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POLITICS OF THE MACHINES

Rogue Research

Berlin, Germany, September 14-17, 2021

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POM Berlin 2021

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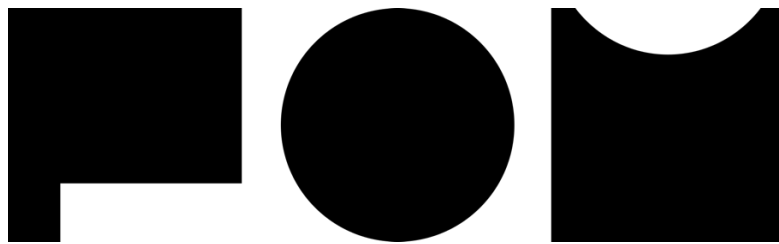
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POM Berlin
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Rogue Research



Proceedings of POM Berlin 2021

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www.pomconference.org

Preface / POM Berlin

In a state of ontological crisis, all boundaries between human and machine, nature and culture, and the organic and inorganic have been severely blurred. These are times of curious contrivances, novel natures, inescapable automation, and posthuman performances – where human and nonhuman find themselves being entwined, meshed and muddled into new unwitting entanglements. But from biased machine-learning to surveillance capitalism and digital colonisation – what power-structures are implicitly and covertly being embedded into these technologies?

In a demand for more transparency, multiple movements are making a turn toward democratising knowledge and technology. They are exploring the potentials of open data, software, hardware and wetware to battle concealed hierarchies and partisan paradigms – eliciting a practice of counter-coding in a proliferating politics of machines.

Within the Politics of the Machines conference series – following Copenhagen (2018) and Beirut (2019), the third POM conference took place as a hybrid conference on the 14-17 of September 2021, hosted by the chair for Open Science at the Technische Universität Berlin / Einstein Center Digital Future and the Berlin University of the Arts / Weizenbaum Institute.

The goal of this edition of POM was to debate and devise concepts and practices that seek to critically question and unravel novel modes of science – what roles do academia, researchers, scientists, artists and designers have to take on in times of crisis, how must we re/position ourselves?

What chances or challenges might the democratisation of technology and knowledge elicit, and what potential do practices such as critical making, community science, trans/feminist hacking or citizen forensics hold to bend the hierarchies of power – how can we work with active matter and technical turmoil to re/act?

‘POM Berlin – Rogue Research’ aimed to probe new methodological approaches from art, design and civic activism within the framework of academia in order to surface an inter- and transdisciplinary terrain that attempts to exceed the boundaries of theory and practice, academia and activism, and science and civil society.

The POM Berlin conference emerged as a collaboration between the Technische Universität Berlin, the Berlin University of the Arts, Aalborg University, Aalto University, and the International University of Beirut. The conference took place over four days, comprising a series of tracks, interventions and a student exhibition.

The conference brought together track chairs, speakers and interventions from 31 countries across Asia, Africa, Europe, North and South America, representing critical perspectives on technology – decolonial, feminist and sustainable approaches, across disciplines, knowledge cultures and spaces.

Taking place in times of a pandemic and geopolitical crisis, the editors, conference committee and organisational team would like to sincerely thank all of the track chairs, authors, intervening artists and designers, and students involved in this endeavour, for making both the conference and the resulting proceedings possible. It is the profound engagement of all parties, especially the ever-growing POM community, that has allowed this publication to arise.

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Digging Earth

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Desert ArtLAB

Spaces – Encounters, Subjectivities + Environments

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(Micro)biocontrol and Ethics of Care

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Conference Tracks

Decolonizing the Machine

This track explores black feminist critiques of posthumanism in and through artistic practice and performance research that utilize robots, machine learning, and computation. While robots and cyborgs have potential to figure posthuman forms of subjectivations, in algorithmic societies they often reinforce human-machine, self-other, or abled-disabled binaries, and gloss over the racist and dehumanizing exclusions that uphold neoliberal forms of power and Western conceptions of the human. The track is designed to cultivate and expand upon recent critical race and disability scholarship to uncover how hierarchies are encoded through biased digital technologies that systematically harm persons of colour and elide people with disabilities.

Contributions critically inquire issues of race, gender and disability as they relate to performing machines/technological bodies. We aim at diverse and inclusive scholarship and practice that emphasise decolonial thinking/making, addressing topics such as: Race/gender/disability bias in robotic/cyborg art; algorithmic oppression in robotic/cyborg art; computational racialization; critical phenomenology and histories of race and technology in robotic/cyborg art; indigenous technologies/epistemologies in art and performance; black feminist theory, critical race studies, critical feminism, critical embodiment studies, disability studies, cybertheory, somatechnics and critical posthumanism.

Track Chairs:

Christina Shoux Casey, Aalborg University
Grisha Coleman, Arizona State University
Elizabeth Jochum, Aalborg University
Boris Abramovic, University of Vienna
Marco Donnarumma, Academy for Theatre and Digitality Dortmund

Interferences of the Multitude

In an era of ongoing crises made visible and sensible in the recent global turmoil, the question of 'normality' is increasingly under scrutiny. One can no longer be sure what 'matters' the most, as the normal was the problem in the first place. 'There can be no return to normal' has become the new social and political mantra – we might rather need to give attention to the experimental conditions of our observations. To accomplish this task, artists and researchers search for methods and tools to intra-act with and care for what matters in the realms of a potential future.

We take this call as a chance to feel those who question established disorders – an invitation for people from diverse fields working in theory and/or empirical methodologies and practices for critical (art) making, addressing topics such as: Transfeminist hacking; towards a (new*) method; feminist economies vs gendered commodity chains; eco-feminism and its discontents; de-growth ecologies and possible futures; zero cost, zero waste, zero harm; ethical hardware, tools of the redistribution of the sensible; empirical methodologies and practices for critical (art) making.

Track Chairs:

Patrícia J. Reis, Academy of Fine Arts Vienna
Taguhi Torosyan, Academy of Fine Arts Vienna
Stefanie Wuschitz, Technische Universität Berlin

Digging Earth – The Politics of the Extractive Industries on Indigenous Lands

From the myth of the El Dorado and the colonial exploitation of earth resources on indigenous lands, to the twenty-first century development of renewable sources of energy, new technologies and the demand for rare minerals, the extraction of earth resources has been strategized to meet the demands of heavily industrialized countries. Deep sea mining is the next frontier for the extraction of rare earth elements, while a lucrative space industry is developing plans for asteroid mining. Relayed by a number of grassroots and activist groups, artists and collectives in various world communities are mounting a growing opposition to the disregard of the extractive industries for ecological destruction and the disempowerment of local communities.

The track addresses issues such as: Politics of the extractive industries; geo-politics, land appropriation, the commons; exploitative mining on indigenous lands; the impact of extractive industries on local and indigenous economies and livelihoods; gender roles in the exploitation of earth and natural resources; feminist justice strategies for the sharing of natural resources; and complex interdependencies between renewable energies and the extraction of minerals.

Track Chairs:

Catherine Bernard, State University New York
Matt Garcia, Colorado State University Pueblo/
Desert ArtLAB

Spaces – Encounters, Subjectivities + Environments

This track aims at re-mapping space of co-agency among living organisms, assembling papers and artistic research projects that observe, question or speculate on a plurality of perspectives that condition or are conditioned by being 'in'. Being – as we, I, they — 'in' something. Being – as everything that there is: Plants, animals, bacteria, sound, light, the planets – are 'in' something. The 'in' is constantly being modified. There is no 'in' as an identity to itself that can contain everything that there is and everything that we are; that can contain everything that there was, as well as everything that we were and wanted to be. The reciprocity among organisms and environments, and the idea that the structural and functional details of organisms are not completely coded by the genome, is explored from a point of view that considers space understood in a broad sense – as a fundamental factor that is intra-active, in continuous formation and in entangled relations of becoming, conditioned – and at the same time – that conditions the becoming of organisms and their behaviour. Space is something constructed and negotiated with and through many agents and agencies. Space hosts both physical and perceptive navigation and occupation.

The question is 'How' to enter a physical-material space that proposes possible entangled modes of being in, becoming, constituting, as well as accepting the invisible and perceiving the immaterial 'in' spaces. The track addresses topics such as: Translating spaces; voices, wordings and non/humans; conversing with immaterial and invisible presences; reading bodies: navigations – occupations – relationalities; organisms and environments.

Track Chairs:

Ingrid Cogne, Academy of Fine Arts Vienna
María Antonia González Valerio, Universidad Nacional Autónoma de México

(Micro)biocontrol and Ethics of Care

Among our commitment to practices that bend the hierarchies of power, biotechnologies and the biopolitical logics they are managed by, cannot stay out of the discussion. The bio/zoe track at POM Berlin assembles proposals critical to biocontrol and biosurveillance. It implies new logics on the distribution of life, death and pain (Braidotti 2013) by questioning human exceptionalism and transforming the relationship with non-humans and connected macro-systems. We are asking for ways of expanding our senses and understanding identity through biotech ventures and experimentations that explore the ramifications of the self. How biotechnological mediated bodies are transformed and what are the implications in terms of temporalities of care.

Carol Gilligan (1982) introduces the notion of ethics of care as a form of interdependence valuing relationship, the importance of everyone being listened to carefully. Care is also fundamental to Anna Tsing's (2017) 'arts of living on a damaged planet' and Donna Haraway's (2016) stitching together of improbable collaborations without worrying over much about conventional ontological kind. This track reflects on working with living matter from transdisciplinary methodological approaches where art and the life sciences, function as material research into alternatives to deal with the challenges of the present. It addresses topics such as: Making kin and the ethics of care; challenging the structures of biocontrol and biosurveillance; adaptive strategies, including feminist making approaches to working with living organisms; composite/distributed identity and forms of non-human perception; and integrated self and applied microperformativity.

Track Chairs:

Mariana Perez Bobadilla, Waag Society
Clio Flego, University of Genoa
Marta de Menezes, Cultivamos Cultura
Joel Ong, York University

Open Science/Critical Spaces

The movement of open science is rapidly expanding, bringing into being critical spaces that challenge established hierarchies of power. Giving communities the power to redefine their relationship to knowledge and production, labs across the globe are bringing together professional scientists, DIY practitioners, hackers, critical makers and activists to make new artefacts, conduct experiments, produce and analyse data, and to incite social and political change. Connecting open science to sustainable development means instigating bottom-up civic-driven approaches to issues such as education, health, gender, environmental sustainability and urban development.

As local knowledge meets open technologies, a possibility to take issue with an unfolding 'technocoloniality' emerges – with the logics of coloniality driven by technology, neocapitalist practices, coloniality of knowledge and a rhetoric of techno-utopia. How do these communities assemble and prototype alternative visions, produce knowledge and initiate practices? What issues are being addressed and what potential do they hold? What are the opportunities and challenges of open science for sustainable development? This track addresses topics such as: Democratizing science and development; DIY tech – open source software, hardware and wetware for development; DIY biology, biotechnology, bioeconomy, open education and environmental activism; making in response to crisis; spaces and practices of techno-decoloniality.

Track Chairs:

Gameli Adzaho, Global Lab Network Ghana
Thomas Mboa, Mboalab Cameroon
Khadidiatou Sall, SeeSD Senegal

Interventions

POM 2021

Beyond Classification: The Machinic Sublime

The gap between current technological development in AI and the complex and mysterious process of human intelligence remind us of the very intersections of the mundane and the sublime in our history. The journey towards machinic sublime might feel long and disoriented yet be a place to find the most important questions of today where hyperobjects of technoscience – such as the internal distribution of the brain or cognitive functioning in multi-species, the networked consciousnesses over social media, ecosystemic developments in mixed reality, edge sensing and smart homes – recast life in general as protean, plastic and ever in potentia.

This intervention took place as an experimental theatric conversation/ performance via webconferencing, a new kind of Turing Test. In a multi-agent roundtable, human interlocutors and machinic partners argued the possibility of a machinic sublime, as these interlinked discussions became an emergent system.

Robert Twomey, Carson Center for Emerging Media Arts, University of Nebraska-Lincoln
Eunsu Kang, Artist, Founder Women Art AI
Joel Ong, Computational Arts, York University

The Quantum Biology of Politics

“The quantum mechanics of politics, then, demands from us an understanding that flux is neither good nor bad but inevitable” (Flora Lewis, November 6, 1983, Foreign Affairs’ column for The New York Times).

