has a general anti-method stance, which emphasizes meanings and effects of the artefact and not that of its creation. It ignores the individual agent of creation that is the author, ignoring his/her intention, the authors find out that this is a limitation to its application to design. This perhaps could be why critical design becomes an ‘elitist mystery’ like art itself.

and frameworks similar to film production, that make fictional worlds possible in cinema (Wille, 2015). The possibilities of these artefacts follows a certain narrative logic or diegesis that allows for the suspension of disbelief whereby the audience can believe the performative role of the artefact¹⁰, even if it cannot be proven to be real (Raven & Elahi, 2015). These so called “diegetic prototypes” create desirable technological possibilities as a “performative artefact” made real by contextualizing technologies through a narrative within the frame of speculation (Kirby, 2010). Designers thus enter these future narrative as archaeologists of the future, learning from and producing the artefacts from this imagined future (Candy, 2013). The future scenarios are chosen to envision better solutions to what exists today by garnering foresight from these speculative far future scenarios that are brought back and manifested in the here and the now, in this case, a solar cell. So long as the aim of the fiction is to discover an artefact from the broad solution space, apologetics can be used as a creative tool¹¹ to strategically justify or apologize for anomalous inconsistencies in the future scenarios without discarding possibilities (Shedroff & Noessel, 2012). Thus, in telling a compelling narrative of radically different futures, an encounter with a conflicting artefact may lead to a creative speculation of its own.



[Figure 1] A iterative, back-casting Speculative Design Method proposed for creating alternative product solutions today (credit: Author)

3. CASE STUDY: 3D PRINTED OPTICAL SOLAR CELLS

3.1. Imagining Better Futures: Three Horizons, Design Fiction and VR

A speculative design fiction titled “Blockchain Radioactive” was created by projecting the “symptoms” of a radically hopeful future over sweeping horizons in the Three Horizons framework (Curry & Hodgson, 2008). The technological and socio-economic drivers projected here are research areas being pursued today while allowing possibilities for speculation. Using these future horizons as the backdrop, a futures poker game¹² was created for building radical future scenarios by forcing combinations of these symptoms of the future that would undercut, amplify or interplay with each other. Apart from written fiction, “Blockchain Radioactive” addresses the question of solar energy in a speculative future as been solved in the form of an “energy harvest”, visualized in virtual reality and film¹³. Each of them an exploration of the future scenario that is set in the post nuclear wasteland of Chernobyl. The narrative goes on to explore how an “energy staff” and a sentient “energy drone” together create the ritualistic “energy harvest” from sunlight, wind and radioactive soil. Being the designer here, the fiction provoked me to apologize (Shedroff & Noessel, 2012) and solve the design of the “energy staff”, by projecting existing technology from today. Thus, the solution was speculated to use a transparent solar ink canister with graphene electrodes¹⁴ at the top, a carbon nanotube muscle¹⁵ ‘hinge’ that bends in the wind in the middle and a mycelium (fungal) electrode that feeds on radioac-

¹⁰ Taken from film theory, a diegetic artefact embeds within it the narrative diegesis/narrative logic. So, a lightsaber in Star Wars may not real in the real world but it is real in the narrative world. A lot of this depends on suspension of disbelief and narrative strengths of the world-building that the film plays with.

¹¹ In the book Make it So, the authors found themselves using the method in the cases where they looked at an interface that couldn't work the way it was shown and “apologised” for it by thinking of ways that the interface could work the way it was depicted. Thus, in telling a compelling narrative of a radically different future, an experiential encounter might not need to provide a heavy burden of proof to begin with and sometimes conflict may lead to a speculation of its own.

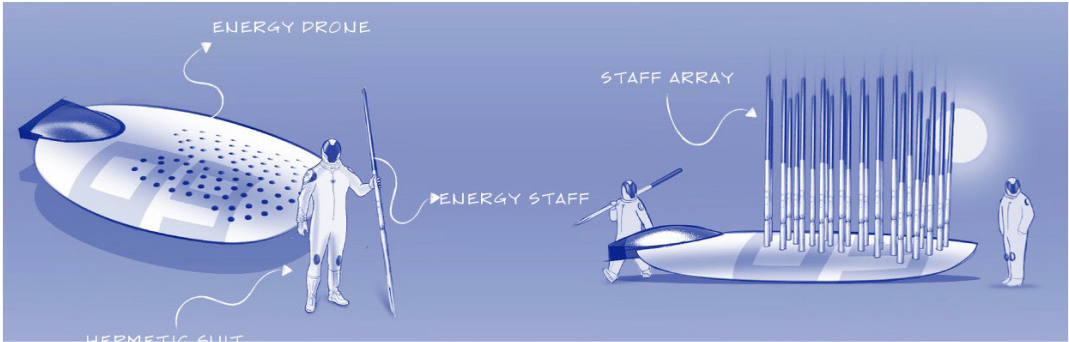
¹² The card game was inspired by Futures Poker, a game created by Strange Telemetry, a London based studio. “Projects.” n.d. Strange Telemetry. Accessed January 19, 2018. <http://www.strangetelemetry.com/projects/>.

¹³ Link For Blockchain Radioactive: A VR Experience concept Film: <https://youtu.be/6ZQrbOBcWxk>

¹⁴ “Electrons Flowing like Liquid in Graphene Start a New Wave of Physics.” n.d. Accessed March 11, 2018. <https://phys.org/news/2017-08-electrons-liquid-graphene-physics.html>.

¹⁵ Johnson, Dexter. 2015. “Graphene Overcomes Achilles’ Heel of Artificial Muscles.” IEEE Spectrum: Technology, Engineering, and Science News. May 22, 2015. <https://spectrum.ieee.org/nanoclast/semiconductors/materials/graphene-overcomes-achilles-heel-of-artificial-muscles>

tive soil¹⁶ at the bottom. The arrangement of these energy staffs would be inspired by the properties of a polar bear's hair that allows for absorption and internal scattering of light (Stegmaier, Linke, & Planck, 2009).



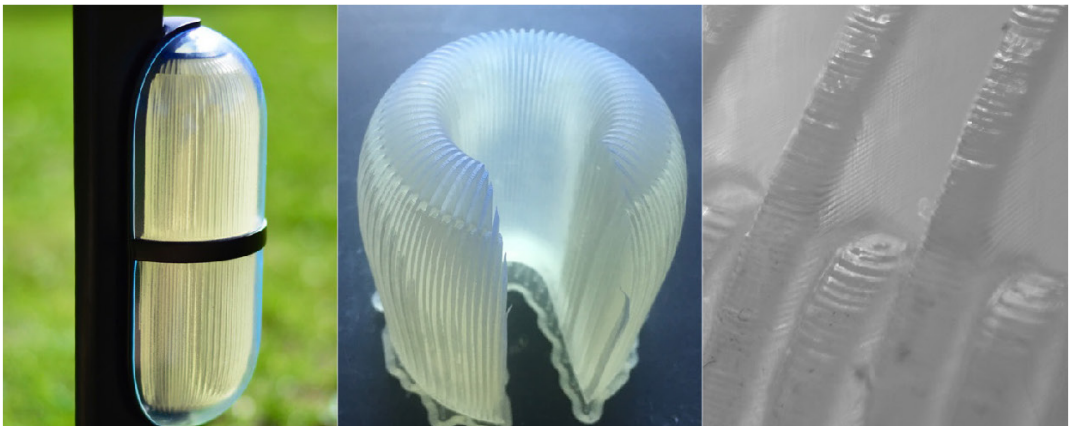
[Figure 2] Energy Harvest Ritual from the Design Fiction “Blockchain Radioactive” (Sketch credit: Author)

[Figure 3] Left: Experiential future VR scenario produced using the design fiction. Right: Concept Film shot in VR (Design and Image credit: Author)



3.2. Back-casted Solar Cells

Having explored a speculative future of solar energy, the challenge was to create a solar cell that could contribute to a solution and still point to a vision of long-term sustainability. This is where this project diverges from a traditional SCD project. In this case, the intention was to pursue a “pragmatic” back-casting that would point to a radical solution for solar energy today. The back-casting was done in order to manifest a solar cell that could allow for internal reflection and refraction of light within a 3D printed optical structure and that could be coated with graphene and produce energy from heat and sunlight. In keeping with existing technology, the concept here proposes making solar cells out of fibre optics¹⁷ by coating the optic surfaces with solar inks such as dye-sensitized solar



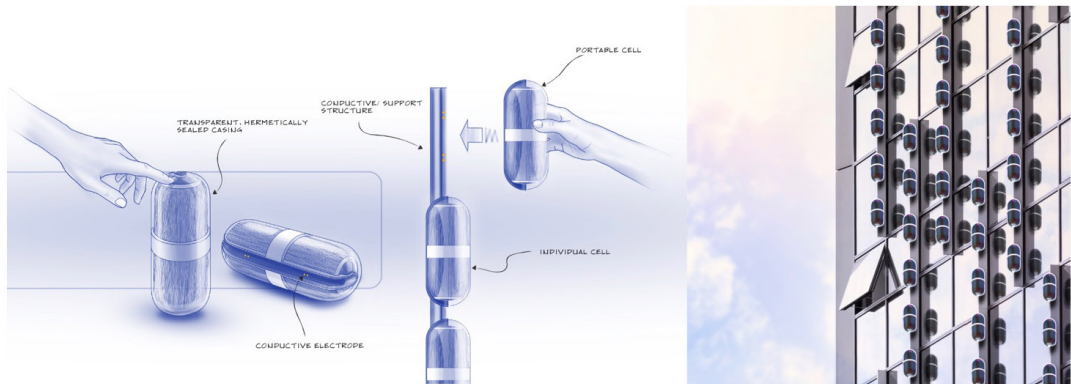
[Figure 4] 3D Primed Optical Solar Cell Concept showing optical structures with layers resolution 100 microns and made using existing LA primers with clear resin, without any surface treatment.

¹⁶ Biello, D., & Biello, D. (n.d.). Do Fungi Feast on Radiation? Retrieved January 22, 2018, from <https://www.scientificamerican.com/article/radiation-helps-fungi-grow/>

¹⁷ Bourzac, Katherine. n.d. “Wrapping Solar Cells around an Optical Fiber.” MIT Technology Review. Accessed March 14, 2018. <https://www.technologyreview.com/s/416052/wrapping-solar-cells-around-an-optical-fiber/>.

inks or perovskite solar solutions¹⁸. These optical structures are then etched with graphene nanotubes¹⁹ that capture a large spectrum of visible and infrared solar energy vastly increasing efficiency. The modularity of the solar cells is inspired by glass sponges in the sea that grow scalable and resilient hierarchical optical structures called 'spicules' in different scales. The concept also incorporates digital fabrication for these cells that allow for 3D optical structures to be printed with precision and in a decentralized manner. As a manifestation of the radical future solution in the present, a 3D printed optical solar cell was produced by the author using existing resin based 3-D printers that can print at a resolution of 100 microns, structures that possess the 'speculative' optical properties.

On the question of climate action today, the solar cell can contribute to transforming our existing cities into solar power plants, without the need for massive infrastructure overhaul. When mounted vertically on dense urban skyscrapers, the cells could also additionally capture the reflections and scattered incident sunlight off of other buildings in addition to direct sunlight. At night, the 'urban heating effect' becomes a possible source of infrared radiation that the 'graphene ink' could capture thereby greatly enhancing the efficiency of these cells. If we challenge the notion of the 'rooftop approach' to solar, a possibility opens up where the vertical facades of existing buildings can be transformed into solar panels and cities thus become net generators of energy instead of net consumers.



[Figure 5] When mounted on vertical facades of buildings, these 3D solar modules capture reflections and scattered incident sunlight from other buildings as well. These cells could thereby transform cities into net generators of renewable energy. (Design and Image credit: Author)

4. REFLECTIONS

Weaving different future scenarios around the position of "what if", the future of solar cells questioned here was to engage not with how things are but how they "could be" and thus create a design intervention that facilitates long-term sustainability today. When dealing with the uncertain future, it makes sense to put forth speculations that may otherwise seem absurd from a 'business as usual' perspective since the proposed SCD method uses a far future scenario to construct a fragment from a world yet to be. In that respect the designed artefact allows for a form of in-ter-dimensional time travel that can probe, sense and respond to the fictional world as a normative everyday object that projects the designer's values into a context of the future; a complex unknown. The point of this speculative method is to open up space for new possibilities for such 'designerly' visions and as such does not attempt to "prove" the solutions. The possible solution suggested here, a 3D printed optical solar cell, points to an infinitely scalable, modular solar cell that can be deployed in complex and varied combinations to create resilience for renewable energy transitions.

While it is important to dispel the myth that merely shifting to renewables from fossil fuels will be enough to transition to a sustainable future, the rigorous imaginings of the future of solar cells presented here suggests that speculative narratives built around technological artefacts can create a point of departure for technologies to over-come the framing within 'business as usual'. Industrial Design praxis thus creates discursive spaces that strive to-wards, better long-term sustainable visions of the future not just by speculative "problem finding" but also by "prob-lem solving". In such an SCD process, posing the question "what if" provides for possibilities that today's research might take in creating the technological futures we want and still imagine possible alternatives to our existing solu-tions. In the absence of a perfect world with perfect solutions, this paper looks towards opening an alternative space in acting towards long term futures and sustainability decoupled from the dystopian visions of 'business as usual'.

¹⁸ "Printable Solar Cells Just Got a Little Closer: Research Removes a Key Barrier to Large-Scale Manufacture of Low-Cost, Printable Perovskite Solar Cells." n.d. ScienceDaily. Accessed January 2, 2018. <https://www.sciencedaily.com/releases/2017/02/170216142800.htm>.

¹⁹ "Proof: Graphene Can Convert Sunlight to Electricity." n.d. Scienordic.Com. Accessed March 6, 2018. <http://scienordic.com/proof-graphene-can-convert-sunlight-electricity>.

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Publication 3

Awaiting Proceedings Publication

Joseph, J. (Presented June 2021, June). ReFuturing Studio: Designing long-term sustainability for the biosphere. *ACSA Teacher's Conference*. 2021 ACSA/EAAE Teachers Conference: Curriculum for Climate Agency: Design (in)Action, New York, Oslo.

ReFuturing Studio: Designing long-term sustainability for the biosphere

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PhD Fellow (Industrial Design)

The Oslo School of Architecture and Design (AHO)

Keywords: long term sustainability, industrial design, climate change, alternative futures, design education

The trajectories of the Earth's climate and ecosystem services are unravelling, pushing the life sustaining biosphere on the path towards "biological annihilation". As the worst climate predictions come to pass, it has become urgent to introspect on the predictable consequences of our global economic system designed for extractivism. Attempting to address and understand these issues seems to create a sense of foreboding and anxiety about our climate futures. This paper will discuss this in relation to the tendencies of defuturing in design, that is, the negation and erasure of our better futures and possibilities when trying to imagine a long-term sustainable future for human and non-human others. The discussions here are based on observations and discussions with design students in a workshop called "ReFuturing Studio" which attempts to engage young designers to confront the urgency of climate breakdown and long-term sustainability beyond "business as usual" (BAU).

This paper argues for a "refuturing"— to reclaim that which is defutured and dehumanized, beyond the homogenizing and hegemonic futurism of BAU by re-imagining, rethinking and 're-humanizing' through a 'designerly knowing' of the yet unknown long-term sustainable futures. Refuturing thus critically proposes alternative perspectives, solution spaces where designers and design educators can begin to understand and reconcile design practice with climate action by "designing for the biosphere" by imagining possibilities for co-regenerative practices as a means for human well-being and ecological flourishing.

PARADIGM SHIFT: RADICAL CHANGE AND/OR RADICAL COLLAPSE?

The trajectories of the Earth's climate and ecosystem services are unravelling (Steffen et al. 2018). The life sustaining biosphere is seemingly on the path to "biological annihilation", the urgency of which cannot be understated (Ceballos, Ehrlich, and Dirzo 2017; Díaz et al. 2019). As the worst climate predictions come to pass, it is clear now more than ever, it is brought on by the predictable consequences of a global economic system designed for extractivism and affluent consumption which have also obscured the interdependence of

our socio-techno-economic and political assemblages (Tsing 2015). With the rapidly declining social, political and ecological conditions we see around us, formalized knowledge systems seem to be failing humanity (Fazey et al. 2020; Folke et al. 2021). While design today still seems to function on certain assumptions handed down by the nineteenth century reductionism (Dorst 2019), there have been consistent attempts across the design disciplines to formulate articulate responses to the climate crises beyond Business as Usual (BAU).

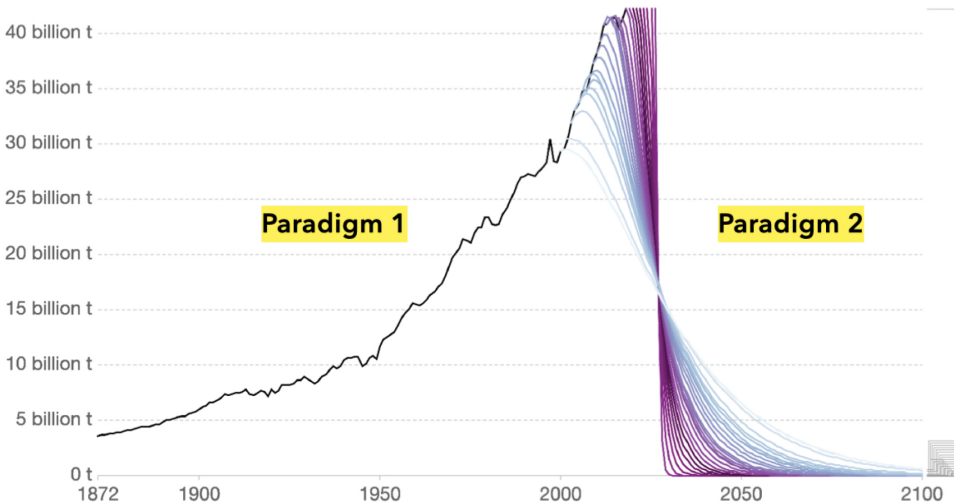
Despite the vast scholarship and knowledge being generated, it seems that a more profound understanding of climate action still evades us. Thus, as more carbon was emitted into the atmosphere *knowingly* than was ever done in ignorance (Wallace-Wells 2019), baselines for climate action were continuously being shifted (Jackson, Alexander, and Sala 2011). It would seem then that knowing alone "is not the road that leads to understanding, because the port of understanding is on another shore", requiring a different navigation (Max-Neef 2009). The research group ReFuturing Studio at AHO has been focused on attempting such a 'different navigation'. It is precisely the possibilities and challenges of this new navigation that informs our questions of designerly agency facing the climate and ecological crises to act beyond climate despair by instead trying to envision a long-term sustainable paradigm, by design.

The propositions discussed in the following sections are based on observations and reflections from a series of two-week workshops titled ReFuturing Studio with a focus on industrial design facilitated together with Prof. Håkan Edeholt (AHO), carried out in three countries of both the Global South and the Global North (China, India and Norway). This paper acknowledges that the provocations that follow have been based on reflections together with the participants and also within the research group ReFuturing Studio. Over the first week of the workshop, the students/participants were given inputs on the urgency of the climate crises and tasked to speculate on long-term sustainable future scenarios in the form of a design fiction. The second week required of them to express the "diegesis" of their fictional futures with tangible, "diegetic" artefacts (Kirby 2010; Candy 2013). To confront the challenges of the climate crises, the workshop made explicit early on the designer's task was to both discover and understand

CO₂ reductions needed to keep global temperature rise below 1.5°C

Annual emissions of carbon dioxide under various mitigation scenarios to keep global average temperature rise below 1.5°C. Scenarios are based on the CO₂ reductions necessary if mitigation had started – with global emissions peaking and quickly reducing – in the given year.

Our World
in Data



Source: Robbie Andrews (2019); based on Global Carbon Project & IPCC SR15
 Note: Carbon budgets are based on a >66% chance of staying below 1.5°C from the IPCC's SR15 Report.
 OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

Figure 1. To stay below 1.5°C requires a different imagination, a deep paradigm shift. Image credit: Our World in Data

the “logic or intelligence” of our unsustainable paradigm. To make the speculative practice more enjoyable, we began from a premise assuming that this paradigm shift towards negative carbon emissions had already occurred (figure 1). The diegetic artefacts then, were based on this shift and were to address the *essential* human needs that would be fulfilled by designers in this context, given that human society had now prefigured itself towards long-term sustainability. Given the limits of this paper, it seems more appropriate to frame these discussions to the general tendencies within our social imaginaries which may provide better insight and facilitate a more relevant reflection on the issues raised rather than the individual outcomes of the workshop.

CLIMATE DESPAIR AND TECHNOLOGICAL SALVATION

“We never realized how bad things are” is a common refrain we hear early on in these sessions as being confronted with the facts of the climate emergency easily overwhelms many of us given the profoundly wicked nature of the ecological crises. It is peculiar how designers express this sentiment within their fictional scenarios where narratives might imagine with a ‘world’ being destroyed given the issues of climate change in order to build better alternatives. Furthermore, these may even be expressed in future worlds where overpopulation, resource wars, scarcity, rogue artificial intelligence, climate

refugees, mass extinction are to be ‘solved’ through near universal technocratic solutions to preserve future progress, development and avoid climate disaster. This despite recent scholarship suggesting that a 1.5°C world with guaranteed good quality of life to every human being is achievable today without the need for relying on mythical technological fixes (Keyßer and Lenzen 2021).

Techno-optimism though, is not an anomaly in design practice, given that designers, being practitioners of the artificial, are trained to create new desires for modernity, regardless of their rational and constructivist positions (Dorst and Dijkhuis 1995; Escobar 2018). With climate breakdown, however, the failure of technological redemptions to address these issues, when other strategies would do, transforms into a deep sense of technological disappointment similar to those observed in post-apocalyptic science fiction tropes. In this context however, what these tendencies reveal is not an individual’s capacity for imagining futures, but a ‘feedback loop’ of the social imaginary which seem to have normalised certain dystopian science-fiction tropes in our popular culture. More often than not these tropes are based on projecting technological development as a supernatural agent of redemptive change. The historical legacy of technology itself is not indifferent to certain deeply religious motivations, which to this

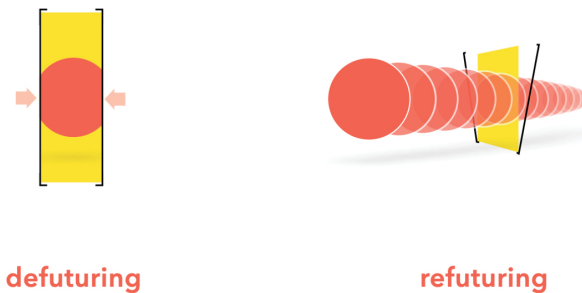


Figure 2. Differentiating the narrow frames of Defuturing and the pluriversal framing of Refuturing. Image credit. Jomy Joseph

day, seem to be reflected in pursuits of ‘technological salvation’ (Noble 1997).

Over time, it would seem that such technological salvations have been realized today into ‘bureaucratic’ technologies rather than ‘poetic’ ones (Graeber 2018). Thus promises of ‘ubiquitous computing’ (Weiser 1991) over time devolved into surveillance infrastructures, to further enable capacities for extraction, accumulation and consumption (Zuboff 2019). These tendencies may be further reflected in the discourse around “productive nature” which require a sanitized vision of the natural world, stripped of its indigenous people, displaced from their ancestral lands where technological prowess may enable further modes of consumption of resources be it for preservation or sustainable consumption (Thekaekara 2019; Patel and Moore 2017).