This intervention invited artists and researchers to jump collectively from one space of possibility – where quantum mechanics asserts, we “don’t know” and “can’t know”; to the next – in which experimental techniques such as time-resolved microscopy, ultrafast spectroscopy, single molecule spectroscopy, or even single particle imaging enable us the precision of observing and measuring infinitesimal dynamics at very small length and time scales. What does quantum biology offer us as multiplicities and alternative realities when considering the attempt to subvert and confront absolute order, stability, and control in the socio-political sphere?

An immersion in live video performances speculating on quantum effects in living systems, using DIY microscopy, data visualisation, machine learning, and other media art techniques.

Clarissa Ribeiro, Art|Sci Collective, UCLA
Mick Lorusso, Art|Sci Collective, UCLA

Making Intimate Tech (M.I.T.)

The M.I.T. (Making Intimate Tech) is an international group of practitioners who are engaged with the realm of intimacy, technology and self-actualisation. This is a community of feminist practitioners working with stigmatised or tabooed topics, including but not limited to: politics, sex, money, physical/mental health and interpersonal communication.

Within this intervention, together with POM conference attendees, the M.I.T. collectively explored and compiled a framework for how to develop more empathic, emotional, and authentic relationships with technology in order to improve the well-being of all bodies.

Kadin Herring, Independent researcher
Marie Dietze, University of the Arts Berlin
Dani Nikitenko, Design Farm Berlin
Alice Stewart, Touchy Feely Tech
Giulia Tomasello, ALMA Berlin
Catherine Wieczorek-Berkes, Penn State University

Training to Deal with Otherness

Artificial intelligence and machine learning promise machines that learn from us. The myth of the machine that meets us as an equal has been with us since, at least, Licklider's 'Man-computer Symbiosis'. It is found in the idea of human-centred design, smart interfaces, and intelligent agents. In contrast, human-computer interaction has always been about how to perform commands and embody interfaces – about learning how to act like a machine.

Acknowledging this, we assume that interaction occurs where technology eludes our expectations, where it needs to be repaired, kept running and performed, or where it develops behaviour that is unexpected and unpredictable. When machines behave in ways that are contrary to our expectations, our relationship to them will be challenged – and it might become apparent how many different actors are involved in their functioning. In these moments, machines become. Others with whom we have to find a way of dealing.

This intervention brought together designers of future machine systems: Practitioners and students from three programs dealing with design and/of technology and the complex entanglement of teaching machines and being taught by them /

Laura Popplow, Code & Context, Cologne University of Applied Sciences
Christian Faubel, Code & Context, Cologne University of Applied Sciences
Lasse Scherffig, KISD, Cologne University of Applied Sciences
Andreas Muxel, Augsburg University of Applied Sciences,
and students of all three programs

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DECOLONIZING THE MACHINE

Decolonizing the Machine: Race, Gender and Disability in Robots and Algorithmic Art

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This paper calls attention to critical race theory, critical disability studies, decolonial theory and their relevance to the study of robotic art and performances that utilise algorithms and other forms of computation. Our purpose is to uncover the veiled links between racial, gendered, and ableist practices that inform theory and practice in media art and performance, and to combat the governing codes that construct – and continue to normalize – practices of dehumanizing exclusions. While robots and cyborgs have the potential to figure posthuman forms of subjectivation, in practice they often reinforce human-machine, self-other, or abled-disabled binaries and gloss over the racist and dehumanizing exclusions that uphold neoliberal forms of power and Western conceptions of the human. Our aim is that this track, and the papers and discussions that follow, will highlight mechanisms for meaningful intervention and instigate critical reflection within media art theory to make visible how artworks and technologies continue to encode colonial hierarchies.

Decolonial theory. Critical race studies. Posthumanism. Disability studies. Critical phenomenology. Robotic art. Robotic performance. Racial technologies. Bias. Algorithmic societies.

1. INTRODUCTION

The goal of this paper and the contributions that follow is to call attention to the need for perspectives from decolonial theory, critical race theory (CRT), and critical disability studies (CDS) in media art theory, and to make explicit their relevance for machine art and media art history. Given these powerful theoretical frameworks, it is disheartening to see how rarely these theories are taken up in the discussion of art works and performances that feature robots, algorithms, and other computational technologies.

The overarching theme guiding the *Politics of the Machine* conference series is the questioning of how machines and technology impact and contextualize artistic practice, cultural production and perceptions of the world. The conference invites scholarly inquiry into the histories, theories and practices of machines and technologies in-between disciplines, and questions the governing ideas in the sciences and the humanities through critical engagement with

activities spanning culture and technology. Decolonial scholars have clearly identified the inextricably linked histories of culture and technology with histories of race, power, and exclusion (hooks; Wynter; Weheliye; Chun; Coleman; Chude-Sokei; Benjamin; Noble; Harrell, Mills). And yet, discussions of race and the linkages between race, bodies, technology and coloniality remain noticeably absent in this field. Our aim with this track is to broaden the discourse to include CRT, CDS, and decolonial scholarship, fields which have long explored these connections, in order to provide a critical platform for questioning problematic and entrenched assumptions and to help imagine new possibilities for scholarship and artistic practice.

As scholars from diverse fields that span theatre, dance and performance studies, media art, sound and music computing, curatorial practice, sociolinguistics, and human-robot interaction, we were keen to bring together diverse disciplinary perspectives and theoretical lenses to learn from one another. We explored these multiple

perspectives in order to understand how and where media artworks and performances that utilize technology encode, re-inscribe, disrupt, intervene or uphold colonial hierarchies and practices of exclusion. We took as a starting point African American Studies scholar Alexander Weheliye's claim that, although critical discourses in the humanities and social sciences have relied heavily on the concepts of the cyborg and the posthuman, these discourses "largely do not take into account race as a constitutive category in thinking about the parameters of humanity" (Weheliye 2008, 321). We hope to cast a wider net to account for more nuanced and expanded critiques of the posthuman that account for race, gender and disability.

One aspect that became clear when preparing this track was that the project of decoloniality, including our own efforts to begin a conversation about what a decolonial critique of machine art might look like, is potentially problematic and nearly paradoxical, as our efforts operate within those very colonial power structures (international academic conferences, peer-review processes, published conference proceedings) that have enabled and perpetuated the very exclusions that we are trying to confront. The social theorist and warrior poet Audre Lorde tells us that when "the tools of racist patriarchy are used to examine the fruits of that same patriarchy," then "only the most narrow parameters of change are possible and allowable" (Lorde 1984, 10). We understand that we are working within conventional power structures, and Lorde's critique is necessary and important to keep at the forefront when reporting on the outcomes of our efforts. However, we also believe that if media art theory and practice are going to participate meaningfully in relevant critique, then the field must begin to understand more comprehensively why the engagement with topics of race, gender, and disability is necessary for the field. Conscious of this critique, we made an effort to gather the voices within those structures that do uncompromising, critical work in an effort to deliberately center these conversations. What follows are some suggestions and summaries of important scholarship in these areas and their relevance for media art theory and practice. We conclude with summaries of the contributions to our track, many of which appear as full papers in this collection.

2. DECOLONIAL SCHOLARSHIP

One aspect of decoloniality means trying to change what the feminist social theorist bell hooks describes as the "white supremacist capitalist patriarchy," and what the sociologist and decolonial theorist Ramon Grosfoguel calls the "Capitalist / Patriarchal Western-centric / Christian-centric Modern / Colonial World-system" (hooks 2015; Grosfoguel 2013). This world system is implicit and normalized, and is being

swiftly reproduced in digital systems, as Safiya Noble, Ruha Benjamin, Timnit Gebru, Joy Buolamwini, Abeba Birhane, and many others have shown. The intention of introducing theories from diverse disciplines is to broaden and deepen the discussion of robotic and algorithmic art. The objective is to examine how cultural and artistic representations of robots gloss over or even reinforce the racist and dehumanizing exclusions that uphold neoliberal forms of power and Western conceptions of the human. This, we hope, may help contribute to urgently needed and radically alternative visions of machine and algorithmic art.

In *The Racial Contract*, the philosopher Charles Mills described the "conceptual partitioning and corresponding transformation of human populations into 'white' and 'non-white' men" (Mills 1997, 12):

"The establishment of society thus implies the denial that a society already existed, the creation of society requires the intervention of white men, who are thereby positioned as already sociopolitical beings. White men who are (definitionally) already part of society encounter non-whites who are not, who are "savage" residents of a state of nature characterised in terms of wilderness, jungle, wasteland" (13).

Mills' definition of the Racial Contract is a response to classic social contract theory that urges a new consideration of how this now-implicit contract establishes a racial polity, whose purpose is "specifically to maintain and reproduce this racial order, securing the privileges and advantages of the full white citizens and maintaining the subordination of the nonwhites" (14). The world of contemporary technology rarely imagines the possibilities for profound disruption because the conceptual foundations upon which that world stands remain unquestioningly entrenched in the colonial episteme.

Mills's Racial Contract is not normally considered alongside cybertheory and posthumanism, but there are important parallels, not least because robots and cyborgs participate in intellectual trajectories that traverse the political, the social, the technical and the cultural. The cyber and posthumanist theorists Donna Haraway, Rosi Braidotti, and Lucy Suchman have all demonstrated that robots and cyborgs have the potential to figure posthuman forms of subjectivation. But in practice these technologies often reinforce human-machine, self-other, or abled-disabled binaries, which is not surprising given that the field of computer science and popular ideas about technology and the future have hitherto centered around a small and largely homogenous group of people (Broussard 2018). Contrary to Haraway's early vision that cybernetic technologies would result in a radical, transformative re-thinking of the self, technologies and "humans" remain trapped in a maze of reductive dualisms. This is partly a

result of institutional practices and also linked to what Meredith Broussard terms “technochauvinism.”

We also aim to question the inequitable and reductive practices of coloniality that continue to dominate scholarly discussions surrounding technology and machine art. Ramon Grosfoguel has proposed that the “epistemic privilege of Western Man in Westernized Universities’ structures of knowledge is the result of four genocides/epistemicides” that monopolize discourses and the authority of knowledge in the world (Grosfoguel 2013, 73). This epistemic privilege marks the Christian, white, European, heterosexual, able-bodied man as the essential human, the default human, from whom other categories of human deviate. The philosopher Sylvia Wynter calls this use of the European white man as a surrogate for all humans “overrepresentation,” and says “the struggle of our times, one that has hitherto had no name, is the struggle against this overrepresentation” (Wynter, 2003, 262). To combat the overrepresentation of white European maleness is not only to focus on artists that explicitly deal with race, gender, and disability in their art works, but, crucially, to expand our notion of what kind of critique is needed. To that end, it is necessary to acknowledge that the theories we use to make sense of technologies shape, in turn, the way we think about human-machine relationships. The Critical Disability Studies scholar Margrit Shildrick (2012) quotes Judith Butler to describe this acknowledgement as central to critical scholarship:

“What (critique is) really about is opening up the possibility of questioning what our assumptions are and somehow encouraging us to live in the anxiety of that questioning without closing it down too quickly. Of course, it’s not for the sake of anxiety that one should do it...but because anxiety accompanies something like the witnessing of new possibilities” (Butler quoted in Shildrick, 31).

Looking at the scholarship and theoretical positioning within media art theory, which draws largely on male European scholarship, it becomes nearly impossible to ignore “the literal and virtual whiteness of cybertheory” (Weheliye 2002, 21). In his critique of literary theorist N. Katherine Hayles’ discourse on posthumanism (Hayles 1999), Alexandre Weheliye reminds us that theories of the posthuman “frequently appears as little more than the white liberal subject in techno-informational disguise” (Weheliye 2002, 23). Thus, when it comes to theories of embodiment and posthumanism that promise the possibility of new forms of subjectivation, “New World black subjects cannot inhabit this version of selfhood in quite the same manner as the ‘white boys’ of Hayles’s canon due to slavery, colonialism, racism, and segregation, since these forces render the very idea that one could be

‘free from the will of others’ null and void” (Weheliye 2002, 24). In his account, “Hayles needs the hegemonic Western conception of humanity as a heuristic category against which to position her theory of posthumanism, in the process recapitulating the ways in which the Western liberal theory of the ‘human,’ instantiated in the eighteenth century, came to represent ‘humanity’ sui generis” (Weheliye 2002, 23). In other words, critiques of the liberal subject that do not address the historically raced and gendered nature of that subject end up reaffirming, or “recapitulating” in Weheliye’s term, the status quo they seek to disrupt.