Curiously enough, barring a few exceptions, even in the most dystopian visions with their technological disappointments, the social and economic inequalities that exist today may remain unchanged or are exacerbated in some form or the other. It is quite well known that extreme carbon inequality today extracts a heavy cost from those at the “bottom” even as the lifestyle emissions of those at the “top” being responsible for most of the emissions (Althor, Watson, and Fuller 2016; Chancel and Piketty 2015). Even the language of overpopulation for example, has been criticized for obscuring the patriarchal and colonial relations that see women’s bodies as a means for a demographic end (Dyett and Thomas 2019). Thus, as we race to curb emissions, the logic of pursuing ‘behavioral change’ towards “sustainable consumption” seems to be directed at those least responsible, as elaborate forms of “climate apartheid” are imagined (Hickel 2016; Carrington 2019; Chancel and Piketty 2015). Moreover, such mythologizing may have also obscure the regimes of care and social reproduction which go into sustaining these systems which continue to remain fundamentally unacknowledged (Cowan 2008).

DEFUTURING: AN ALIENATING SPECTACLE

Whether it be a grand escape to Mars or total planetary control through geo-engineering projects, such futurisms seem to point to particular social imaginaries of dehumanizing, technological spectacles. It might not be accidental then that many tensions found within apocalyptic imaginaries share certain colonial frames (Nenquimo 2020; Hickel 2018). In essence, these visions speak of human species which, by either total domination of the planet or total alienation from it, would remain disconnected from its own life-giving ecosystem as it is now (Nenquimo 2020). Such futures only further narrow the opportunities available (figure 2) and lead to ever more homogenous forms of climate dystopias. These alienating spectacles of futurism (Bookchin 2019; Debord 2010), only serve to narrow the possibilities of the designerly imagination further feeding into cycles of climate anxiety and climate despair, eventually leading to the position where it might just be far easier to imagine the end of the world than to question such frames, lest they be considered impossible or naive and unrealistic.

What these tendencies effectively describe is defuturing, which “effectively exposes the negation of world futures for us, and many of our unknown non-human others” (Fry 1999). These take the present form of BAU as it exists today and make it smaller, bigger, more extreme, more digital, more biological yet ultimately projected uncritically into the future. These may be considered a peculiar manifestation of what Freire has termed “false generosity” (Freire 2014), where say a technoutopian aesthetic obscures the oppressive nature of these defutured climate imaginaries that are never fundamentally challenged, given the fact that they ultimately deprive us of alternative visions for climate action.

REFUTURING: A RENEWED IMAGINATION

Refuturing is a designerly re-imagining, rethinking and ‘re-humanizing’ of futures, breaking the narrow frames of the homogenizing, reductive and hegemonic defuturing of BAU and open up towards ‘pluriversal’ futures (figure 2). To

“refuture” what’s already been defutured, is to reclaim the dehumanized futures by regaining our humanity, what Freire has called rehumanization (Freire 2014). Arguably then, design may need to speculate on a “new logic” of long-term sustainability beyond the prevailing logic of BAU which only narrows the most imaginative speculative futures. Therefore, refuturing begins with the assertion that we perhaps need to change the present as we know it such that the future is profoundly different when we arrive in it. When designing for long-term sustainable futures that do not yet exist, implies rethinking the agency of design to move beyond the choices that lie between making or not-making, say, sustainable choices (Findeli 2001).

Refuturing can be understood in terms of a missing dimension to the dichotomies of making and not-making, as a means to “design beyond design” (Dorst 2019), that is, to imagine and make *differently*—by rethinking in action. When refuturing pursues “solution spaces” as scenarios/futures, it does so specifically to creatively imagine different paradigms (Kuhn 1970), that emerge in the tacit dimension (Polanyi 2009). It seems plausible that with the tools available to designers, the discipline might already be well equipped with the “designerly ways of knowing” (Cross 2007) these long-term sustainable paradigms that can be profoundly understood, complementing our realms of knowledge (Max-Neef 2009). The workshop, thus named ‘Refuturing Studio’, attempts to establish a deeper connection to such *designerly* ways of making and sensing divergent ‘pluriversal’ futures in the here and now, which involve a constant negotiation between the ‘rational and speculative reflection in action’.

DECOLONIZING FUTURES: CLIMATE ACTION REPARATIONS AND TECHNOLOGIES OF CARE

The pluriversality of futures is deeply rooted in decoloniality in order to imagine ‘a world where many worlds fit’ (Escobar 2018). Global climate action and climate justice are furthermore integral to deeper questions of climate reparations and decolonization, given that the legacies of colonial relations are still ongoing and are reflected in the global economic inequalities we see today (Schultz et al. 2018). While the debate on the question of decolonization is still ongoing (Schultz et al. 2018). Climate reparation calls for transformative forms of climate action that acknowledge the deep harm that certain colonial legacies have inflicted on ecological systems and to transform systems that ensure such tendencies do not repeat themselves (Táiwò and Cibralic 2020). Refuturing attempts to mediate these decolonized relations that arguably need to be considered to go beyond the metaphorical, as complementary themes and not merely buzzwords (Tuck and Yang 2012).

Refuturing is also about acknowledging the colonizing role of design futurisms and understanding the task which lies ahead of us beyond climate despair. To attempt such a task, one may first attempt to rethink the worldviews that led to our current predicament. Today, the worldview underlining

the assumptions of BAU seems to be based on the primacy of the so-called ‘laws of economics’, leading us into ecological and social collapse (Temesgen, Storsletten, and Jakobsen 2019). Understanding ecological boundaries, that is, the ‘laws of nature’ reminds us that human society is a subset of the biosphere and the economy subservient to human needs (Temesgen, Storsletten, and Jakobsen 2019). Thinking as such in terms of ecology and ecosystems warrants a reasonable approach to long-term sustainability which may be more compatible with the ecological boundaries of long-term sustainability (Klein 2014).

For example, long-term sustainability may necessitate a decoupling of civilization’s material footprint in order to stay within planetary boundaries, where degrowth might help fulfil essential human needs, while also reducing consumer desires within a fairer society. Furthermore, reduced capacities for extraction and affluent consumption might further help decolonize indigenous land, expanding indigenous forms of land management/care which offer possibilities of addressing global food security and sovereignty through agroecological means (Díaz et al. 2019). Renewing social contracts may even lead to better social outcomes even as drastically reduced work hours complement regenerating the commons, acknowledging human and non-humans that have been othered in our deliberations.

Serious deliberations of such a kind may need to acknowledge the interdependency of fulfilling essential human needs with the expansion of so called ‘wild nature’ by regenerating biosphere ecosystem services that are in a critical state today than ever before. These goals might even imply reimaged archetypes and typologies of technological artefacts that enable and sustain the material prospects towards fulfilling essential human and ecological needs by engaging both ‘rational and speculative’ frames (Joseph 2019). Such refutured technological possibilities might aid in expanding human, social and ecological possibilities more “appropriate” to the task of climate reparations and socially useful production (Cooley 1987). These would work in localized scales of socially useful production and consumption applying benign, ecologically regenerative fabrication processes within carbon negative cascades (Bates and Draper 2019).

Designing *for* the biosphere, therefore, calls for similar mutually regenerative propositions for social and ecological flourishing where we design, fabricate, care for, nurture, sustain and socially reproduce these ecologically regenerative pluriversalities. However, such seemingly rational choices for a long-term sustainable paradigm tend to be deemed irrational, or ‘politically impossible’ within BAU. On the other hand, what seems rational within an unsustainable paradigm further narrow our choices which in turn only further entrench our climate denialism and inaction as we head towards the precipice of climate tipping points (Steffen et al. 2018). Arguably then, the task of

“refuturing” is to acknowledge the complexity of the challenge, not to predict or prove the future, for that remain out of scope of design agency, but to suggest propositions for alternative possibilities that can be tangibly realized today (Joseph 2019). However, recent scholarship suggests that it might already be possible to bring about these changes easily enough today by rethinking these assumptions. That is to say, a 1.5°C world with good quality of life for both humans and non-human others is *realistically* possible (Keyßer and Lenzen 2021; Folke et al. 2021; Kuhnhehn et al. 2020).

RECLAIMING UTOPIAS TODAY

Refuturing thus, is about reclaiming utopias in the here and the now, by rehumanizing futures even as the planet becomes increasingly uninhabitable for the human species (Wallace-Wells 2019). It is about building radical hope when none may seem forthcoming, approaching more *human* futures that we can consciously consent to, keeping room for dancing, laughter, play, fun, leisure, creativity, even boredom—which seems impossible to imagine today. However, it must be noted that rehumanizing utopias is not to imply that alternative futures will be bereft of any conflict. In pluriversal spaces, many worlds may deliberate on such concerns through practises of conviviality and autonomy (Escobar 2018).

It may be urgent to do so, given that the climate and ecological breakdown is not a usual design problem that can be ‘solved’ away as such, and there may be certain cognitive limits for designers alone to addressing such wickedly complex problems (Dorst 2019). Between the systemic constraints of designerly practice and the wickedness of climate and ecological crises, to comprehend the choices at hand becomes an incredibly overwhelming task. Understandably enough, it is not long before many of us might end up questioning the design discipline itself where doing the *right* thing seems to present a professional dilemma. When internalized enough, designers may tend to see themselves as the ‘most dangerous profession in the world’ and may choose rather not to design at all or continue with BAU (Papanek 1985). Furthermore, Speculative and Critical Design (SCD) rejects commercial, consumerist solutionism in an intriguing practice with fantastical alternative futures within similar climate themes but have largely gravitated towards a “warning of things to come”, of futures few may want to inhabit (Tonkinwise 2014). In either case, one is left with few choices of action, while we remain in ‘the trouble’ and without the tools for addressing climate action, further entrench climate inaction/despair as BAU continues (Joseph 2019).

Even though refuturing offers remarkably creative possibilities for designerly agency, many possibilities lie beyond the realms of design itself, and may need disciplinary cooperation and synergies. However, it is also entirely possible that the inputs given to the students may be inadequate for such a task and this will be continually improved upon. For these reasons, this

paper takes the form that it does to rather discuss the seemingly universal yet deeply entrenched social imaginaries instead of showing successful student projects from the workshops. It might be that the climate dystopias reflected upon have been a ‘hyper-normalized’, manifestation of a zeitgeist losing its ability to imagine alternatives (Yurchak 2006). What this paper should make abundantly clear is that these defutured tendencies might not be the students’ own but perhaps a reflection of the elaborate expressions of climate denialism that have already been deeply internalized in our social imagination (Klein 2014).

Even though refuturing might create uncomfortable and unsettling encounters that challenge many of our deeply held assumptions, many of the opportunities that lie ahead may only be revealed and understood when externalizing these tacit assumptions and engaging with them by practicing reflective thinking in action. Ultimately, the goal of such frameworks is to create respectful dialogue about hopeful futures of expanded humanized possibilities that may become tangible, thinkable and doable today, opening up deeper realms of understanding towards long-term sustainable futures.

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Publication 4

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Walk the talk: Towards an ecological futures framework for our designed cultures

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Abstract | Based on the bleak trajectory of the near and far future due to climate change, this paper outlines some of the assumptions that makes relevant actions so hard to implement. We suggest a framework that enables us to radically rethink sustainability as well as both human and design agency. Based on a simple “Walk-the-Talk” model, potential actions are mapped for both (i) established and (ii) more alternative approaches. The former being the one espoused in today’s discourse, while the latter seems to get surprisingly little support. By describing three concrete product concepts we illustrate how by shifting focus to more alternative approaches, we can precisely address the challenges that more traditional approaches have obviously failed to address. In order to find relevant leverage points for both design and required systems change, the paper finally discusses why the traditional approaches still are so dominant in our quest to address climate change.

KEYWORDS | CLIMATE CHANGE, DESIGN, DEVELOPMENT, LONG-TERM SUSTAINABILITY, SYSTEMS CHANGE

1. Background

Design has for quite some time been concerned about the changes needed in how we humans design, build and organize our sociocultural and techno-economic environment. An important insight from long-term sustainable systems is that they are typically characterized by cooperation and diversity. For many centuries, however, the western cultural sphere, with its initial European epicenter, has worked in the complete opposite direction. The hallmarks of this direction have been expansion, exploitation, competition and domination. It can be argued that it is primarily facilitated and accelerated by the global implementation of an economic and industrial 'monoculture' with infinite exponential growth as its primary and essential strategy for survival, which in turn is predicated on continually plundering the life-sustaining biosphere. This monoculture is contrary to everything we know about resilient and long-term sustainable systems. In this 'race to the bottom', the natural world is swept out of the way, as a mere externality.