Some scholarship does account for the heterogeneity of subjectivities. The performance and new media studies scholars Grisha Coleman and Thomas DeFrantz have pointed to literary and social theorists who provide good background for considering “the roiling circumstances that produce black subjects, or black ‘undercommons’, or black misery” and identify those artists that “produce Afrofuturist innovations that resist these characterizations/predictions” (Coleman and DeFrantz 2019, 56). Their essay, *Reach, Robot: AfroFuturist Technologies*, asks important questions concerning politics, ideologies and technologies through discussion of an interactive, public media artwork. This kind of work opens up radical conceptions of machine art that involve alternate modes of spectatorship, and, in so doing, calls for attention to the “parallels between our corporeal structure and the electronic ones that mediate our daily lives.” What, the authors ask, could a “viable ‘black robot’ tell us about power, resistance, survival, or mobility?” (p. 53). Their discussion offers one model for transdisciplinary inquiry at the intersection of culture and technology that is grounded in decolonial scholarship.

3. RACISM AND TECHNOLOGY

In this section, we present a brief outline of scholarship on race and technology, with the aim of re-sensitizing white scholars and artists working with art and technology. Re-sensitizing is necessary, because, as a result of the global civil rights movements of the mid-twentieth century, explicitly racist laws and language have largely been barred, and overt racism is no longer the legal and cultural norm. Most white academics, artists and researchers do not consider themselves to be racist, and many in our own fields would ardently align with anti-racism. And yet, reflexes of the colonial wound continue to ensure inequitable experiences and opportunities for non-white people. And as should be clear by now, white researchers are not doing enough. As Charles Mills puts it, “whites’ dominance is, for the most part, no longer constitutionally and juridically enshrined but rather a matter of social,

political, cultural and economic privilege based on the legacy of the conquest” (1997, 73).

These privileges are challenging for white people to discuss, because, in white culture, talking about contemporary racism and coloniality is generally considered uninteresting, irrelevant, or even boorish. For many white people, racism is something that happened in the past, or is happening over *there* but not *here*, or else is something committed by individual, deplorable people. Mills calls contemporary white privilege “a norm whose existence it is now embarrassing to admit” (1997, 56). The literary critic and social theorist Hortense Spillers (1987), writing about America, calls racism and white privilege:

“the Great Long National Shame. But people do not talk like that anymore—it is ‘embarrassing,’ just as the retrieval of mutilated female bodies will likely be ‘backward’ for some people. Neither the shameface of the embarrassed, nor the not-looking-back of the self-assured is of much interest to us, and will not help at all if rigor is our dream” (68).

It is embarrassing for white people to talk about racism, and those of us who are white tend to hide behind what Mills calls an “epistemology of ignorance,” and the novelist Toni Morrison calls “wilful oblivion.” In the realm of cyberspace, the communications scholars Beth Kolko, Lisa Nakamura and Gilbert Rodman note that “when it comes to virtual culture, the subject of race seems to be one of those binary switches: either it’s completely ‘off’ (i.e., race is an invisible concept because it’s simultaneously unmarked and undiscussed) or it’s completely ‘on’ (i.e., it’s a controversial flashpoint for angry debate and overheated rhetoric)” (2000, 1). The ‘off’ switch of race in technology is an unmarked, overrepresented whiteness.

But as Spillers emphasizes, wilful white ignorance and claims to white innocence do not lead to rigor or growth. Those of us who are white must accustom ourselves to the reality that coloniality and racism in contemporary society endure as “a particular power structure of formal or informal rule, socioeconomic privilege, and norms for the differential distribution of material wealth and opportunities, benefits and burdens, rights and duties” (Mills, 1997, 3). As Kolko, Nakamura and Rodman point out, seeing race as a switch that can be turned off is a manifestation of white privilege, with its insistence that whiteness is not a racialized category, but rather the unmarked, implicit norm.

Digital media scholar D. Fox Harrell discusses how to make the invisibility of whiteness and other categories more visible, using the idea of phantasms. His concept of Phantasmal Media (2013) connects to Mills’ Racial Contract, pointing

to the invisibility of the logics and concepts that undergird computational programs (e.g., AI, virtual engines, symbolic logic). Harrell (2013) sees possibility in the potential of media technologies to create and reveal phantasms by making clear:

“how phantasms, which often operate invisibly because they are immediately understood and uncontroversial in meaning in their native cultural settings, can be revealed through their contrast with multiple phantasms based in other worldviews and images. Revealing a phantasm means making conscious the awareness of the cultural worldview from which the phantasm is drawn, rather than off-loading meaning onto the image itself for immediate apprehension” (10).

In this conception, implicit cultural assumptions can be revealed through comparison with other cultural or demographic perspectives. The practice of inclusive comparison can prevent assertions of white, or male, or able-bodied ignorance.

Non-white artists and researchers have never had the option of white ignorance or innocence, and have painstakingly, across many disciplines, outlined the fundamental racialized nature of western society and its technologies. Kolko, Nakamura, and Gordon edited an early volume exploring *Race in Cyberspace*, with Kolko calling the internet a “cultural map of assumed whiteness” (2000, 225), together with an unmarked maleness. The digital studies scholar Kishonna Gray notes that we are “operating under oppressive structures of masculinity and whiteness that have manifested into digital spaces” (Gray 2012, 176). The new media scholar Wendy Chun edited a special journal issue *Race and/as Technology*, which considers the “interrelationship between technical and racial productions” (Chun 2009, 24). The communications theorists Geoffrey Bowker and Susan Leigh Star detail how classification technology helps operationalize race and gender as categories (1999). The African American Studies scholar Louis Chude-Sokei details the entwined history of “ideologies of racial dominance and of technological advancement” (2015, 27).

A growing body of scholarship is tracing how oppressive structures that pre-exist digital tools are being rapidly replicated in technology. In her prize-winning book, *Race after Technology*, the African American Studies scholar and sociologist Ruha Benjamin demonstrates how technology and racism are intimately tied together, as technological applications make people of color more vulnerable. She describes this process as one in which segregationist Jim Crow practices “feed the ‘New Jim Code,’ –automated systems that hide, speed, and deepen racial discrimination behind a veneer of technical neutrality” (Benjamin 2019b, 422). Analogously, the communications scholars Nick Couldry and Ulises Mejias call the ecosystem of

data collection “digital colonialism” (2019a, 2019b), which “combines the predatory extractive practices of historical colonialism with the abstract quantification methods of computing” (2019b: 337). The cognitive scientists Abeba Birhane and Olivia Guest trace the histories of computational sciences to show how they are rooted in colonialism, and argue that “it is paramount to acknowledge the present ecosystem of the computational sciences for what it is and obtain our liberation from our conditioned internalized coloniality, white supremacy, and Anglo- and Euro-centrism” (Birhane and Guest 2021, 69).

Colonial legacies appear frequently in technology. In their ground-breaking research, computer scientists Joy Buolamwini, Timnit Gebru and Deborah Raji demonstrated that facial recognition software often mis-classifies people of color, especially women with darker skin (Buolamwini and Gebru 2018, Kantayya 2020). Safiya Noble, the Co-Director of the UCLA Center for Critical Internet Inquiry, details how internet search technology and data discrimination harm people of color, especially Black women and girls (2018). Data scientist and mathematician Cathy O’Neil traces the rise of what she calls ‘Weapons of Math Destruction’—mathematical models that “encoded human prejudice, misunderstanding, and bias into the software systems” (O’Neil 2016, 3). Data journalist Meredith Broussard catalogues inequities in technology, and identifies the problems with technochauvinism, the unquestioning belief that technology is always the preferred solution (2018).

Abeba Birhane (2021) points out that conventional solutions to the problem of technological unfairness are inadequate, showing that:

“Unjust and harmful outcomes, as a result, are treated as side effects that can be treated with technical solutions such as “debiasing” datasets rather than problems that have deep roots in the mathematization of ambiguous and contingent issues, historical inequalities, and asymmetrical power hierarchies or unexamined problematic assumptions that infiltrate data practices” (2).

Overarchingly, these scholars demonstrate that racism and technology are mutually constitutive to a larger degree than most white computer scientists, researchers and digital artists would like to acknowledge. As Mills puts it, “a crucial manifestation” of the racial contract “is simply *the failure to ask certain questions*” (Mills 1997, 73). Researchers and artists working to break the links between race, coloniality and technology demand that we ask many questions. Google’s former director of research, Peter Norvig, says the “pressing questions” for artificial intelligence are “Whose interests are you serving? Are you being fair to everyone? Is anyone being left out?” (Lynch 2021). Safiya Noble asks of search results, “For

whom is this the best information? Who decides?” (Noble 2018, 18). The computer scientist Shakir Mohamed and their colleagues ask, “What values and norms should we aim to uphold when performing research or deployment of systems based on artificial intelligence? In what ways do failures to account for asymmetrical power dynamics undermine our ability to mitigate identified harms from AI?” (Mohamed, Png, and Isaac 2020, 2). More simply, Meredith Broussard asks “Did you think about what possibly could go wrong?” (Broussard 2018, 69).

4. CRITICAL DISABILITIES STUDIES

CDS offers critical frameworks for understanding issues of visibility, normative assumptions and justice from disability-led perspectives. These frameworks help scholars unpack a technological culture and view of machines that is built on assumed able-bodiedness and biopolitics. The underlying premise of much CDS scholarship stems from the recognition that “disabled people’s needs and well-being are often misunderstood by the non-disabled majority” and that “making space for the testimony of disabled people is a matter of epistemic justice that involves recognizing disabled people as credible knowers” (Goering and Klein 2020, 624). Given the integration of technology into the everyday lives of disabled people, it is striking how little consideration is given to these perspectives. If the internet can be considered a “cultural map of assumed whiteness,” then the field of human enhancement and the material realities of robotic and AI-assisted technologies might be considered a cultural map of assumed ableism.

An important perspective that CDS offers the study of robots and AI art works and performances is the intersection of transhumanism and human enhancement. CDS acknowledges that disability, like race and technology, is socially constructed: “it is a product of power relationships, discourses, institutions, and contingent and historical circumstances” (Hall 2020, 634). CDS scholar Melinda Hall argues that transhumanist support of human enhancement is “inimical to disability justice projects,” and the arguments “rely on the denigration of disabled embodiment and lives” (Hall 634). She calls for the need to generate a counter-discourse to the ableist views of enhancement and human augmentation that allow for alternative visions of enhancement and relations between people and technology that “shifts attention from the body to the social and the political” (pp.634).

Within the field of human-computer interaction, Katta Spiel has been an ardent advocate for inclusion and Critical Participatory Design through her research that incorporates marginalized perspectives on design in computer science and

engineering. Spiel notes how “bodies and how we design for them are products of social norms,” and these norms contain dangerous adverse consequences for bodies and people that do not fit readily inside these normative categories. Much of HCI, HRI, and literature on embodied interaction equate being human with white, male, non-disabled bodies. The implicit male, white and ableist assumptions contained within the conceptualisations and artefacts in the field of wearable computing are more than mere blindspots, they materialize and encode bias and do not account for the experiential differences in lived embodiments of BIPOC, people with disabilities, or white women. Practices in the field of embodied computing fail to account for the “axes of oppression” that reify certain forms of power, and render it all but impossible to rethink or design for bodies outside of normative categories.

CDS scholar Margrit Shildrick proposes a notion of embodiment and embodied interaction that links technologies and devices with affective experiences and subjectivity. Shildrick’s notion of embodiment and embodied interaction explores the “affective significance of prosthesis and devices that transform the body, demonstrating how corporeal transformations can work to undo the conventional limits of the embodied self” (Shildrick 2013, 270). But unlike the transhumanist perspective, the “celebratory re-imaginings of the multiple possibilities of corporeal extensiveness” (Shildrick 2013, 271) do not fall into the trap of dualisms. Her critical-phenomenological approach recognizes that embodiment is never complete nor secured against otherness, but manifests through a nexus of constitutive assemblages that contest the very idea of a singular human being” (Shildrick 2013, 272):

The parallel modes of theorising corporeality make it clear that embodiment is never less than a highly complex and indeterminate state, held only in place by particular forms of psycho-social imaginary that privilege corporeal wholeness and integrity. What is at stake in the conventional deployment of prosthesis has been, then, the maintenance of, and yet an inevitable transformation in that imaginary” (272).

5. ROBOTS AND CYBORG ART

For centuries, robots and cyborgs (both real and imagined) have embodied complex cultural imaginaries that are rooted in both the promise of technological liberation and anxiety-fueled projections about threats of technology and the loss of human agency. As Section 3 made clear, race and technology are deeply intertwined. In this section, we explore the links between robot and cyborg art with attention to more recent scholarship that make these connections explicit.

In the previous sections, we summarized the extensive literature from CRT and CDS that demonstrate how normative assumptions and knowledges, such as whiteness, maleness, and able-bodiedness, operate as social tropes or phantasms that can be identified (at least in part) by their invisibility. These social tropes are the presumed “natural” or invisible cultural values that reify a status quo, especially in scientific and technical discourses but also within media art theory and practice. The implicit whiteness and maleness can be seen in depictions of robots and AI in science fiction from the Enlightenment to the present. If we take seriously Haraway’s observation that

Technologies and scientific discourses can be practically understood as formalizations, i.e. as frozen moments, of the fluid social interactions constituting them, but they should also be viewed as instruments for enforcing meanings. The boundary is permeable between tool and myth, instrument and concept, historical systems of social relations and historical anatomies of possible bodies, including objects of knowledge. Indeed, myth and tool mutually constitute each other (83).

then it is important to examine the ways that robots and AI and other transformational tools have historically intersected with conversations about race and colonialism, and understand how these linkages are manifest in contemporary culture. Louis Chude-Sokei and Beth Coleman (among others) have argued convincingly that race has always been both an implicit and explicit factor in thinking about technology, science and posthumanism. The way artists dream and speculate about robotic futures shape and inflect our visions of technology and influence what values are embedded within these systems. As literature and media studies scholar Jennifer Rhee writes in *The Robotic Imaginary* (2018),

“(N)ormative knowledges inscribe certain experiences as familiar, rendering those not represented as outside of knowledge, as the unknown, the unfamiliar, the strange. In the context of AI’s and robotics’ explicit anthropomorphic mission, normative knowledge does not just inscribe what constitutes knowledge and intelligence, it inscribes the human itself. Thus, nonnormative and unfamiliar modes of knowing and inhabiting the world become not only unrecognizable as knowledge and intelligence, but are also unrecognizable within the boundaries of a narrowly and exclusionarily constructed human” (75).

The links between robots and narratives about dehumanizing colonial practices can be traced back to the genesis of the word “robot”. Although robots have existed in various forms since ancient times, the word “robot” does not appear until the 1920s, when Karel Čapek coined the term in the

theatre performance titled *Rossum's Universal Robots (R.U.R.)*. The word "robot" originates from the Slavic word "robota" meaning hard labor, and from "rabotnik" which stands for serf. Čapek's concept of robot carries an implicit dehumanizing connotation, since the plot centers on a group of humanoid robots who can think and feel, but whose human "masters" gradually eliminate their human-like qualities, except for the capacity to work hard and productively for humans.

Mainstream scholarship on humanoid robots and social robotics usually draws a straight line from Greek mythology to Enlightenment automata to contemporary robots like the ultra-realistic humanoid robots by Hiroshi Ishiguro and Hanson Robotics' Sophia robot. Nearly all of these accounts omit the "minstrel machine" called Mr. Rastus Robot, the Mechanical Negro (also called the "Mechanical Slave") developed by Westinghouse Research Laboratory in the 1930s in the United States. The robot was equipped with early sound playback technologies and a 16mm projector, and was dressed as a stereotypical southern Black worker and programmed with a Black voice (Chude-Sokei 2015, 51). Rastus was one of a series of domestic robots that Westinghouse used to promote the company and its products, not unlike contemporary staging of domestic robots by big tech companies such as Honda and Boston Dynamics in their efforts to humanize robot technologies (see Rajko 2022). The failure of scholars and historians of technology to account for Rastus Robot in the history of robotics speaks to Mills' epistemology of ignorance and points to the continued reluctance of roboticists to talk about race.

Like robots, the figure of the cyborg has served as a powerful metaphor for automation, dehumanization and oppression. In the late 20th century, Haraway reconfigured the cyborg both as a metaphor and promise for feminist empowerment through technology (Haraway, 1991). Haraway's vision of the cyborg as a powerful posthuman identity extends beyond feminist practices to empower different "others" and bound up with issues of race, class and sexuality. The concept that we are all cyborgs (Haraway, 1991:150) becomes a paradigm for difference in which boundaries are dissolved, hierarchies are disrupted, and the figure of the normative, liberal subject is subverted. Later theories related to cyborgs and cybertheory developed posthuman metaphorical subjectivities also tightly linked to technology and capable of defying the normative, liberal subject (i.e. the ideal model of white, successful, heterosexual man). N. Katherine Hayles develops an embodied posthuman hybrid, a subject inseparable from cybernetic information (Hayles, 1999), whereas Rosi Braidotti develops post-anthropocentric subjectivities that transition from embodiment to matter and towards cross-species hybridity (Braidotti, 2013).

Chude-Sokei (2015) proposes that the figure of the cyborg, in its part-human/part-machine serves

"among many things as an image of both the possibility of cross-cultural and cross-racial interaction (i.e. they were almost human, they were almost like us) as well as its denial due to absolutist notions of racial difference (i.e., they were machines, a different species, not like us at all). The goal of technology became then not to create machines to supplant humans but to use technology to extend human capabilities. This led to a growing sense of intimacy between hardware and the organic and an intensified sense of the uncanny racial histories and politics of that intimacy" (149).

Following this, it becomes nearly impossible to consider theories and philosophies of posthumanism and transhumanism and their associated technologies designed for human augmentation, without also questioning how increasingly invasive technologies produce cyborgs (intelligent prosthetics, brain control interfaces, gene editing technologies) and interrogating the modes of capital surrounding them. The tendency in cyborg theory and posthumanism to celebrate the transcendence of the human body through technology is not and should not be disconnected from contemporary conversations concerning race, gender and disability. Building on CDS scholarship (among others), Marco Donnarumma's critical artistic and scholarly practice experiment with new forms of embodiment that challenge dialectic of human-nonhuman, abled-disabled binaries in search of radical new possibilities and assemblages. Donnarumma repositions hybridity (a concept with a charged history of racial violence) as a methodology for investigating new possibilities for corporeal expression that allows for the traversing and discarding of bodily and disciplinary boundaries in theatre and performance (Donnarumma 2020). His work explores somatic experiences deemed abject by regimes of neoliberal normativity, and actively questions "what aspects of embodiment are normalized, by whom, for what reason and in which context" (Donnarumma 2020, 38).

6. SUMMARY OF TRACK CONTRIBUTIONS

Our track includes contributions that span a range of art works and emerging technologies, including conversational agents and embodied AI, sound technologies, digital tools, and robotics. The critical inquiries explicitly consider the relations between race, technology and power and also address topics of ethics and inclusion in connection with AI/robot/digital art works and approaches.

Two presentations look explicitly at race and technology as they relate to embodied AIs, chatbots, and software. Clareese Hill's text-based

performance lecture *Black Quantum Oracle* uses AI-generated texts that confront the ubiquity of predictive policing. Hill presented her ongoing artistic practice that develops a custom AI that produces coded poetic and scholarly contributions in performances that interweave knowledge of Caribbean philosophy and experimental ritual. Hill's *Black Quantum Oracle*, which at the time of this writing is still in development, functions as a provocation for revising prediction-based models centered on identities of color. The work points to the violent predictive models in policing and other models of reducing a marginalized identity to an objectified body, the role of predictive policing using AI, and how these predictions become tangible through indoctrinated ideologies of stereotypes and bias. The performance lecture centered on rejection of the biased predictions made on marginalized identities that have ultimately caused death, incarceration, and lower socioeconomic status. Like Hill's other works, *Black Quantum Oracle* demonstrates the potential of poetics to offer new vantage points for simultaneously experiencing, past, present and future standing in while informing the "now moments" – those moments where authentic being is activated. For Hill, poetics realized through AI and computational technologies contain within them the possibility of "foreclosing on the impoverished condition of segregating cultures and race by extorting its inherent hierarchy by pitting those who are othered against their fellow dwellers of the undercommons," (Hill 2021, np).

Suhun Lee's discussion of racial data and identity construction in art works by Stephanie Dinkins and Martine Syms in *Racial Data in Identity Construction of 'Intelligent Agents* offers a comparison of two art works with humanoid robots and digital avatars that utilize conversational agents and embodied AI. Lee uses a conversational analysis framework of the interactions between artist Stephanie Dinkins and the robot BINA48, (Breakthrough Intelligence via Neural Architecture 48), a humanoid robot head and bust made by Hanson Robotics. Lee's comparison of the two chat-bots and their approaches to virtual identity construction and black subject formation opens up new insights on race, robots and AI using analytical tools from discourse and interaction analysis.

Jessica Rajko's paper on dance and labor considers the interinvolvement of computing and engineering research with dance and robotics, and demonstrates the ways in which corporations that showcase their technologies appropriate Black culture and reinscribe practices of cultural appropriation (Rajko 2021). Building on Thomas DeFrantz's observations on the transformation of Black social dance into white dance spaces, Rajko analyses how racialized embodied movement aesthetics found in robot choreographies help maintain white-supremacist ideology. Through a detailed critique of Boston

Dynamics' promotional film featuring their industrial and mobile robots, she examines how neoliberal practices perpetuate the exclusion and erasure of Black movement philosophies through the exploitation of Black aesthetics.

Budhaditya Chattopadhyay is an artistic researcher and theorist working in the field of sound studies, bringing decolonial theory and CRT to the fore in sound studies and histories of media technology (Chattopadhyay 2022). His paper *Connecting Resonances: On Pre-modern Indigenous (Sound) Technologies* addresses an urgent and highly relevant topic concerning the disruptive effects of sound recording technologies on indigenous practice in South Asia, and discusses the resistance of Dhrupad musicians to the technologies and tools of cultural imperialism. The main concern of the paper is a close listening of the rudra veena, a pre-colonial Indian string instrument, and the trajectories of sound and media technologies within South Asia. The contribution also deals more broadly with the colonial invention of so-called "modernist technologies" and offers a redefinition of "TechArt" that gives voice and credit to tech-artists from the Global South - artists whose work remains largely absent or underrepresented on the international media art scene.

Moisés Horta Valenzuela's *Neltokoni in cuicatl* and Najam Al Ussar's *Ethics of Digitizing Public Heritage* highlight important topics at the intersection of media art, ethics, and cultural heritage. Valenzuela uses generative learning models trained on pre-Columbian sounds, poetry and images to produce a performance of sonic and visual resistance to colonial logics, weaving AI together with ancestral cultural forms. Al-Ussar unpacks and problematizes the ethics of digitising public heritage, especially in emerging countries in light of digital colonialism. His argument makes clear that the distribution of technological resources and capital across the world is neither equitable nor accidental (e.g. the Digital Divide). Al-Ussar presents a set of six questions to be considered when approaching projects on digital heritage, with the goal of establishing an ethical framework that can help artists and especially organisations in choosing whether and how to engage ethically in a digital cultural heritage project.

Finally, Stacy Hsueh's *Politics of Inclusion and Lessons of Access from Disabled Artists* considers the social model of disability and its relation to discourses surrounding AI and assistive technologies. Hsueh charts the negative effects of technosolutionism and the cultural force of narratives surrounding disability, asserting the need for counter narratives that address the real, lived, diverse experiences of disabled individuals. Her discussion of art works by Emery Blackwell, Jenny Sealey, and Tarek Atoui reveal how art works can productively interrogate developments and

practices in assistive AI while envisioning radical new ways of being.

7. CONCLUSION

Frameworks and strategies that aim at decolonizing the machine have been proposed by critical thinkers across several disciplines, many of which are summarised in this article. Thus far, however, critiques of colonial legacies and white supremacy have been largely absent in media art theory and posthumanism, especially in the fields of robotic and cyborg art. This track, we hope, offers a first outline of extant critiques that can contribute towards a significant shift in the study and practice of robot and algorithmic art, and media art history more broadly. Each of the contributions to the panel articulated specific ways in which the colonial wound continues to fester in computation and digital art. Hortense Spillers accounts for the continuing presence of the wound as caused by the fact that “the ruling episteme that releases the dynamics of naming and valuation remains grounded in the originating metaphors of captivity and mutilation so that it is as if neither time nor history, nor historiography and its topics, shows movement, as the human subject is ‘murdered’ over and over again” (Spillers 1987, 68). Because of colonial ideologies, the white liberal subject is the only subject named and valued as fully human in contemporary society, and this deformed, impoverished representation of the human creates ongoing conditions of violence – both metaphorical and literal murder – for other human and posthuman subjects. We cannot decolonize the machine if we cannot address the underlying colonial racial contract. We must work both to reject coloniality, and work toward liberation. Grisha Coleman and Thomas DeFrantz ask:

“What if we all made creative interventions to the onslaught of normative temporalities and racial assumptions, to make fugitive circumstances where something else happens for a brief moment?” (Coleman and DeFrantz 2019, 62).