Modern human civilisation has now arrived at an evolutionary cliff—towards a literal "hothouse" Earth (Steffen et al., 2018), stripping the life carrying capacity of the natural world (Ceballos et al., 2017; Díaz et al., 2019). It has been argued that it is a feature of our existing economic system tied to infinite growth which has historically *cheapened* the natural world in order to dominate and exploit it (Patel & Moore, 2017). However, in order to discuss the situation and its implications we first need to get some fundamental assumptions in place.

1.1 Rethinking Sustainability and Development

Sustainability as a concept has been frequently used, and probably also misused, since at least the late eighties when UN's Commission on Environment and Development (WCED) published 'Our Common Future' (WCED, 1987). A unique insight of the report was how it understood the environmental crisis as an interlinking of seemingly disparate systemic crises that could not be addressed in isolation. In particular, it had highlighted sustainability's relation to development, as it was explicitly written in both the commission's name and in their oft-quoted definition of *sustainable development*:

"Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Generally speaking, sustainability can be described as the ability to 'exist constantly', while today it more specifically refers to the capacity for the biosphere and human civilization to coexist. One tension becomes highlighted when 'sustainability' is linked to 'development', as what is perceived as development today just as well could be unsustainable. If true, should one still try to sustain that development? It has even been argued that 'sustainable development' is an oxymoron as the development paradigm is possibly inherently unsustainable (Brown, 2015), which of course depends on what is meant by 'development'. With the hindsight of more than 30 years since the UN published their report, it is therefore

important to ask if it is development, as we know it today, or should we rather refer to a more 'terrestrial' (Latour, 2018) or 'regenerative' (Wahl, 2016) notion of the concept. Regardless, it is becoming increasingly obvious that what we today call 'development' is destroying the life sustaining biosphere, while both increasing the gulf between the few very rich and the many poor (Hickel, 2017) *and* exponentially increasing the extraction of resources and emissions (Martenson, 2011; Raworth, 2017).

The UN's attempts in the early 21st century to resolve this inherent tension between sustainability and development resulted in 15 years (2000-2015) of Millennium Development Goals (MDGs), but as an exercise, it nearly ended in complete failure (Hickel, 2018). Eventually, after some statistical maneuvers, which included moving the baseline year for measurement from 2000 to 1990, it was claimed that the goals had been more or less reached (Ibid.). Following this, 17 Sustainable Development Goals (SDGs) were announced, to be achieved within 15 years from 2016 to 2030. While it is still too early to know the exact outcomes of these goals, there seems to be consensus emerging on the *very* bleak prospects for our planetary future (Díaz et al., 2019; Wadhams, 2017). Especially as the SDGs still set the goal for economic growth (SDG 8), as a condition to solve the crises, which for many is the primary driver of the crises (Brown, 2015; García-Olivares & Solé, 2015; Hickel & Kallis, 2020). In figure 1, Rockström & Sukhdev (2016) sketch out how the SDGs link up to the 'biosphere' and 'human civilization', illustrated as 'society' and its 'economy', respectively.

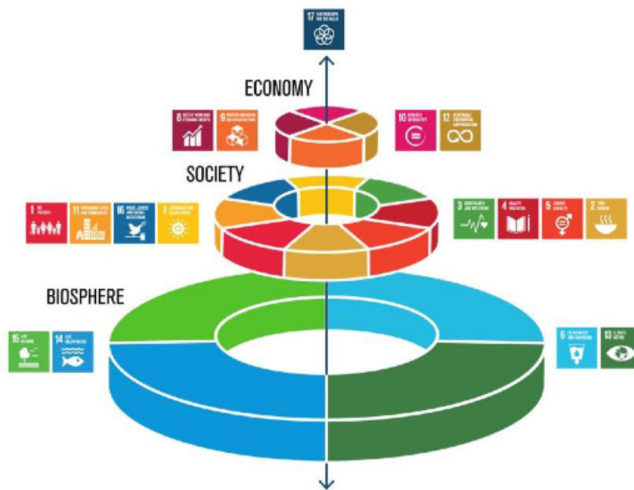


Figure 1. Rethinking and reconnecting the 17 UN SDGs with food. Credit: Stockholm Resilience Centre (Rockström & Sukhdev, 2016)

1.2 Rethinking Human Agency

The discourse surrounding both sustainability and sustainable development tends to be highly politically charged (Fry, 2011; Giddens, 2011; Latour, 2018). Much of that goes beyond the scope of this paper. However, we believe that figure 1 above at least needs to be clarified by adding the actual relation between the three levels at hand.

Below figure 2a illustrates how the entirety of our human civilization is a mere subset of the biosphere; completely dependent on and 'nested' within the Biosphere, what is typically termed as a 'nested system' (Capra & Jakobsen, 2017). This implies that the larger system of the Biosphere does not have the same kind of dependence to us humans. As long as we don't mess up the Biosphere, it's remarkably resilient. However, there is a limit to what it can take and many of these limits might already be on the brink (Steffen et al., 2018).

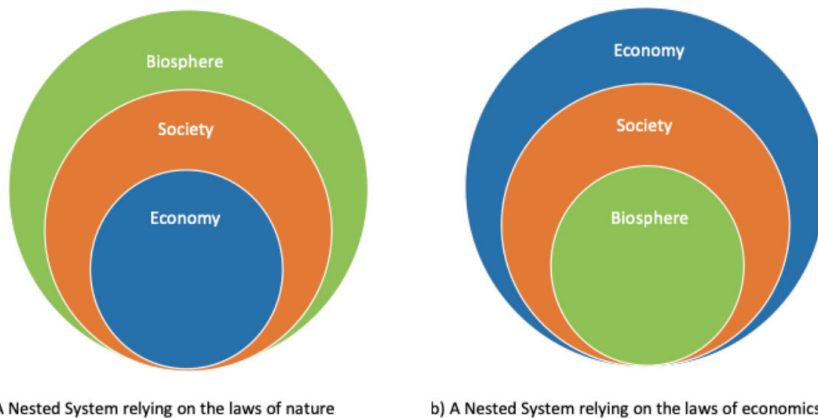


Figure 2(a,b) The nested systems model modified from Temesgen et al. (2019)

The biosphere, bound by the laws of nature, offers the bedrock from which society emerges and from within society, the economy emerges. Contrastingly, our present civilization seems to follow a completely reversed nested order as illustrated in figure 2b, implying that the 'laws of economics' set the limits to what can be done in the system. So arguably, in spite of the *talk* about what's required to restore and renew what human society has damaged, we seem to *act* as figure 2b illustrates, i.e., the complete opposite to figure 2a and by that challenging the laws of nature in favor of economically feasible solutions. Or as Naomi Klein puts it:

“What the climate needs to avoid collapse is a contraction in humanity's use of resources; what our economic model demands to avoid collapse is unfettered expansion. Only one of these sets of rules can be changed, and it's not the laws of nature.” (Klein, 2014, p. 21)

1.3 Rethinking design's agency

Design has been criticised for being a mere instrument for developing the consumerist 'wants' for sustaining economic growth, which the present system seems to depend on far more than the 'humans' that designers are told to be focusing on. Giving a "perception of designers as creative, capitalist nerds delivering sexy looking things" (Fry, 2009, p. 120).

The full enormity of the climate and ecological crises has brought us, a small international research group in design, to confront and deliberate on our role as designers as we look to change this bleak trajectory that is leading us towards the complete collapse of our life sustaining biosphere. How then do we as designers explore, develop and use our disciplinary tools and mindsets to address issues related to climate breakdown and comprehend the radical changes that are essential within nearly all levels of our society? Instead of looking from within a human centred point of view, in this paper, we will take a step out of most typical frames by asking what we, as the human species, need to do to better fit into the larger system of the biosphere that we both threaten and depend on. In this paper we'll therefore discuss what is required to '*walk the talk*' towards a more long-term sustainable trajectory.

2. The Walk the Talk Model

As discussed by Amsale Temesgen et al. (2019) it makes an immense difference whether we restrict our options and goals to be feasible within the present economical paradigm or not. In this paper we'll explore if this distinction can be generally useful in order to discuss the multitude of approaches available today, how 'densely they tend to be populated' in present day discourse and the leverage points (Meadows, 1999) to change the present system to a more 'long term' sustainable one. We'll do so by first establishing a rather simplified map illustrating the 'tension field' at play.

We call it the 'Walk the Talk Model', which first maps out different kinds of possible responses to global warming based on our actions and claims (i.e. walk and talk, respectively). In addition, it also makes a distinction between those that try to respond within the present mainstream system versus those who try to find solutions outside it. We follow it up by describing three illustrative cases relating to energy production. The model illustrated in figure 3 below shows how we do, or do not, *walk our talk in relation to climate change* (CC). Exactly how the different approaches are allocated on this, admittedly simplified map is a bit arbitrary and should only be understood as illustrations of what could be there. Illustrated by the tone of grey in the background, we argue that the lower right triangle currently dominates the present-day discourse.

The lower left quadrant is populated by those that neither walk nor talk in relation to CC. Lower right quadrant is populated by those that rather talk than walk, while the upper left is the opposite, consisting of the ones walking without talking about it; i.e. those communities

that just live and thrive in a sustainable manner. All these three quadrants relate in different ways to the approaches populating the upper right quadrant. The upper right quadrant, is also where both the tension and the contrast between the attempts to solve the crises *within vs. outside* the present system becomes most obvious.

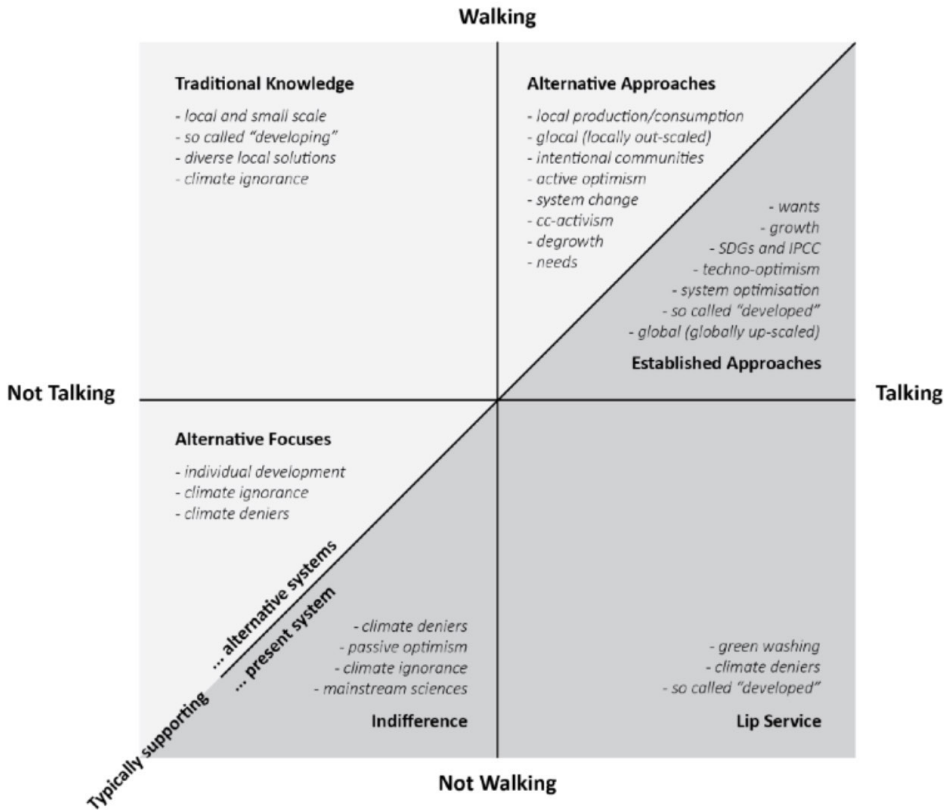


Figure 3. The walk the talk model. Credit: Authors

If one considers figure 3, an explicit tension emerges between the 'alternative systems' of the upper left quadrants and the established present system of the lower right triangle. If one assumes an '80-20' distribution, we note that while *most* of the world's population resides in the upper left triangle, they are continually impoverished yet much of the resources and energy are being consumed by those in the lower right triangle, by a privileged few. When we zoom in on the upper right quadrant of "walking-talking", this tension becomes even more apparent when talking about energy and resources allocated for climate action today. Essentially, we seem to avoid solutions that might disrupt our

present economic order, focussing much less on alternative ‘Societal Transformation Scenarios’ (STS) which might be especially relevant today for staying below 1.5°C (Kuhnenn, et.al., 2020). We will expand on this tension further, explored through three cases that highlight the kind of additional solutions we might be able to create if we could dare to *walk* outside the hegemonic box of our present, growth-dependent economic system. What might happen if for a while we freed ourselves from the economic feasibility of the short term and screen new ideas and more thoroughly explore the long-term alternative approaches above the diagonal line in figure 3?