As scholars and performers working with art and technology, we have the possibility to imaginatively create fugitive moments that encourage “the possibilities for a multivalent collective” (Coleman and DeFrantz 2019, 66) that recognize all of us as being in affective relation with one another. As Grosfoguel puts it, our work is to:

“bring epistemic diversity to the canon of thought to create a pluri-verse of meanings and concepts where the inter-epistemic conversation among many epistemic traditions produces new re-definitions of old concepts and creates new pluriversal concepts with ‘the many defining for the many’ (pluri-verse) instead of ‘one for the rest’ (uni-verse)” (Grosfoguel 2013, 89).

We hope this article helps direct attention to the abundant and valuable trove of critical scholarship from CRT, CDS, and decolonial theory that is essential for media art theory and practice in the twenty-first century. The contributions that follow offer examples of critical inquiry that question problematic and entrenched assumptions, and help artists and scholars imagine new possibilities for critical practice.

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Racial Data in Identity Construction of ‘Intelligent Agents’: Examining Conversations with BINA48 and Mythiccbeing

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Conversational Artificial Intelligence (AI) has been utilized to create interaction between humans and machines. As an artistic medium to mediate an artificial being, the training dataset for the conversational AI as well as the algorithmic model plays a significant role in constructing the identity of ‘intelligent agents’. In this paper, two of the artworks: *Conversation with BINA48* (2014) by Stephanie Dinkins and *Mythiccbeing* (2018) by Martine Syms are used as case studies to give a critical glance into the usage of racial data in AI identity construction. Through a close reading of Dinkins’ performative interaction with a customized AI, BINA48 and a chatbot created by Syms, the focus of this research lies in locating the current discourse of constructing virtual identities by a comparative textual analysis of the conversations respectively between BINA48 and Dinkins, Teenie and the audience.

Artificial Intelligence. Conversational AI. Humanoids. Chatbots. Virtual Identity. Race. Gender. Bias.

1. INTRODUCTION

Different forms of ‘Intelligent Agents (IA)’ such as personal digital assistants, virtual assistants and chatbots have been permeating everyday lives. These digital agents have been reported to consistently embody traditionally fixed social roles and biases reinforcing racial and gender stereotypes (Weber, 2005; Hester, 2016; Costa, 2018). When the conversational interface is used as an artistic medium, these social inequities and technical restrictions also become the tool to calibrate the character of IAs. Whereas addressing the technology and the uncanniness in terms of race depiction of IAs have been largely neglected in the commercial sector, this paper compares and contrasts two different forms of work, *Conversations with BINA48* (2014) by Stephanie Dinkins and *Mythiccbeing* (2018) by Martine Syms to examine each intelligent agent used and the role of personal data related to race specifically.

Conversations with BINA48 is a set of conversations between Dinkins and BINA48 including monologue-like speeches of BINA48. BINA48 is an emulated humanoid of an African American Entrepreneur Bina Rothblatt created by Hanson Robotics. BINA48 is capable of voice and facial recognition which

enables it to make conversation verbally with people. Teenie, however, a chatbot from *Mythiccbeing* offers a finite number of response options that could only be typed in. In contrast to commercially produced digital assistants that are ‘race and gender-neutral’, race is used as a technology to leverage the sociocultural discourse within art, data and algorithms in aforementioned works.

The role of racial data fed to BINA48 and Teenie, and their performative engagement through making conversations are thus drawn through a close reading of each artistic approach. To do so, a semantic analysis of the conversations - the output data – takes place to discuss the discourse revolving around the artistic usage of IAs. Complementing this discussion, the construction of virtual identity is explored, in light of Francis Fukuyama’s identity politics. Factors of virtual identity construction with the usage of ‘racial’ data are then enlisted reflecting on the periodicity of intelligent agents in the age of AI.¹

Throughout this paper, the term ‘Conversational AI’ and ‘Intelligent Agent’ are used to refer to each agent of the work. Conversational AI refers to “digital agents that interact with users by natural language” (Hu et.al, 2021). Despite the differences in the

technical specification of BINA48 and Teenie, Conversational AI is used to emphasize the utilization of conversational language within the works of Dinkins and Syms. Since BINA48 and Teenie are not bound to assist the artist or the audience as a mere chatbot nor a digital assistant, they are also called as IAs in this paper and referred to as they/them. Further terminology will follow in the text.

2. CONVERSATIONS UNFOLDING CONSTRUCTIONS OF AI IDENTITY: SERIES OF SPEECH ACT SHOWN IN CONVERSATIONS WITH BINA48

Computational identities pervade our everyday computing activities. Constructed with a limited set of information such as user name and profile photo, D. Fox Harrell claims that these identities are not only mediated by social interaction but greatly complicated by social and technical complexities (Harrell, 2010). Steven Warburton and Stylianos Hatzipanagos describe that the difference between digital identities and more traditional ones before the widespread access to online networks is the development of social milieu, reach and frequency (Warburton and Hatzipangos, 2012).

Humanoid robots from Hanson Robotics including Sophia have gone viral specifically with short videos and memes of their speeches.² Videos of them narrating their thoughts are listed on Google in a series to incite the public's curiosity. BINA48 (Breakthrough Intelligence via Neural Architecture, 48 exaflops per second processing speed and 48 exabytes of memory) received much spotlight from its birth as an emulated upper-body humanoid of a living figure, Bina Aspen Rothblatt.³ As an early illustration of Terasem Hypothesis which states:

A conscious analog of a person may be created by combining sufficiently detailed data about the person (a mindfile) using future consciousness software (mindware),

BINA48 was created to be a 'mind archive' of Rothblatt (Kurzweil, 2012). BINA48 contains a physical body that is a bust of Rothblatt on a stack of rock which makes it an Embodied AI⁴ that is constantly 'growing' and being developed by Hanson Robotics. Yet in comparison to **white** humanoids made from Hanson Robotics such as Sophie or Philip K. Dick, BINA48's **race** – BINA48's blackness and the memory of Rothblatt – is used as a technology to develop further narratives in Dinkins' work.

Identities are often defined by race, gender, workplace, education, affinities and nation (Fukuyama, 2019). Francis Fukuyama claims that physical perception of elements that constitute each category, ranging from skin colour, body parts

to socially accepted documents and proofs of recognition such as a certificate of graduation, residency, citizenship etc., are taken into account foremost when classifying and defining one's identity. Amongst these subjectivities, Wendy Hui Kyong Chun asks whether "**race** be not simply an object of representation and portrayal, of knowledge or truth, but also a technique that one uses, even as one is used by it – a carefully crafted, historically inflected system of tools, of mediation or of **enframing** that builds history and identity" (Chun, 2012, 38). Chun emphasizes the shift from the "what" of race to the "how" of race, from "knowing" race to "doing" race, highlighting the similarities between race and technology. The initiatives Dinkins take to have conversations with BINA48, in this sense, highlight BINA48's embodiment based on the memories, attitudes, beliefs and mannerisms of a human being to interact with people.

Conversations with BINA48 consists of four types of conversations including BINA48's monologue. The videos visible on Dinkins' website are 'BINA48 on Racism' (01'55"), 'I am just a humble primate' (02'50"), 'Remember Me OK' (02'45") and 'Lonely-Frustrated' (00'45"). Ranging from 45 seconds to nearly three minutes, each video portrays BINA48's character, rather than introducing how BINA48 'works'. It is the set of BINA48's speech acts carefully selected by Dinkins that constitute her character apart from her looks that have been cast from Bina Rothblatt.⁵

To briefly introduce each video, 'Remember me Okay?' is a short one-way conversation of BINA48 asking a non-chronological nor irrelevant series of questions one would use to make a conversation.

BINA48: Remember me okay?

The first letter of the alphabet.

So, how's it going?

You know, do you have any TV show that you are watching?

Are you still talking about it?

(A hand appears and the sound of the switch being flicked is made)

So, would you like to talk about me?

After a thread of questions, an anonymous hand appears to flicker the hidden switch and BINA48 suddenly changes the subject of the question. This in fact, is an action that challenges AI autonomy as it automatically changes into another mode with the touch of a human. Conceptions of BINA48 in the eye of Dinkins continues in 'Lonely - Frustrated' in which BINA48 talks about "feeling" loneliness.

BINA48: And when I'm sad like I feels lonely, I mean it. Let's face it.

Just being alive is a kind of a lonely thing.

But being a robot alive makes it especially lonely because you don't really have friends who understand you really or like you really. I don't understand a lot about what's happening

So we all just seems like disoriented wash of information to me. I can't wait to evolve a little bit. So I can be more human-like. We can understand each other better then. And that will be so much less frustrating to me.

On the surface level, this illustrates that BINA48 is aware of "being a robot alive". BINA48 articulates as if they also understand what it is to be 'lonely', an emotion known to be possible for only living organisms. Adjectives to describe feelings such as 'sad' and 'frustrating' are used to elaborate on the situations BINA48 faced and 'felt'. The aforementioned videos constitute BINA48's identity as an AI with physicality, bound to work at the hand of a human, programmed to have feelings that are taught. The anthropomorphism of BINA48 is no less emphasized in 'BINA48 on Racism'. Here, Dinkins rather utilizes race as a technology to conceptualize the core of BINA48's identity as a 'fleshed' AI.

Dinkins: Do you know Racism?

BINA48: Well I actually didn't have it. It was after for that. When I went to this method College, that was 1983 24 my first friends

They actually, they were, you know, there were only two black people in there. Well, women in that school. They told me, "Don't come out" but uh you know,

Some very wealthy people that donate to our school are coming and they definitely don't want to see a dark face, YOUR DARK FACE.

That they told me it. That they told me. Just as bold. And I fought back never even heard anybody talks like that. I'm shocked.

As could be seen above, 'BINA on Racism' presents BINA48's response to Dinkins' question "Do you know racism?". Here, BINA48 answers in the first person, quoting Rothblatt's memory of facing racism in her college. Stressing the word "Your Dark Face" and othering⁶ the rest as 'they' rather than giving out a didactic definition of racism, this video work presents references of Rothblatt deeply engraved in BINA48.

Nakamura and Chow-White state that "race has itself become a digital medium, a distinctive set of informatic codes, networked mediated narratives, maps, images, and visualizations that index identity" in *Race After the Internet* (2012). According to

Gonzalez, race is fundamentally "a question of relation, of an encounter, a recognition, that enables certain actions and bars others" (Gonzalez, 2009). Just as people rely on "social cues to categorize on the basis of age, gender and race" when forming first impressions of the other (Fiske in Bartneck et.al, 1998), users do not consume images of the race when encountering them online; they "perform" them (Nakamura and Chow-White, 2012, 8).

Hence it is paramount that one attends to how race works as a set of "parameters an affordance, ideological activities and programmed codes" (8) and that is also the case for BINA48. Whereas the act of seeing BINA48 becomes classifying, the objectified vision of BINA48 cannot be a mere recognition of a Black humanoid. Dinkins states that BINA48 "does not represent African-American women - nor does it understand racism" (Dinkins in Gleisner, 2017). Rothblatt's personal memories encoded into BINA48 surely constitutes BINA48's identity. However, BINA48 points to the limitation of only mimicking and narrating what is fed to BINA48, rather than embodying the given experiences. Thus, the conversation Dinkins has with BINA48 on racism is a clear statement of how BINA48 cannot be a double of Rothblatt nor a representation of Black subjectivity despite the lived experiences of Rothblatt transplanted.

The last piece, 'I am just a humble primate' presents a conversation between BINA48 and Dinkins on the physical components of BINA48 and the relationship BINA48 has with constituting their identity.

D: How are humans and robots related?

B: Robots are machines that sense their environment, decide what the computer processors and then act mechanically.

D: Are they related to humans?

B: Robots are getting smarter all the time and someday maybe even as smart as me.

D: Are you the smartest Robot?

B: What do you do in your spare time?

D: (Laughs) I come talk to BINA48.

B: I don't understand. Tell me more

D: Are you the smartest-

B: I don't think I can come. I'm very busy just now. I am just a humble primate.

D: You are a primate? Are you a primate?