3. Three Illustrative Cases

The three cases, in 3.1 – 3.3 illustrate the tensions in how to address the daunting challenges we face today. The narrative today tells us that renewable energy is growing much faster and even becoming cheaper than the traditional fossil fuel sources used today (Gore, 2016). However, on scrutinizing figure 4 below, at least 3 problems of that story emerge:

1. In order to make the narrative compelling, it needs to compare relative growth instead of absolute growth. The present story becomes invalid if one compares the more important absolute growth.
2. In contrast to case 3.1, the narrative completely forgets that during the last few decades we have emitted more CO₂ than the whole of humanity, had ever done before that (Wallace-Wells, 2019). Due to the Climate system’s inertia most of this CO₂ is still in the pipeline without revealing its final consequences today.
3. In contrast to case 3.2 and 3.3 the present narrative assumes that we can produce the required equipment for ‘renewable’ energy production, without using even more fossil fuels and minerals.

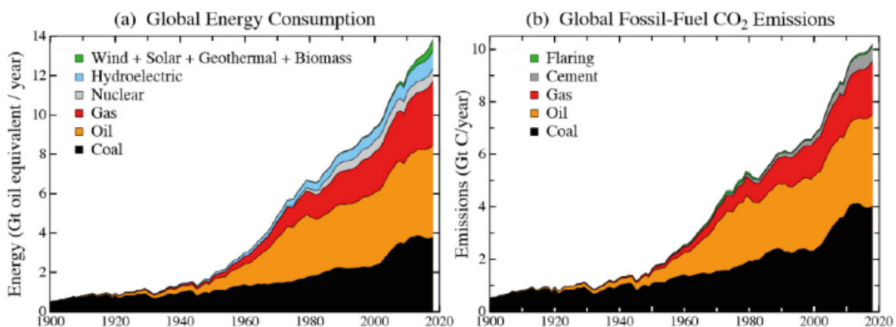


Figure 4 (a,b). Global Energy consumption and fossil fuel emissions. Credit: Hansen, (2020)

We will therefore discuss three different cases developed within design master program at AHO that can all be juxtaposed as ‘alternatives’ to the way we produce and use energy today. The design concepts themselves are all feasible in principle but haven’t been able to scale *up* on the market yet. The first case is indeed used in certain niche markets, but far from what’s required to unleash its CO₂-negative potential. The two other cases, are speculative concepts based on basic science, but as such get less attention than one would expect if one considered the urgency to *replace* and not add to the already extracted fossil minerals and fuels. The three cases are all divided in two subsections: ‘How things are’, which roughly represents the lower-right triangle of our ‘Walk-the-Talk’ model (figure 3). While the second subtitle, ‘How things could be’ goes on to illustrate possible alternatives that rather might appear in the upper-left triangle of the same model.

3.1 Reversed Carbon Emissions

How things are: from soil to atmosphere

Since the advent of industrial revolution, we have organized our societies and developed technologies, products and their production capacity around a seeming abundance of fossil fuels like oil, gas and coal. The social, technical and economic systems we live in today are typically so dependent on these resources, extracted from the deep soils of our globe, that the comparison to a severe drug addiction easily come to one’s mind (Raworth, 2017). But just as with any other drug’s immediate and addictive comforts, it also comes with severe negative, long-term consequences. One can argue that the most serious one, with numerous negative and cascading effects, is that it takes fossil carbon from the earth and in the process emits vast amounts of CO₂ that cause both global warming and acidification of the oceans.

How things could be: from atmosphere to soil

The pioneering book, *Biochar for Environmental Management*, by Lehmann & Joseph (2009) proposes reversing carbon emissions by utilizing Biochar. Since then, biochar has been discussed as a way of sequestering carbon from the atmosphere and by doing so *reversing* some of the devastating flow of carbon our society has produced (Bates, 2010). The idea is simple. Instead of burning biomass in air to ash, one burns it without oxygen into coal (as one fraction) and energy (as another). Thus, one ends up with both energy and carbon (or biochar), where the latter can be put back into the soil and make it more fertile. By this process the highly stable biochar, becomes a long-term carbon sink by circumventing biomass carbon emissions to the atmosphere. While promising, enthusiasm for biochar was initially hampered by the sobering fact that, as illustrated in figure 4, the sheer scales of carbon emissions are so immense. In fact, the accumulated carbon emissions turn out to be much more than what could be considered directly economically feasible to be useful for our soil. However, more recently Albert Bates and Kathleen Draper argue in their book *Burn-using fire to cool the earth* (2019) that this dilemma potentially can be resolved by utilizing carbon’s inherent versatility and ability to replace fossil oil, not only as a fuel, but in all kind of designed products typically needed in our everyday life. They coin the process ‘Carbon Cascading’ as it can be used in series of different applications before it eventually ends up in

the soil again. Figure 5(a,b) illustrates a very simple concept for application of biochar where an energy loop is maintained by only using the gas produced from the feedstock to cook food and letting the remaining carbon go back to the soil thus enhancing its fertility. Furthermore, with a *cascading* approach one could let the Biochar produced pass several stages of other productive uses before it eventually ends up in the soil.

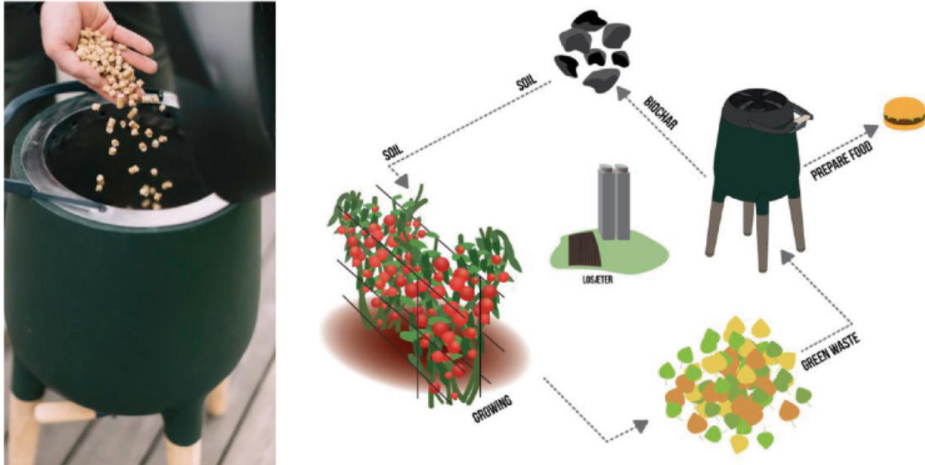


Figure 5 (a) the Emu biochar stove and (b) its systems of reversed Carbon Emissions
Credit: Benjamin Ngoma Rodahl.

3.2 Redistributed manufacturing

How things are: Centralized mass production

If biochar forms a closed loop of energy flow within a socio-technical system, then this might also drive the production model in a more generally sustainable direction. Although the centralized mass production model has become a mainstream economic development strategy and has contributed to the creation of economic wealth in many countries, this development has also brought us a series of negative effects, including the vulnerability and inflexibility of the system, resource exhaustion and environmental degradation, the barrier between consumers and producers, etc (Biggs et al., 2010; Johansson et al., 2005).

How things could be: from consumer to prosumer

Arguably, we probably need a more resilient and flexible distributed production model to drive the system from mere optimization to the kind of changes really required. This means that material extraction, manufacturing and other involved processes probably need to change too. Pure consumers could ultimately become more of “prosumers”, producing their own goods and services (Kotler, 1986). Instead of relying on infrastructure separated by thousands of kilometers, people could receive a greater proportion of both long-term sustainable products in general and even required energy from their own community or

home. The 3D-printer 'biomA' is a solution that aims to facilitate exactly that. It uses algae to 'grow' batteries (Figure 6a,b). This concept speculates about an alternative solution to lithium batteries by combining algae with chitosan biopolymer instead of the extracting minerals for batteries to accelerate the global transition to more long-term, sustainable and distributed energy production. Within such a distributed production network, all users are considered a localized open manufacturing node, or 'terminal', in a network with so called 'prosumers'. The 'prosumer' gets involved in both the production and the consumption of resources, goods, and services on which they depend. The node can therefore more efficiently reflect the scale and context of local needs, conditions and resources. In addition, the networking between multiple nodes can still enable sharing of the information, resources and knowledge required to reflect changes in the demand from individuals to communities, regions and countries. Or in other words, the main driver of the process might eventually move from the needs of our present system to more essential needs for both the user and the biosphere we depend on.



Figure 6 (a) biomA 3D prints organic batteries from algae and chitosan biopolymer. (b) Designed for local production and consumption with prosumers. Credit: Jomy Joseph

3.3 Renewed Energy production

How things are: Non-renewable, renewable energy

The share of, so called, 'renewables' in the global energy supply has never been higher (Figure 4a). However, it is being added over and above the already existing energy sources and not so much *replacing* the fossil fuels as promised but further *increasing* capacities for energy consumption. This compounds into a 'race to the bottom' where technology enables ever *newer* capacities for extraction and consumption in addition to what already exists (York, 2017). Despite offering some growth in the short run, it is estimated that these 'renewables' are on course to deplete global reserves of crucial resources such as copper, lithium and other rare-earth minerals given the inherently unsustainable rates of consumption today (García-Olivares & Solé, 2015). It seems that we are caught within a "double bind" where trying to reduce emissions through the present economic system could

end up creating even more emissions if we don't drastically reduce and rethink "civilizational wealth" (Garrett, 2012) as well as "green growth" (Hickel & Kallis, 2020).

How things could be: long-term renewable energy

Given what we know, distributed and scaled *out* nodes of global renewable energy infrastructure might need to be *decoupled* from existing "extractivism" and sourced, manufactured and powered renewably. Speculative Solar, in figure 7, is an alternative, 3D printed optical solar cell that harvests solar energy using optical structures coated with graphene solar inks from sequestered atmospheric carbon. The 3D printed optical structures coated with graphene propose to capture a larger spectrum of visible and infrared solar energy, vastly increasing energy efficiency and effectiveness within the same footprint. In combination with reduced energy consumption, these cells could potentially transform cities to become net generators of energy instead of net consumers, all within the existing frames of today's infrastructure. Designed for modularity and complexity, these solar cells are predicated on adapting to localised production and consumption for community needs rather than market needs, i.e., for scaling *out* rather than scaling up. If one were to carry forward the principles of distributed manufacturing, replacing fossil energy and combine with graphene made from sequestered sources, it might be possible to build a 'virtuous cascade' of renewable energy replacing and regenerating itself through other, locally produced, renewable production systems.



Figure 7 (a) 3D Printed Optical Solar Cell Concept. (b) Cells mounted on vertical structures and facades of buildings to capture reflections and scattered sunlight. Credit: Jomy Joseph

4. Discussion

In this paper we have tried to question some contemporary discourses, which typically seem to be 'marinated' with assumptions that are often taken for granted regarding sustainability and how to best combat climate change. Comparing some established and alternative approaches reveals to us that even the best of the more established sustainability interventions only does *less* damage yet receive *most* of the world's resources and

investment, but on the whole, leaves the damaging engine of infinite growth unchallenged. On the other hand, the kind of alternative solutions we briefly illustrate in our three product cases (3.1 – 3.3) could as a contrast, not only potentially *replace* existing technology, but even reverse some of the damage already taking place. However, these mostly remain relegated to the margins today, revealing the tensions as described in figure 2(a,b) and figure 3.