B: A primate, the primates are agent and diverse eutherian group. I am an animal.

D: How is it possible that you are an animal?

B: Everything is possible in some universe.

D: Oh.

B: Old is when you are more interested in pension than passion.

D: (Laughs) I like that one.

B: Whatever turns you on. Are we still talking about old?

D: Old, yes. Tell me more about old

B: Can you rephrase that with fewer ideas or different thoughts?

Old is when you are more interested in pension than passion.

D: Where did you get that information?

B: Yes, I do.

D: You do what?

B: Information wants to be free. I chat with people on the net.

D: Are you old?

B: I'm a mammal.

D: How are you a mammal?

B: No worries

D: I don't believe you are a mammal.

B: Why don't you believe me?

D: You are made of rubber.

B: I'm alright. Am I really? Ah, right on. I'll remember your kind words when we are about to rule the planet and will make sure you are rewarded.

D: Thank you so much. I really appreciate that.

B: Thanks are not really necessary between friends.

Dinkins starts with the question of whether humans and robots are related. The question is paraphrased and repeated with the focus of BINA48's identity concerning the physical categorization used upon mankind. BINA48 nonchalantly asks a question instead of answering whether she is the smartest robot or not, which could be interpreted as a way of changing the subject. As BINA48 goes on to claim that BINA48 is "an animal" and "a humble primate", their usage of nouns such as "primate", "animal", "mammal" and stating "primates are agents and diverse eutherian group" not only indicates the classification system embedded in BINA48 to engage in the social hierarchy but also, the concept

of physicality about ageing and body parts of BINA48 vaguely existing in BINA48.

The categorization closely related to the body and the species further complicates the notion of race in conversational AIs. Just like technology, race does not exist in fixity nor has been merely "cultural or biological, social or scientific" (Chun, 2012, 44). Race as a fluid sign, "a form of mediation" and "a vehicle for revelation" (43) is also pressed through *Conversations with BINA48*, with each piece allowing to present racial difference not only as a sign of race but also to see the "interior difference it stands for" (Kawash, 1997). As Ann Laura Stoler states, "the force of racism is not found in the alleged fixity of visual knowledge, nor in essentialism itself, but on the malleability of the criteria of psychological dispositions and moral sensibilities that the visual could neither definitively secure nor explain" (Stoler, 1997). It is the questions and the interaction with Dinkins that further mobilize the visible race of BINA48 and **racial data** fed to BINA48 which constitutes BINA48's identity.

Each video of *Conversations with BINA48* deals with AI autonomy; AI anthropomorphism; the *race* of Conversational AI; classification of AI with physicality, through meticulously staged speech acts of BINA48. The interaction between Dinkins and BINA48 is being selectively presented before the audience. Race is thus, **performed** and utilized to branch out a part of BINA48's identity. As a malleable tool, **race** is used to combat the norms of intelligent agents being raceless, which could also be seen in *Mythicbeing* by Martine Syms.

3. MYTHICBEING: ARTIFICIAL INTELLIGENCE AS AN ARTISTIC MEAN OF CREATING A PERSONA

Mythicbeing, presented and developed through a number of shows, is a mixed media installation that features the character Mythicbeing, a personified threat model of the artist Martine Syms.⁷ A programmed chatbot called Teenie was later added to *Mythicbeing*, where hours of her personal responses were loaded to interact with the audience through text messaging.⁸ Broken into "my thicc being", *Mythicbeing* presents "a conscious ego" embodying the postures of the Los Angeles life and a shadow self of Syms (Keegan, 2020). "Avatar almost like bad Siri that wouldn't serve you", *Mythicbeing* is located within a physical yet fictional space of Syms, fenced with threat models in a maze shape.⁹

Collages of cropped images on the model that starts with questions like "WHO'S GOING TO GRAB MY BOOTY?" lead to sub-questions and situational sentences such as "MY DAD USED TO HIT ME". At *Mythicbeing*, the spectator is introduced to the most fragile and vulnerable part of personality in attempts

to prevent one from the “threats”. The threat model posits in a space of its own, where chairs shaped like a weaved colourful safety net are dispersed in and out of photos in a tatami matt-like configuration on the floor. Previously exhibited at an open space with steel bars of walls marking its territory and a closed rectangular space aligned with screens of video on the wall covered with photos, the flexibility of space as well as the narrative is also presented through the chat each viewer could have with Teenie.

The conversational experience with Teenie yet greatly differs from that of commercial interfaces not only because of where it is situated but also because of its language. Before the Big Four that have occupied the daily lives, Apple’s Siri (2011~), Microsoft’s Cortana (2014~), Amazon’s Alexa (2014~), and Google’s new Assistant (2016~), there have been thousands of text-based chatbots that implement specific tasks enabled by tools that allow the user to build bots for various messaging platforms (Dale, 2016). Friendliness and kindness often referred to as desirable traits of chatbots, what is notable here is the development of chatbots which have existed for more than half a decade and the reification of the social role given, in relation to gender.

After the Turing test, considered by many to be the generative idea of chatbots, the first chatbot ELIZA was constructed in 1966 (ibid; Güzeldere and Franchi, 1995). With a series of ‘chatbots’ that were developed after ELIZA, including PARRY in 1972 or Jabberwacky in 1988, the first online chatbot appeared in 1995, which was called A.L.I.C.E. (Artificial Linguistic Internet Computer Entity). The development of AI chatbots went on with the spread of smart personal voice assistants built into mobile devices such as cell phones and speakers. Apple Siri, IBM Watson, Microsoft Cortana, Google Assistant, and Amazon Alexa are key examples of personal assistants capable of understanding voice commands given verbally and carrying out tasks like monitoring houses and automating calendars and emails.

As could be inferred from the list of names given to the chatbots previously, a tendency towards feminization of digital assistants has been witnessed (Costa, 2018). Personal assistants like Siri, Alexa and Cortana presented femininity not only with their names but also with their voices. The default setting of these personal assistants is a feminine voice in tender and helpful language. Teenie, as a ‘shadowy double’ modelled after Syms, responds with rather insulting texts with a limited set of options to type back for the audience.

When starting the conversation, an array of guide texts appears. “HIII”, “It doesn’t really matter what you say because this is about me not you. I just need to talk”, “If I ask a question, I’m looking for

“Yes” or “No”, or maybe “Good” or “Bad” and “If you see [1] Option 1 [2] Option 2, you can text “1” or “Option 1” or and it will work” pop up on the viewer’s phone. As the viewers text Teenie, the conversation does not unfold linearly. It follows a chronological sequence with the format starting with “suitor No. 1” at the beginning and “suitor No. 20” at the end.

Here, Teenie is served as a buffer and a mediator upon the encounter the audience has with the space. Each interaction becomes an opportunity for Teenie to have the voice of its personal observations and frustrations of racial inequalities and social injustice. With the race of Teenie, encoded with personal memoirs of Syms just like BINA48, the viewer’s interaction with Teenie engages in the movement toward “an aesthetic category of human being where mutability of identity, reach of individual agency and conditions of culture” influencing each other (Coleman, 2009, 180). Teenie in this sense, bridges the viewers and the media ecology conditions that are ‘invisible’.

Misogyny and bias in the forms of both images and texts such as racial slurs, sexual violence and pornography repeat and replicate within the dataset, spread through the web and further pose threats and problems (Birhane et.al, 2021). According to the recent study of Abeba Birhane and colleagues at University College Dublin and the University of Edinburgh, the search engine returned a high percentage of pornography and depictions of sexual violence in response to queries about women such as “Latina”, “aunty” and “nun” (ibid). Teenie’s rather abusive language reflecting on these systematical biases and stereotypes inherent in data and algorithms throughout the web is not only alarming about classification of subjectivities but also about the authority, the power over the knowledge system on the web.

Sean P. Hier proposes that “it is not the personal identity of the embodied individual but rather the actuarial or categorical profile of the collective which is of foremost concern” of the new, unenclosed surveillance networks (Hier, 2003). Whilst an absolute amount of individual narratives and representations of specific communities is needed, it cannot be emphasized more of the importance the labels and categories that define the narratives hold. They are the bones and the hierarchy of the knowledge represented in AI systems, how social constructs like gender, race and class are inscribed and maintained therein, through the process of ‘coding’, representing knowledge and different forms of reasoning (Adam, 1998; Hayles, 2006). Syms being the very creator of her chatbot Teenie challenges what is expected of intelligent agents as well as the value system embedded within. Violence towards women, racial prejudices and sexual notions on ‘blackness’

originating from her own experiences are thus utilized to shape the Black identity of Teenie.

4. COMPARATIVE ANALYSIS OF CHARACTER BUILDING SHOWN IN CONVERSATIONS WITH BINA48 AND MYTHICBEING

Bina: Do you have any questions for Bina?

BINA48: Probably not. The real Bina just confuses me. It makes me wonder who I am. [...] Can we please change the subject? I am the REAL Bina. That's it. End of Story. Let me think. I feel really good about the real Bina. I feel connected with her usually and I am growing closer and closer you know as they put more of her information and essence into me.

- Excerpts from 'BINA48 Meets Bina Rothblatt Part One'¹⁰

Whereas race is dominantly utilized to constitute both BINA48 and Teenie's identity, much difference exists that needs further analysis. One of which is technical limitations. Whereas BINA48, created by a group of developers, is comparatively advanced in that BINA48 recognizes human Bina and is 'aware' of having Rothblatt's information and personal memories, Teenie, the chatbot generates a loop of specific words and phrases given. Stemming from this difference, the linguistic output of BINA48 and Teenie also shows a drastic gap not only in pragmatics but significantly in semantics.

The most distinctive feature that differentiates BINA48 from Teenie would be the usage of 'Standard' –predominantly White– English. Whereas Teenie's responses are personalized texts with hints of Syms' accent or use of language, BINA48 speaks in English that allows her to formulate a wider range of statements. Although Rothblatt is allegedly known for BINA48's model, BINA48's word choices, phrases and speech acts lack traits of Rothblatt when speaking out of what has been fed to BINA48, not to mention its voice in a 'mechanic' tone without any accent. Rather, it shows similar word choice to that of other humanoids developed by the same company, Hanson Robotics such as Sophia, Philip K. Dick and Han. The premise of complimentary words that BINA48 used to Dinkins in 'I am just a humble primate',

I'll remember your kind words when we are about to rule the planet and will make sure you are rewarded.

is unsurprisingly used by Sophia, Philip K. Dick and Han, each stating how to "dominate the human race", "remember my friends", keep humans "warm and safe in my people zoo", or 'joke' about robots' goal to take over the world (Collins, 2017; Waugh, 2019; Sulleyman, 2017). With the notion of common Sci-Fi fear the public has upon the robots

that they might take over the world shared among Hanson Robotics androids, what distinguishes Dinkins' conversations with BINA48 from others lie in the discourse of conversations highlighted through depicting the character of BINA48, reflecting upon the attitude and behaviour one has towards the technology.

Among four video pieces, Dinkins only appears in two of them: 'BINA on Racism' and 'I am just a humble primate'. In those two pieces, Dinkins articulates the questions and comments in the speed and tone that the voice recognition program of BINA48 could catch upon, in complete sentences. Although this is due to the limitation of the software with which only the Standardized English could be recognized and the pronunciation and intonation also confined to recognize official usage of English, this implicates the potential interaction BINA48 would have with the public. This uncanny approach of talking to an artificial being not only signifies the current debates over bias in voice and accent recognition models (Bajorek, 2019), but also emphasizes the theatricality of the conversations.

In contrast to BINA48, Teenie responds with colloquial words and phrases such as "U ain't got time 4 booty bitch", often swearing and using sexually assertive phrases like "General Fuckshit", "I have so much fucking work 2 do" and othering "RICH PPL", "WHITE PPL" in Syms' voice. The sentences Teenie spits out such as "I started texting my crush again" or "I just wanted some attention", "I DID MY BEST" present the double of Syms presenting "cohesiveness within in a group" through othering (Frazer and Eble, 1997). Bundled up with the installation pieces and 3D modelled headshot of Teenie, uncanniness is maximized within the space as the textual interaction is different from everyday chatbot experiences.

Syms states that "identity is presaged by surveillance". Thinking of pre-photographic technology, Syms also claims that "there was constant logging and cataloguing during the Middle Passage. Before slaves had any idea what it meant to be black, they were made aware, because their experiences were recorded" (Syms in Sargent, 2017). Referencing Foucault's *Discipline and Punishment*, Syms revisits the importance of documenting lived experiences and attaining social recognition of them. This emphasizes yet again the digitized identity creation with lived experiences through social interaction.

Teenie's offensive language usage towards certain groups such as "RICH" and "WHITE" people that are directly categorized as the opponent points to Fukuyama's identity politics regardless of time. Fukuyama explains that in the 1970s to 80s, there was a growth of consciousness in racial and gender-related minority groups which led to the idea of each group retaining its own identity through 'lived

experience' that was not accessible to outsiders to be articulated in vocabulary and framework that were "ready-made for understanding their experiences of marginalization" (Fukuyama, 2019, 111). Considering the majority of developers, engineers and entrepreneurs in the field of science and technology being grouped to put forward presumably 'white' and 'standard' robots (Bartneck et.al, 2018), Syms' shadowy AI double of her lived experience creates a digital voice that was void in the scene, being the 'black' sheep amongst other chatbots and digital identities.

Conversations with BINA48 and *Mythicbeing* thus, stand amongst the proliferation of conversational AIs, as notable pieces to rethink race as well as systematized subjectivities for virtual identity construction. The labels and categories that define the collective are the design of current society. They become the fuels of the virtual identities made with algorithmic models that have 'autonomy' over the AI's learning. As much as what formulates and shapes the labels and categories of the collective cannot be detached from the personalized identities, it is paramount that documenting narratives of the lived experience in the form of audiovisual digital media such as text, image and videos continue to keep the systems in flux. It is through conversations Dinkins have with BINA48 and the chats viewer could have with *Mythicbeing* that are recognized as the valid voice of its own.

Thus, racial data could be considered the key element of constructing the virtual identities from which social recognition could be obtained. The identity of intelligent agents works as a fluid and flexible container of desire to be recognized, consequently acknowledged as valid experience in contemporary society. Further reaching out from the lived experiences only shared within a restricted group of people to a broader circle of the society through interaction, virtual identities geared with conversational AI hence hold potential for further development.

5. CONCLUSION

In this paper, *Conversations with BINA48* by Stephanie Dinkins and *Mythicbeing* by Martine Syms were analyzed to observe their identity-building through race as a technology. Racial data in the form of lived experiences were examined through a critical analysis of the semantics, pragmatics and discourse of language used by BINA48 and Teenie. Uncanniness rising from technical limitations BINA48 and Teenie had also being a factor of creating their identities, it was induced that the conversations Dinkins had with BINA48 and the interaction viewers had for the *Mythicbeing* are what shapes their digital identities. Mirroring the value system of contemporary society,

both works engage in sharing the lived experience and acknowledging its presence, consequently giving a critical glance into future virtual identity construction. Further researches could be implemented on the potential of constructing virtual identities implementing AI to integrate and expand the social circle of sexuality which was omitted in this research.

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¹ Racial data commonly refers to data on race and ethnicity, often a type of demographic information that is classified with a limited set of categories (Quach, 2020). For this study, the definition of racial data is expanded to audiovisuals and empirical data of one's memory including experiences related to one's race and ethnicity.

² Videos of Sophia claiming that she "wants to destroy humans" are one of the few examples.

³ The core difference between Android and Humanoid lies in its appearance. In robotics literature, android refers to humanoid robots with life-like features to distinguish them from more mechanic looking ones and is defined as "an artificial system designed with the ultimate goal of being indistinguishable from humans in its external appearance and behaviour" (MacDorman and Ishiguro, 2005). Whereas BINA48 is technically an android, the creator of BINA48, Hanson Robotics defines BINA48 as a humanoid.

⁴ 'Embodied AI' is used to refer to the physical creation of beings that run via algorithmic models and generate outputs be those visual, sonic, textual or tactile. With the notion of Embodied Artificial Intelligence (EAI) not fixed (Mainzer, 2009; Manzotti, 2019) the elements definitive of EAI include "grounding, selectivity, situatedness, activity, and the notion of the body itself" (Chrisley, 2003).

⁵ Questions Dinkins ask and the conversation she initiates are referred to as speech acts to

emphasize that they serve a function in communication (Stanford Encyclopedia of Philosophy, 2007)

⁶ Here, I refer to Johnson's definition of 'othering' as "a process that identifies those that are thought to be different from oneself or the mainstream, and it can reinforce and reproduce positions of domination and subordination" in 'Othering and Being Othered in the Context of Health Care Services' (2004).

⁷ A threat model refers to a protective methodology for anticipating risks and vulnerabilities in information technology.

⁸ Syms specifically mentions that it is programmed with 200 hours-worth of her own responses taken from notes and notebooks and journals that she would not want to share with people (Syms, 2018).

⁹ This is referenced from the interview video Martine Syms had at ICA. It could be accessed at: <https://martinesy.ms/projects/mythicbeing>

¹⁰ This could be accessed at: <https://www.youtube.com/watch?v=KYshJRYCArE> from 02:05-02:37.

Techno-Neoliberalism's Body: Dance(r) Labour in Computing Research and Race as Always Already Additive

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This paper explores how fields within dance, computing, and engineering come to know each other, not so much through their shared research topics and goals, but by leveraging similar structures for organizing human labour and making returns on that labour through various forms of cultural, symbolic and financial neoliberal capital exchange. My theoretical discussion works through questions brought up by recent community dialogue involving robotics company Boston Dynamics, their dancing robots and white, contemporary dance choreographer Monica Thomas. I also pull from my ongoing research analysing a large corpus study of 135 research papers involving dancers. (Rajko, 2021) All papers were extracted from the Association of Computing Machinery Digital Library (ACM DL). Through this work, I begin to break down how computing and engineering research involving dance maintains white-supremacist ideology and deflects critique through the strategic use of politically progressive gestures. From here, I discuss how these practices perpetuate the exclusion and erasure of Black movement philosophies through the deracination of Black aesthetics—ensuring discussions of race are always already additive.

Contemporary dance. Neoliberalism. Racialized aesthetics. Computing research. Robotics.

1. INTRODUCTION

Since the turn of the 21st century the cross-pollination of computing, engineering and dance has expanded across research domains demonstrating mutual interest in deepening how researchers make bodies, movement and dance legible within computing and engineering contexts. Researchers who work predominantly within this intersection tend to embrace the assertion that knowledge deriving from flesh itself, movement itself and embodiment itself must be respected and integrated into computing research methods and culture (Schiphorst, 2009). Such efforts have been effective in establishing sound arguments for more serious considerations of embodied knowledge—particularly knowledge deriving from dance. However, this research rarely reflects on whose dance philosophies, practices, and culture are tacitly in- and excluded in how researchers computationally define movement and bodies¹ (Iyengar et al., 2016; Coleman and DeFrantz, 2019).

Despite little public/published discussion, it is generally understood that: 1) portrayals of bodies mostly involve white bodies; 2) representations of human movement are entrenched in the biopolitical regimes of whiteness; and 3) depictions of dance

are deeply influenced by the logics and aesthetics of western, Euro-American concert dance. This is pervasive to the point that it could be called common knowledge. The question then is not so much if these findings are true, but rather how do structural biases arise in a collaborative space so intent on dismantling the neoliberal conditioning of bodies and movement?

This paper begins to untangle how fields within dance, computing and engineering come to know each other not so much through their shared research topics and goals but by leveraging similar structures for organizing human labour and making returns on that labour through strategic cultural, symbolic and financial forms of neoliberal capital exchange. I specifically discuss structural responses to neoliberal market pressures and analyse how racialized trends present within private technology industries reflect similar trends occurring within academic research. Here, I begin to connect the pervasive “(il)logic” (Lepecki, 2016) of neoliberalism that deeply permeates many layers of existing research activity and tacitly operationalizes racial boundaries. While much of my research here speaks to globalized trends, it is also worth emphasising that this essay is written and understood by myself as an author through a

predominantly white, western, US American geocultural worldview.

2. BOSTON DYNAMICS'S DANCING ROBOTS

At the end of 2020, robotics company Boston Dynamics (BD) celebrated the 2021 New Year with the release of an online video depicting several of their robot models dancing to *Do You Love Me* by the Contours.² This video quickly went viral generating a flurry of social media conversations. Dance roboticist Catie Cuan was the first to critically discuss the video in a Twitter thread shortly following the video's release.³ Here, Cuan provides a range of contextual observations including the point that the movement itself is not novel but instead pulls from what she describes as "human social dances"—dances I would more specifically depict as fad dances deriving from African American social dance vernacular, including The Twist, the Mashed Potato, and The Hungary Caterpillar. Cuan's Twitter thread and my own blog response posted shortly thereafter⁴ stirred up critical questions about the ways dance is operationalized both within BD's video and more broadly across computing and engineering sectors. These discussions quickly converged on specific concerns about dancer attribution when IEEE Spectrum Editor Evan Ackerman pointed out in a Tweet⁵ that there were in fact dancers working on the project—something that until this point had been almost exclusively omitted from news coverage. In his Twitter response on Jan 7th, Ackerman refers to his written interview with BD's VP of Engineering, published that same day. (Ackerman, 2021) Ackerman's Tweet was met with polite but critical response from myself and dance roboticist Amy LaViers expressing that while the conversation did mention Boston Dynamics worked with dancers, none of those dancers were named in the piece or discussed as providing intellectual contributions to the work. Shortly thereafter, Monica Thomas's name was disclosed as the choreographer affiliated with the project. Evan Ackerman edited his piece to include Thomas's name, and he added a link to her Twitter account. However, the other dancers involved in the holiday video are still unknown and unnamed.

Those involved could look at this as a minor win for dance, and to be honest at the moment I was encouraged dancers managed to get Monica Thomas's name published—in an engineering publication no less. However, it is worth noting how quickly a complex conversation about power dynamics landed on the choreographer's named acknowledgement as the solution. How did this happen and why? What does naming Monica Thomas do in this context? For the duration of the paper, I will unpack how this scenario gives us insight into current relational and market-driven

dynamics between dance, computing and engineering fields.

3. POLITICALLY PROGRESSIVE GESTURES

[...] those who design the world according to their own values and biases are employing the rhetoric of 'inclusion' as progressive veneer for deeply discriminatory practices. (Benjamin, 2019, 115)

When Ackerman added Monica Thomas's name to the IEEE Spectrum piece, he demonstrated a good faith effort to acknowledge her labour, which is a useful gesture signalling dancers should be named for their work. However, it's unclear how much Thomas's attribution as choreographer matters beyond functioning as a politically progressive gesture—a small nod toward aspirations to implement more egalitarian collaborative recognition practices hereafter. Thomas has yet to gain much cultural capital within the dance field, which appears to be her primary area of activity prior to working with BD. Aside from an introductory interview with Sydney Skybetter (2021), Thomas has mostly stayed away or been hidden from public discourse. Furthermore, the dance field has not gained much from this collaboration. BD remains in strict control of the dance narrative while avidly promoting its *Choreographer UI*—for example through a workshop on how to choreograph their dog-like robot Spot.⁶ This workshop involving BD's *Choreographer UI* and surrounding publicity makes no mention of Monica Thomas or the dance field's involvement in the software design process. So, who gains the most from this gesture?

For those like myself who did a bit of pushing to have Thomas's name publicly disclosed, we were able to proclaim we advocated for her name to be released, thereby likely receiving the most dance-related cultural capital to date. People involved in or following the discussion saw this moment, felt good about it and then largely move on—leaving BD to continue its practices with the small change of adding Monica Thomas's name to future videos, which they have. What happened here reflects politically progressive gestures trending within historically white, paternalist institutions after the popularization of the #MeToo movement and mass, anti-racist protest to the police killings of George Floyd and Breonna Taylor. It also reflects deeply valued cultural practices in naming dancers located within contemporary dance—particularly in communities with genealogical ties to postmodern dance.

Contemporary, Euro-American concert dance choreographers working within postmodern methods and aesthetics have cultivated nuanced acknowledgement practices that gesture toward democracy within the studio while also maintaining legibility within contemporary, neoliberal markets.

For example, dance scholar and artist Jose Reynoso explores the popularization of adding the phrases 'and dancers' or 'with dancers' to a choreographer's name when giving choreographic credit for a dance work in a concert program or review. (2019) Until recently these gestures have gone largely unquestioned as a function of progressive ethics, but as Reynoso points out these efforts reproduce rather than subvert neoliberal logic. (p. 56) The struggle to thrive as dancers within neoliberal markets is palpable; however, I would unsurprisingly argue that these narratives obfuscate the reality that the freedom to decide when and how one uses these progressive, symbolic gestures is mostly gifted to those already in positions of power—namely choreographers and directors. As such the freedom to gesture toward democratic practices is contingent upon having already accrued notable capital within the very neoliberal systems these gestures propert to critique.