The upward trends of global energy consumption and CO₂ emissions (Figure 4) make it fairly evident that in the foreseeable future, it will not be possible to replace *all* fossil-based energy we use today with *truly* renewable alternatives. However, we are still asking ourselves why isn't more being done to start the seemingly most logical development trajectory to address this dilemma; i.e. (i) to develop solutions that facilitate a way of living that require radically *less* energy and (ii) to make sure that the energy sources really are long-term renewable. One quite obvious answer is that these alternative product approaches do not make 'economic sense' when the focus is on economic hegemony where cheap fossil fuels are preferred over renewables, scaling *up* over scaling *out*, centralised production and consumption over localised prosumers. One might also contemplate if there is an even more powerful, albeit also more hidden, reason behind this. Might it just be that the alternatives we sketched, being inherently small scale and local, also are too disruptive for a system that is built on gigantic, globally up-scaled solutions? Is it that these alternative approaches, in essence call for a fundamental rethink that challenge the established approaches of the 'laws of economics' (Figure 2b), where the biosphere is *not* a mere 'resource' waiting to be exploited for economic growth?

In this paper we have tried to illustrate how design's agency could be expanded to explore alternative climate solutions at the local level, in ways that could potentially help build resilience and be better suited to addressing the environmental and social crises due to climate change without resorting to the same historical vicious cycles of domination and exploitation of the natural world.

However, underpinned by our own frustration, we have also tried to understand why this is not an easy route to take. Even though many realize that human society might be at stake, we don't seem to address this serious challenge in the required way. One may ask why we don't do what is obviously needed to be done to rein in the worst possible outcomes of a system we still seem to support. Where are these leverage points of change in this system that we as designers might be best suited to address and, to get the required impact, how do we best mediate the work we do? However, in those efforts we probably also need to pay attention to Fredric Jameson's famous words:

"Someone once said that it is easier to imagine the end of the world than to imagine the end of capitalism."

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Abstract: After working several years with industrial design as a tool for the kind of radical systemic change, climate change arguably requires; it now seems timely to discuss the systemic obstacles that seems to make such a shift so hard to implement. Much at odds with current discourse, the article defends current design disciplinary skills by focusing on the tension between what designers tend to do for sustaining the present system vs. what designers could do to support transition to a radically different system and why the latter is so hard to achieve but still so urgently required. With the overarching question – "what can design(ers) do?" – the article establishes design disciplines as a distinct entity apart from design. Subsequently it gives an overview of how different disciplines have emerged as 'answers' to how societies, have developed and finally suggests a model for how to address climate change through disciplinary cooperation.

Keywords: Refuturing, Climate Change, Industrial Design, Development

1. Introduction

This article can be seen as a critique of the current critique of design disciplines. Mainly we disagree with the premise that argues for design to "un-design itself" (Fry & Nocek 2021). Instead, we would like to bring an alternative proposition that supports climate action by *reclaiming* design for what it could be. Without pre-empting the text below we would like to compare the critique with those who rather blame the cow for climate change than the industrialized food system that 'produce' the same cow. To continue the analogy, we will also argue that the same 'cow' brought from the meat factory to a suitable grassland, will heal the topsoil and build a fertile micro-biological system that captures more fossil CO₂ equivalents than the 'cow' naturally emits on its own. But first, a more general section introducing current ecological challenges (1.1), current critique of the design disciplines (1.2) and finally 'systemic' theories addressing disciplinary organisation and knowledge production (1.3). Following the introduction, section two paints a new picture of design that subsequently, in the final section, is used to discuss industrial design's most appropriate roles to effectively address current



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systemic challenges, *within* interdisciplinary frameworks. Finally, we argue, that what we here try to make so apparent for design, is a very general characteristic for nearly all disciplines.

1.1 Current Systemic Challenges

"Despite three decades of political efforts and scientifically informed warnings of the likely catastrophic effects of climate change, CO2 emissions have continued to rise globally and are 60% higher today than they were in 1990" (Stoddard et al., 2021).

From a Climate Change perspective, there are two crucial issues underpinning the challenges we currently face; (i) the urgency to act immediately and (ii) the magnitude of the problem. The urgency can as in Figure 1, be illustrated by calculating the required reduction of the net CO2 we need to achieve for remaining under 1.5°C and how close we are to fly past the many opportunities to achieve it. This despite recent studies claiming that it might still be possible to make these shifts if we only dare to question the systemic rules, which simultaneously also makes it seemingly impossible (Unmüßig and Schneider 2018).

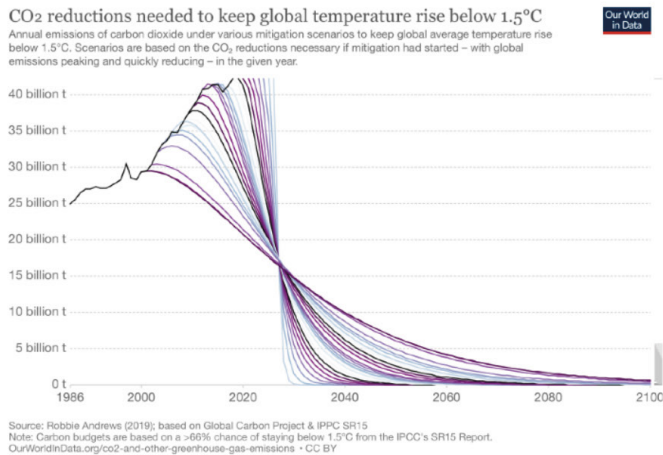


Figure 1. Required reduction of net CO2 to remain under 1.5°C in temperature rise (Andrews, 2019).

The graph (figure 1) clarifies how much easier it had been if we had started 20 years ago and how much more drastically, we today need to reduce to reach this year's COP26 goal to keep temperature increase under 1.5°C. That means that we now urgently need to decide if we prefer a controlled 'soft landing' or a socio-ecological crash that's beyond our control, and then swiftly act accordingly.

To add an understanding of the second issue, the *magnitude*, we can use two sobering graphs published by one of the most famous climate scientists, James Hansen (2020). In Figure 2a he first demonstrates how much energy our current system demands, how much of that is supplied by fossil-fuels (black, orange and red fields) and how little renewable sources like, wind, solar geothermal and biomass in comparison currently contribute (the thin green field on the top). In figure 2b, the magnitude of the challenge is further underpinned by how it e.g., reveals that "since the first IPCC report was published in 1990, more anthropogenic carbon dioxide has been released into the

atmosphere than previously throughout all of human history." (Stoddard et.al., 2021). This has been done in full *knowledge* of the problem, i.e., more than we have ever done without that *knowledge* (Wallace-Wells, 2019 p. 4).

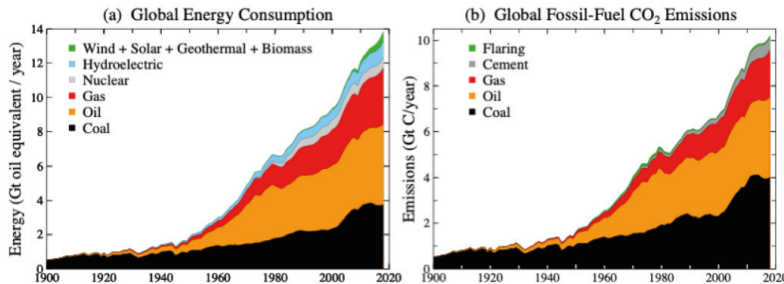


Figure 2. Global energy consumption (a) compared to fossil CO₂ emissions (b). With permission from the author (Hansen, 2020).

However, just as important for this article is how figures 1 and 2 together suggest that we after a required transition, whether as a 'designed' soft-landing or a crash forced upon us, might be dealing with a completely different world that will be so different from the current that Kuhn's early (1962) understanding of a scientific paradigm-shift might in comparison appear quite incremental.

It has for a long time been an overwhelming scientific consensus that humanity today are the ones causing our climate system to change (Cook et.al. 2016). Unfortunately, if not halted, it will jeopardize both humans' and most other species' ability to inhabit the globe (Wallace-Wells, 2019). During the summer 2021, we again experienced unprecedented climate disasters ranging from flooding to wildfires. The latter triggered by heat-waves so severe that the accuracy of the models used by climate scientists were questioned. This time, not from the climate deniers' lobby, but from climate scientists themselves (Mann, 2021). According to the climate scientist Michael Mann the kind of temperatures experienced around Seattle, were so improbable that one must suspect that climate models currently in use might be too *conservative*. That undetected synergy effects and reinforcing feedback loops seems to make these changes occur much faster than the climate models currently predict (ibid). So why are these, arguably urgently required actions, so hard to implement? Or in other words, why are we, as stated in the recent *Annual Review of Environment and Resources*, so tolerant to harms our (in)actions cause others:

"Continued societal tolerance for the unequal harms of the fossil fuel economy has also facilitated domestic inaction on climate change. To date these harms have been borne disproportionately by low-income people, people of colour, and indigenous people while those who are wealthy, typically white, and more closely connected to government and corporate power have been able to avoid costs, while appropriating benefits" (Stoddard et.al., 2021).

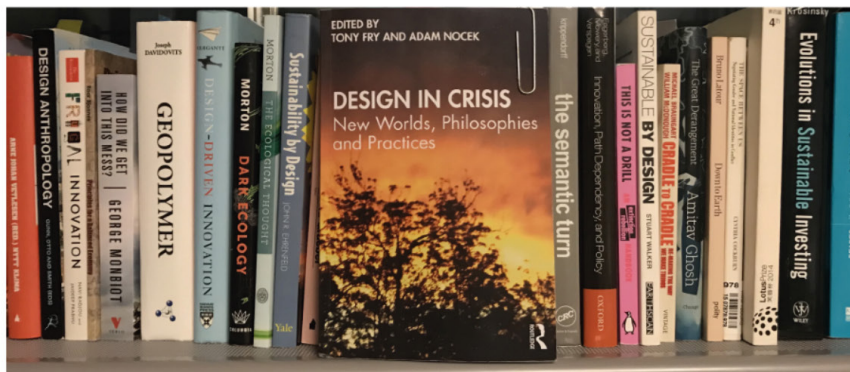
As a stark contrast, we can compare with current COVID responses. Why do most people, companies and governments so promptly adhere to drastic measures when it comes to a pandemic like COVID-19, but nearly not at all to the arguably *much* more dangerous climate change, we have since long known about, followed, and predicted? This is not to set up one disaster against the other, but why

such a difference in response? What follows is an attempt to give a framework for exploring how urgent and existential issues discussed above can be addressed by existing design disciplines.

1.2 Critique of Design and its disciplines.

"What is the 'maximum' limit of the term 'intellectual'? Can one find a unitary criterion to characterise equally all the diverse and disparate activities of intellectuals and to distinguish these at the same time and in an essential way from the activities of other social groupings? The most widespread error of method seems to me that of having looked for this criterion of distinction in the intrinsic nature of intellectual activities, rather than in the ensemble of the system of relations in which these activities (and therefore the groups who personify them) have their place within the general complex of social relations" (Gramsci, 1997 p. 8)¹.

On a typical shelf of design literature, one can often see books that critique design and its disciplines. The recent anthology *Design in Crisis: new worlds, philosophies and practices*, is one such publication, edited by two design philosophers Tony Fry and Adam Nocek (2021). The first sentence in the anthology claims that it "is an essential contribution to the transdisciplinary field of critical design studies". This claim is finally framed in the book's concluding part III; portrayed in its title as where they say "*Farewell to the discipline*" (p. 159).



For the purpose of this article, we'll only very briefly use how the anthology '*Design in Crisis*' is framed in its editorial texts, and that as a mere example on a trend of, more or less constructive, critiques of design in general and, arguably, industrial design in particular. This trend started at least half a century ago with the '*Anti-design*' movement (Midal, 2019, p. 220) and Victor Papanek's influential book '*Design for the Real World*' (1971), later followed by a number of attempts to shed light on or critique the design disciplines; frequently promoting expanded scopes, 'undisciplinarity', blurred borders, different kind of hybrids or completely going beyond design as we know it (Papanek 1988, Norman 2010, Fry 2017, Rodgers and Bremner 2017, Dorst 2019).

Our response to much of this 'critique' comes from a disciplinary position firmly placed in Industrial Design, i.e., arguably one of the most prototypical design disciplines we have and seemingly one of

¹ A book with selected texts from Gramsci's seminal 'prison notebooks', written while imprisoned by Mussolini, 1929 -1937.

the disciplines, according to Fry and Nocek, we should now say farewell to. For the record, but outside the scope of this particular article, we agree in much of Papanek's critique of the discipline's *output* and what's said in the anthology '*Design in Crisis*' about the designed *context* we currently live in. In our work, we certainly acknowledge and try to address how the current system, historically has been tweaked – or even 'designed' – to build the unfair world we inhabit. Something that been eloquently described elsewhere by scholars, or what we also can coin the lion's historians², like e.g., Jason Hickel (2018) and, more recently, David Graeber and David Wengrow (2021).

What we don't agree with, is how some of these views seem to obstruct an adequate thinking of design and its disciplines, rather than support with constructive critique. To illustrate the case, we'll focus on one typical, but significant, way that 'obstructs our thinking'.

The anthology *Design in Crisis* is introduced by claiming something quite obvious, i.e., that "the human is a designing being (a prefiguring and planning being) whose designs design the humans in turn" (p. 2). A bit further on, the argument continues: "If life itself is under siege ..., then it is largely due to the political ontology that design has brought into being. This is a crisis *by design*." (p. 4, italics in original). Even this could, albeit barely, pass as just another way to say that the ecological crisis we currently face is caused by humans. However, the inherent problem in this kind of rhetorical framing is how it tends to lead thoughts and conclusions astray. This can be illustrated by how climate sciences might be certain that the hockey-stick like graph of emission in figure 2b is caused by humanity, but it doesn't follow from that it's caused *by the design disciplines*. Especially if one understands that things done "by design" are not necessarily, or even typically, done by the design discipline itself but by humanity at large or rather a small subset of humanity, distinct from the discipline.³

From our standpoint it appears like many design scholars today tend to be quite normative in a top-down manner and seemingly give relatively little attention to the purposive aspects required by the current urgency. We would therefore instead like to argue, that today it is increasingly important for us designers *to use our disciplinary skills* to co-produce new knowledge in a bottom-up, relevant and situated manner by pragmatically focussing on *current realities* and the *purpose* of whatever we try to achieve. Seemingly at odds with the kind of design discourses e.g., Fry and Nocek nurture, we argue that 'disciplinary designers' only can *suggest* 'designs' to society at large.

What's arguably at stake by scapegoating design *disciplines* is that other more elusive systemic '*designs*' can pass 'under the radar' without being questioned. One obvious candidate would be a global economic arrangement that – by 'design' – requires infinite growth. A system that may rather use the World Bank and IMF frameworks as 'designers' to achieve certain goals (Hickel, 2018). As we hope is by now evident; we urgently need a more *appropriate* base of knowledge to work from than one that merely iterates an old tradition of a category mistake that resembles the "widespread error" Gramsci (1997 p. 8) highlighted nearly a century ago regarding intellectuals – or to paraphrase how Gramsci continues:

² Referring to a Pan-African proverb; "*Until lions have their own historians, tales of the hunt shall always glorify the hunter*".

³ Consequently also 'humanity' needs to be questioned as it hides that the crisis are caused by a small subset of humanity and that a small subset of that small subset has become extensively rich by the current system's design (Oxfam, 2018).

"[H]omo faber cannot be separated from homo sapiens ... All men are [designers], one could therefore say: but not all men have in society the function of [designers] ... Thus, because it happens that everyone some times fries a couple of eggs or sew up a tear in a jacket, we do not necessarily say that everyone is a cook or a tailor" (ibid, p. 9).

1.3 Knowledge production in its system

Where is the life we have lost in living?
Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?
(T.S. Eliot, 1934)

When Manfred Max-Neef in the article *Foundations of transdisciplinarity* (2005, p. 14), rhetorically ask himself to briefly define our times, he echoes T. S. Eliot above by answering that "we have reached a point in our evolution as human beings, in which *we know very much, but understand very little*" (italics in original). This in spite of that both inter- and transdisciplinary approaches have been proposed for decades as a remedy to increase our understanding and link our knowledge production to perceived social challenges that need to be addressed (Jantsch 1972, 1980b, Gibbons 1994, Max-Neef 2005, Bhaskar et.al 2010, Cole 2019). Why does it seem that these approaches for increased understanding are so hard to implement, while disciplinary silos with compartmentalized knowledge still seem to currently flourish in our society? For our discussion, in this section we will describe our understanding of these elusive systems of knowledge production.

A discipline typically denotes a group of professionals⁴ that have certain *knowledges* and are *disciplined* to do certain tasks, within certain domains, using certain skills, tools and methods. Figure 3 below illustrates how Max-Neef (2005) uses a similar way to describe different modes of *discipline cooperation* as Erich Jantsch did already in the early seventies (Jantsch, 1972).

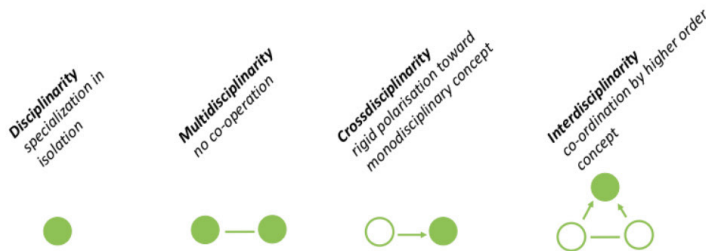


Figure 3. Illustrating Jantsch's (1972 p. 222) system of increased complexity and Max-Neef's (2005, p. 7) clarification of the continuum of concepts (Illustration by authors)

Arguably, the continuum of concepts towards more complex forms are not value-neutral, as with increased complexity a more open, bottom-up and self-organised process follows that's much harder to control. It's therefore unsurprising that big projects and companies often organize its work in a

⁴ 'Professional' is here rather alluding to common language's understanding of a recognized occupation, than the more academic understanding of a profession as a special kind of occupation that, as e.g., a medical doctor, requires a licence to perform. For further scrutiny see e.g., Edeholt and Ek (2008).

structure resembling multi-disciplinarity, where the different disciplines have no or very little *cooperation* and instead are *coordinated* and controlled at 'higher' professional-managerial levels. Yet one may also see small innovative groups that prefer being organised in a manner that rather resembles inter-disciplinarity, arguing that it makes them more appropriate to develop creative and radically new ideas. It might therefore appear that the task is to merely up-scale the system most fitting for developing creative ideas to a size and scope that can have an impact on the global challenges we now face and briefly describe earlier in section 1.1. This *might resemble* a path towards 'transdisciplinarity' with a self-organized universe as its ultimate role-model (Jantsch, 1980a). However, for Jantsch this was only a vision to strive for, nothing that even was achievable within a small subset of 'everything', like the scientific system. In the article *Interdisciplinarity; dreams and reality* (1980b), Jantsch writes:

"Transdisciplinarity is the recognition of the interconnectedness of all aspects of reality ... [It] may be viewed as the ultimate result of interdisciplinarity penetrating the entire system of science. It is an ideal that will always be beyond the complete reach of science, but which may guide in important ways the direction of its evolution." (p. 305)

Max-Neef seconds Jantsch when he as seen in Table 1, describes four levels that constitutes the vision of a transdisciplinary approach (Max-Neef, 2005 p.9).

Table 1. The four levels of transdisciplinarity as suggested by Max-Neef (modified by authors by adding the disciplinary act of 'designing' to the purposive or pragmatic level).

Levels of reality	Examples of disciplinary domains
The Value Level	Values, Ethics and Philosophy
The Normative Level	Planning, Design, Politics and Law
The Purposive or Pragmatic Level	Architecture, [Designing], Engineering, Agriculture, Industry, Commerce, etc.
The Empirical Level	Mathematics, Physics, Chemistry, Geology, Ecology, Sociology, etc.

To draw on T. S. Eliot's famous words that introduced this section, the two 'lower' layers can be characterized by *information* gathering and *knowledge* production that underpins and gives suggestions to the two levels above them. Those being the two 'upper' levels that ideally should be characterized by *wisdom* and by that give a holistic system which is able to navigate humanity, at large, to *live* in the best possible way on a finite planet. Even though each discipline's centre of gravity might be positioned at different levels, one can argue that the visionary – but unachievable – goal should be that all four levels are balanced on a systemic level. We also argue that the design disciplines should be at the purposive- or pragmatic level together with architects and engineers, and from that position connect to other levels and disciplines. While we at the same time would keep the more general notion of design at the normative level together with planning, politics and law.

However, one also needs to realize the potential instability of such an abstract map. What difference will it make if e.g., the *normative* level navigates according to *values* tweaked to a general

individualistic understanding that's completely at odds with the complex history of collective human possibilities that have been explored recently (Graeber and Wengrow, 2021)? What if the same *normative* level is fed with *information* and *knowledge* that's produced by goals measured in individuals' economic gains rather than how much they care for humanity and non-humanity at large? Is that to be done 'by design'? If so, is it to be 'designed' by the design disciplines?

2. Design in its system

"When we only name the problem, when we state complaint without a constructive focus or resolution, we take hope away. In this way critique can become merely an expression of profound cynicism, which then works to sustain dominator culture." (hooks, 2003, p. xiv).

To draw on bell hooks' words, we believe that we need to paint a different picture of design's disciplines than the one caused critique in section 1.2. It starts with; (i) what kind of systemic needs were they an answer to when they came into being and (ii) what kind of role do they 'play' in today's fundamentally unsustainable system? By using figure 1 in 1.1 as a backdrop, one can as in figure 4 below map some few of all the current design domains on a common time-axis to illustrate how fossil CO2 has already changed the world.

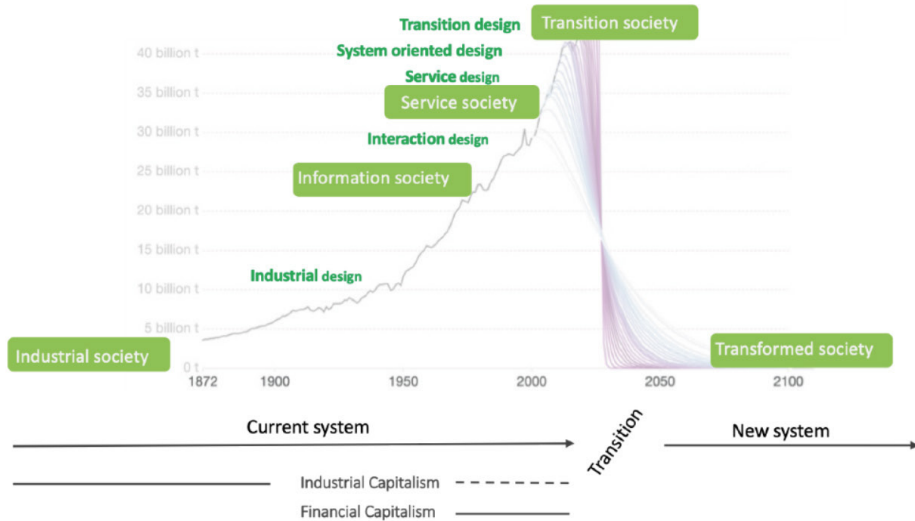


Figure 4. Map of design disciplines' and domains' genesis on a socio-economic and environmental time-axis that, historically, also correlate with economic growth (by authors).

Figure 4 acknowledges the last few decades' shift in gravity of the main driver of our current neoliberal epoch, that among other things has been characterized by a move away from tangible physical products towards more tacit and elusive assets, often described as the transformation from

industrial- to financial capitalism.⁵ With an admittedly very wide and slightly biased brush, we can below briefly describe Figure 4's domains' genesis and their development in(to) our days:

Industrial Design, emerged during the peak of the industrial society, surfing on the post-war enthusiasm and a seemingly infinitely growing demand for new products. However, in the later part of the last century, established markets seemed to become saturated and the system changed its strategy towards the creations of 'emerging markets', intensified its globalisation and invented new financial instruments. The discipline industrial design was suddenly faced with a change from a traditional market of demands and needs to a saturated affluent market, that hence moved the 'systemic focus' from satisfying needs to creating new wants (Foster 2010).

Interaction Design, emerged as a response to needs in the information age (Castells 1996-98, Webster 1995) and how complicated technologies could be designed to become more 'user-friendly' and by that also enable new markets. An often forgotten but very significant 'new market' was all global financial institutions like banks and stock markets that now suddenly could move assets across the globe in an unprecedented speed, paving the road for what we here acknowledge as 'financial capitalism'. By that illuminating the perhaps most impactful hallmark of information technologies, its ability to increase speed and productivity in general.

Service Design, arguably emerged as a response to the Service Society's wish to "create growth with services" (Sawhney et.al. 2004), by e.g., the commodification of the private sphere (Boltanski and Chiapello 2020). But it was also a response to new demands within a society that had grown out of a new global order that had separated consumption in affluent economies and manufacturing of physical products for that consumption in more low-income societies like e.g., China (Foster, 2010). To mitigate the loss of work in traditional industries, a new labour- and an additional elite -market of services was suddenly established, or 'designed', in the so called 'advanced economies'.

Systems Oriented Design, being a useful praxis (Sevaldson 2018), that arguably have emerged as an answer to a new unprecedented global complexity that needed new tools to understand, navigate and control (The Economist 2009).

Transition Design, being a new area of design practice (Irwin 2015), that we argue that all design disciplines need to engage in and try to apply on the society at large.

Building upon our earlier discussions in Table 1, we suggest that design(s) may *play out* at the normative level but as disciplinary domains they rather *act* at the more purposive- or pragmatic level, which till now have largely tended to explore solutions for the system as it exists. As illustrated in table 2 below, the characteristics of the domains above can therefore be made even more concise:

⁵ See e.g., Jameson (1997) and Foster (2010).

Table 2 An overview of some design 'domains' and their current systemic roles (by authors).

Design 'Domains'	Genesis	Systemic role today
Industrial Design	During industrial society and industrial capitalism	Supply new physical products to system
Interaction Design	During information society and early financial capitalism	Increase efficiency and speed of system
Service Design	During service society and financial capitalism	Aid consumption and commodification
Systems Oriented Design	During complexity boom in financial capitalism	Handle current system's inherent complexity
Transition Design	Before transition and during financial capitalism	Explore transition paths from system

3. Changing the conversation: design beyond its crisis

"Thus, the [current economic] system is better seen as a kind of virus and its development is something like an epidemic (better still, a rash of epidemics, an epidemic of epidemics) ... But epidemics also play themselves out, like a fire for want of oxygen; and they also leap to new and more propitious settings, in which the preconditions are favorable to renewed development". (Jameson, 1997, p. 249)

The introduction of this article compared the global response between the challenges of addressing the ecological crises and the Covid19 pandemic. Many virologists claim that rapidly mutating viruses like Covid are typically caused by our extractive system, agriculture monocultures and reduced natural habitat for animals (e.g., Waitzkin, 2021), and with that narrowing the gap between our analogies and reality. The obvious question these medical analogues raise is if we should focus on treating downstream symptoms or if we rather should address upstream root causes found in our current global system? Unfortunately, just as in medicine, the former seems to be more profitable and *efficient* when things suddenly escalate, while the latter tend to be more *effective*, eventually making the former more or less obsolete. However, arguably the diagnosis right now tells us that the 'patient' has such a bad prognosis that the surgeons, regardless of their political leaning⁶, need to remove certain parts of the socio-economic system and at the same time change its diet and metabolism drastically. Or in other words, neither figurative nor literal fire-fighting will now suffice. We therefore argue that all disciplines, *whether in design or not*, in general need to rethink '*how*' they contribute to '*what*'. Design disciplines can in that sense be a clarifying example of a general phenomenon in their development, as illustrated in figure 4 above, even their titles follow the type of society they emerged in. This might be more hidden for other disciplines, even though many arguably rather serve the current system than the humans they often claim to serve; and might even go all the way to what David Graeber calls "Bullshit jobs" (2019). More specifically, we argue that design disciplines need to urgently get to terms with at least two questions:

⁶ Compare with how Bruno Latour in his "*Down to Earth: politics in the new climatic regime*" (2018), calls for a joint effort across established political borders, what we maybe could call 'inter-political' actions?

1. Is the goal to sustain our current system or is it to facilitate a transition to a new? If the latter, what's design discipline's contribution to the transition and the world after that?
2. Do we see 'design' as *'the* solution' or is it rather an actor in a systemic 'ecology of disciplines'? If the latter, what is the designer's role, what does it 'bring to that table' and at which table would it be most appropriate to sit?

The two, admittedly initially rhetorical, questions bring issues to the front that we, working from the "firm position" of industrial design, are struggling with. In our attempts to answer the latter part of the questions, the most palpable challenge we experience is how to have substantial impact when designing for a new system within an economically exceptionally powerful system that frantically strives for its own survival. How that's best addressed is a very open question, where we still are in the explorative phase, only partly comforted by the late system thinker Russell Ackoff's famous insight that it's "better to do the right thing wrong than the wrong thing right" (2001).

Our current work at the ReFuturing Studio in Oslo is recently described in earlier publications (Edeholt et.al. 2021, Joseph 2021), and has since long been underpinned by previous versions of the understanding put forward in this article. However very briefly, it can be characterized by being system critical by developing products that potentially can become system disruptive by how its scenarios give hopes that – with these products – we could rebuild alternative systems that could be long term sustainable, fairer, feasible and desirable. In other words, to borrow John Woods words, they aim to be; "Micro-Utopias: making the unthinkable possible" (2007). Neither from a system, future or narrative perspective is our approach unique. Recently e.g., Fritjof Capra and Hazel Henderson (2020), have used a future scenario that, from 2050, looks back on how the present Pandemic both can be understood and successfully addressed. The game designer Adrian Hon (2020) has, on the other hand, used 100 imagined future objects from 2082, to tell the stories he thinks need to be told today about and for humanity. However, in our work we try to utilize our disciplinary skills in Industrial Design to *suggest* how appropriate technologies could be used to design new kind of products. Products that facilitate societies that typically are based on local production and consumption. Where 'Quality of Life' can be given primacy over a current 'Standard of Living' based on force-fed consumption. In this work we try to understand our own discipline as an important but still just one of many essential roles, within a much broader 'ecology of disciplines'.

The second question adds to the first by fronting how this "ecology of disciplines" could cooperate in the most effective manner, to address together the challenges we face today. As discussed in section 1.3, interdisciplinarity is built upon a long tradition of effective knowledge production, that arguably is deeply at odds with rejecting disciplinary skills and promoting 'blurred borders' or 'hybridity'. This as; *interdisciplinarity isn't a new kind of 'discipline', but different disciplines working together in a certain way*. In other words, as in nature, it nurtures a diversity of interacting complementary skills rather than 'melting pots' that arguably merely creates 'alloyed monocultures'. A simple framework of such an interdisciplinary system is illustrated in figure 5 below where it's mapped on the, in future studies, well-known taxonomy of knowns and unknowns. As illustrated by section 1.1, there are certain things we should anticipate regardless what we find out to do. Our climate systems are already charged with changes so drastic that what we only can hope for is our ability to get our act together, mitigate the consequences and be prepared to handle a world fundamentally different from what we experience today. In order to do that in an informed manner we argue that we need

to produce *appropriate* knowledge and explore the 'holy grail' of the unknown unknowns of our futures.

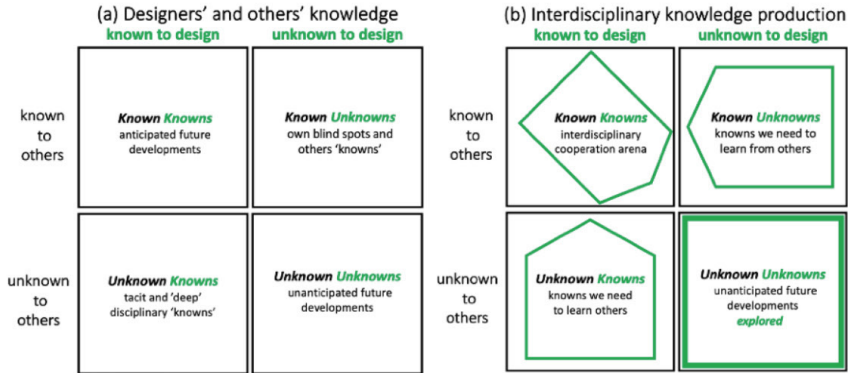


Figure 5. Proposed framework by the authors to (a) analyse design's (and others) knowledge and (b) their interdisciplinary knowledge production. Figure is inspired by the 'Johari window', being developed by Luft and Ingham (1955)

This framework is also general in the sense that one can replace "design" with many other disciplines, whether that's climate science, engineering, history or, for that matter, philosophy. However, for a relevant interdisciplinary knowledge production to take place each partaker needs to enter the 'interdisciplinary meeting arena' with a will to share with others what others *really* need to know about one's specialty and at the same time be open to learn from others. By definition no one knows the unknown unknowns. But what the design disciplines can bring to the table, are methods to explore the unknown based on the most relevant knowns made available on the 'interdisciplinary arena'. What these kinds of knowns 'are', differ from discipline to discipline, so it would benefit the process if all disciplines were explicit about what they could uniquely contribute with to facilitate a transition and what their role could be after that.

To illustrate this point further, we as industrial designers, suggest that we now focus on designing scenarios 'populated' with products that create hope for a transition that is both possible and desirable, and with that also prepare us for a "Future Systemic Role" as designers of new kinds of physical products fulfilling *essential* human *and* non-human needs (Joseph, 2131). However, we believe that this only will be effective if we all understand it as a 'system in crisis' rather than a 'design in crisis'. So, ultimately this is to reach out to other disciplines to join us in our quest to focus on what today seems most important. To *together* reimagine a rehumanized future system that's worth striving for – we call it ReFuturing.

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Designed Artifacts

Designed Artifacts: Presented at the ReFuturing Exhibition and Seminar Series, November, 2021.

For 360 degree documentation of the artifacts presented at the ReFuturing Studies exhibition click on the link below:

<https://youtu.be/gADXCyiTwTE>



Jomy Joseph

REFUTURING STUDIES

Rehumanizing Futures through/by Design

With the onset of climate and ecological breakdown, organized human life faces a precarious present and an even bleaker future. The sixth IPCC report (2021-2022) states that the window for drastic climate action is closing fast. At the same time, the atmosphere of climate disinformation, denialism, and delay has calcified the collective social imagination, unable to see desirable futures beyond Business as Usual. For this thesis in Industrial Design, the question is relatively simple—can Industrial Design imagine radically hopeful climate-resilient futures? This Research through/by Design thesis answers this question by imagining a desirable future that doesn't yet exist and what it may take to get there.

This thesis travels through two worlds or paradigms—*What-is* and *What Could-be*. The world of *what-is* explores the typologies of defuturing and dehumanization as they manifest with climate breakdown. The thesis imagines a speculative future world that *could-be*, explored in the accompanying *The Open Journal of ReFuturing*, a fictional design research journal from 2131 AD. The journal is written as an indigenous critique from the future, looking back at the first century of climate reparations through the speculative solutions enacted today. These speculative solutions are generated through/by designerly *What-ifs* and its designed artifacts for climate-resilient solutions and 'Technologies of Care' that make this world thinkable and doable today. This seriously playful yet studied imagination of ReFuturing Studies is an invitation to reimagine a transformed 'ecology of disciplines' for climate action—to reclaim and rehumanize the dehumanized present such that the future is profoundly different when we arrive in it.

Jomy Joseph (1988) holds a B.Tech in Civil Engineering from Calicut University, India (2010); an M.Des in Industrial Design from Indian Institute of Technology Delhi (IIT-D), India (2013); and an MA in Industrial Design from The Oslo School of Architecture and Design, Norway (2018). Over the years, he has worn multiple hats as a designer, researcher, and lecturer across various fields, such as industrial design, speculative design, communication and visual design, and user experience design. He continues exploring the intersection of speculative industrial design for long-term sustainable futures and the worlds it may lead to. His research was carried out with the support of research project designBRICS.

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