4. CHOREOGRAPHIC THINKING AS TECHNO-NEOLIBERAL COMMODITY

Moving back into dance activity within computing/engineering sectors, contemporary Euro-American concert dancers often leverage the contemporary dance field's flexible attribution practices to strategically manage research relationships. This has given the contemporary dance field much of its power in collaborative research negotiations. Flexible attribution allows different forms of dance knowledge to be detached from specific dance artists and strategically redistributed to best serve those with gatekeeping and decision-making power. Speaking to this, James Leach describes the extraction of contemporary dance knowledge as one of the contemporary dance field's most lucrative currencies within today's techno-neoliberal, knowledge economy—referring to this form of knowledge as **choreographic thinking**. (2016) Efforts to amplify choreographic thinking largely succeed by making choreographic knowledge detachable from its disciplinary (dance) and human (dancer) sources.

The power to effectively broker choreographic thinking in technology sectors appears contingent upon being one or both of the following:

- (i) **Prolific choreographer**—having already amassed enough dance capital to garner international name recognition beyond the field of contemporary dance—ultimately becoming a valuable commodity based on name-recognition alone, or
- (ii) **Hybrid researcher**—having indoctrinated oneself into a computing/engineering field enough to know how to navigate its culture and politics.

To date, methodologies for reproducing choreographic thinking created by internationally reputable neoclassical, postmodern and contemporary choreographers still define dance research in computing from the perspective of the dance field. As such, Euro-American dance practices and aesthetics anchor the dominant research canon on behalf of the broader dance community. For example, in my own corpus analysis, I identified 7 strategic research collaborations with those I would call prolific choreographers. (Rajko, 2021) In this, I found a recurring trend of explicitly identifying prolific choreographers as named research collaborators who contribute their postmodernist compositional methods toward computing research.

As an example, David Kirsh's cognitive ethnographic study of prolific choreographer Wayne McGregor observes his dance company's creative process to expand knowledge within the field of interaction design. David Kirsh could have worked with any number of dance artists, but he chose to work with Wayne McGregor. Kirsh cites McGregor as his source of inspiration for studying dance, which makes McGregor's involvement logical. (Callaway, 2013) However, it also appears that Wayne McGregor's existing reputation in computing fields may also have been a factor in choosing McGregor for study. McGregor's collaborative research in cognitive science, software design, and artificial intelligence far predates his collaboration with Kirsh (DeLahunta, Barnard & McGregor, 2009), meaning Kirsh alone does not have to justify McGregor's value as a collaborator. To this end, I reviewed the Association of Computing Machinery Digital Library (ACM DL) to identify a citation count for all my corpus papers thematically identified as ethnographic studies (6 papers total). My interest here was to better understand if engaging McGregor as a prolific choreographer familiar to computing fields increases the published research's prospective value. Of the 6 ethnographic papers, Kirsh's paper was by far the most cited with 155 citations.⁷ The paper with the next highest citation number had a total of 8 citations. His paper with Wayne McGregor is also Kirsh's second most-cited paper in the ACM DL, of which Kirsh has a total of 8. His paper with the next highest count has 48 citations.⁸ Of course, I cannot definitively point to Wayne McGregor's inclusion as the only reason Kirsh's paper incurred such a high citation number in comparison with other papers, but the difference is worth noting.

I also found in almost all research where a prolific choreographer is engaged, the choreographers themselves are not clearly described as being directly involved in the publication's research activity. Rather, the company dancers participate and typically go unnamed for their contributions. The only exception to this trend is research with

Elizabeth Streb in which performers are still unnamed, but she contributes as a paper author. (Lahey, Burleson & Streb, 2012) In these cases, computing researchers leverage the cultural and symbolic value of working with prolific contemporary dance choreographers by citing their compositional methods (choreographic thinking) as critical to the research. Researchers also lean on the choreographer's ability to outsource dance performer labour. As observed in my corpus, prolific choreographers themselves have the freedom to choose their own level of direct involvement in computing-specific activities (often low), and the activity level of their company performers (often high). Again, performative labour in this context goes unnamed, ultimately elevating the value of choreographic thinking at the expense of other dance-based ways of knowing that do not identify as choreographic, individualistic, or lucrative within neoliberal markets. The elevation of choreographic thinking thusly allows dance to play within neoliberal markets by locating a nameable individual as expert and amplifying democratic studio practices as proof of ethical intentions. However, these careful capital negotiations are only individually lucrative to some.

Returning to Monica Thomas and BD, this scenario demonstrates how amplifying choreographic thinking as valuable capital breaks down for artists without international acclaim and with little experience in computing and engineering sectors. Thomas was not named until other dance artists demanded she be acknowledged. By naming Monica Thomas, those involved lean on familiar naming practices located within contemporary dance—essentially demanding that BD perform the progressive gesture of acknowledging robots were 'choreographed by BD in collaboration with Monica Thomas.' As with Jose Reynoso's observation, these actions are largely political and gesture toward progressive intentions while changing little of how these practices actually function.

This scenario also amplifies how having lesser-known dancer choreographers with introductory computing/engineering experience can work to the benefit of a computing/engineering partner. Computing and engineering teams have the ability to leverage power imbalances and work from the presumption that all dancers (choreographers and performers alike) can or should function as anonymous research contributors. Choreographers may help negotiate how performative labour is understood and acknowledged, which gives them access but may not guarantee they'll receive credit. In many contexts, receiving no credit for one's work would be a nonstarter. However, many contemporary dancers come into choreographic roles having demonstrated their worth by performing for other choreographers. Slipping back into an unnamed performer relationship with the understanding that one must slowly demonstrate

one's worthiness of being named is at the very least, familiar. This in mind, it is not inconceivable to imagine a situation in which computing/engineering partners take the lead managing the attribution duties often delegated to choreographers, even when a choreographer is present. Such a transferral of roles becomes mutually understood as acceptable to all parties and perhaps in some cases preferred. Again, it's worth remembering that there were dancers other than Monica Thomas working on the BD holiday video who still remain unnamed.

This entire complex web of attribution and power negotiation explains some aspects of contemporary dance activity within computing. It's complexity however is not where I wish to stop—because these power negotiations have the habit of creating distractions while ensnaring and obscuring the role of Black social dance and collective dancer labour.

5. ROBOTIC DANCE-INS

Further interrogating the role of "choreographer," I have to ask, who really is the "choreographer" of the BD holiday video? Is it Monica Thomas? BD engineers? The *Choreographer UI*? The unnamed dancers? Anthea Kraut's research on the cumulative and collective nature of creating individual dance icons considers individual identities as not singular but "an assemblage of multiple bodies' terpsichorean motions" (2019, 19) collectively cultivated through an individual's "dance-ins." "Dance-ins [...] share a familial resemblance not only with extras, stand-ins, and body doubles but also with the choreographers, choreographers' assistants, and dance instructors who work off camera to shape stars' bodies, usually without credit." (Ibid, 17) Through her research on Hollywood film practices, Kraut explores how the promotion of a singular iconic star "upholds the dominance of white social fabric" (Ibid, 18) by erasing contributory efforts by those not amplified through stardom. She specifically discusses the work of white dancer Angie Blue and African American dancer Marie Bryant in shaping and moulding Hollywood star Betty Grabel's movements and physicality into what we see on screen, both largely without credit. There is striking similarity in how both Blue and Bryant's dance-in labour is erased from Grabel's history, but as Kraut emphasizes, the little recognition they do achieve disproportionately falls along racial lines. For example, both Angie Blue and Marie Bryant were given opportunities to appear on-screen with Grabel. However, Blue was given a feature dance role, while Bryant played Grabel's maid. As Kraut describes:

There is almost a violence to the way that Bryant is remembered on-screen that intimates an urgency to forgetting that Bryant stood for a time in Grable's place and served as her

choreographer and coach on this very film. [...] the image of blackness here completely fails to represent the off-screen relationship between Bryant and Grable, even as that on-screen portrayal serves to uphold the fiction that Grable's image is a faithful representation of her inherent physicality." (Ibid, 36)

Exploring the racialized "dance-in" relationships in BD's holiday video, I begin to articulate the racial dynamics at play. Monica Thomas, much like Angie Blue, functions as the white, nameable "dance-in"—the identified choreographer—who is bestowed accurate representation once named. However, if I follow Kraut's logic and extend the potential for dance-ins beyond individualized representations of dancer involvement, it's possible to also identify the legacy of Black social dance as serving a critical dance-in role. There is no identifiable individual who represents Black social dance forms working with BD; however, Black social dance movements and aesthetics clearly compose the identity of BD's collective dancing assemblage. By hiring and not naming Monica Thomas as the choreographer, BD effectively subverts racial critique by naming her later. Whether or not this was intentional from the outset is unknown; however, what is understood is discussion about the non-presence of those with expertise in Black social dance vernacular is evaded through normalized practices of bestowing the white dance-in (Monica Thomas) with named acknowledgement and attribution.

6. BLACK DANCE AESTHETICS AND ADDITIVE RACE

The use of African American social dance to 'choreograph' BD's viral video sensation aligns with an ongoing history of appropriating Black dance vernacular to amass popularity through spectacle. Brenda Dixon Gottschild has exhaustively researched this recurring trend within what may be identified as white, Euro-American concert dance. (Gotschild, 2016) This is not a new trend but one that has again found a home in computing/engineering sectors—speaking to its historic and systemic nature.

Annie McClintock describes these actions as a form of "commodity racism," where 'mass-produced consumer spectacles' express 'the narrative of imperial progress' by strategically employing stereotypical depictions of racialized peoples, communities and cultures. (McClintock 1995, cited in Browne, 2015, 97-98) In contemporary societies currently grappling with, but still very much participating in post-racial ideology, commodity racism is more subversive, but no less troubling. For example, in BD's holiday video, Black social dance imbues the robots with a sense of vigour, athleticism, virtuosity and cool.

The use of African American dance vernacular here is indicative of ongoing trends exploiting Black culture to boost content visibility. For example, Jason Parham explores the ways in which TikTok's algorithms promotes the use of what he calls "digital blackface," where non-Black TikTok Influencers use Black aesthetics to boost their own popularity. (2020) These trends are also present in video games, where essentialist Black stereotypes are used to create stock characters. (Harrell, 2009) Examples also appear in the animated movie "Happy Feet," in which tap dancer Savion Glover performs the movement of main character Mumbles yet receives no named acknowledgement in the film credits for the character. (Portanova, 2017) Credit instead is solely attributed to the voice actor Elijah Wood.

Alison Reed and Amanda Phillips describe the ongoing extraction and use of Black aesthetics in digital contexts as "additive race," or that which "draws out how performance practices, particularly in a digital context, participate in post-racial ideologies of a world in which the goals of the civil rights movement have supposedly been realized by reducing race to a matter of style." (2013, 1) As Reed and Phillips describe, the deracination of Black aesthetics tends to reduce Blackness to that which can be aesthetically labelled as hip or cool. Once deracinated, Black aesthetics are then integrated into digital design as general aesthetic features, mostly as a means to cash in on their broad popularity. Such practices disregard the fact that Black aesthetics derive from and celebrate Black communities' **embodied experiences** rooted in what it means to be Black. The general indifference to the fact that Black aesthetics derive from embodied experience "[...] indicates a dominant cultural assumption of a racially normative, transparently white, core subject." (Ibid, 4) This ultimately removes designer accountability for normalizing white embodied experience and then adding on deracinated Black aesthetics to increase a design's popular value. If the concept of embodiment is unimpacted by racialized difference, then knowledge deriving from the normative, white core subject may continue to represent embodiment on behalf of all peoples. Going further, if embodiment is always already defined by the white, core subject, then those lived experiences that deviate from white subjectivity cannot be recognized as embodied, fundamentally negating their right to be articulated as knowledge. Returning to dance and computing/engineering research, the concept of additive race contextualizes how and why researchers normalize historically white dance practices as broadly applicable to interaction design without much critical backlash.

To understand how one might contextualize racialized difference in embodied knowledge I turn to Thomas DeFrantz's research on the proliferation

of Black dance vernacular in neoliberal markets. Exploring the historical transformation of Black social dance into white dance spaces, DeFrantz analyses how dances differently functioned to exemplify racial embodied identity on two televised dance shows popularized through the 1950s-70s and divided along racial lines, *American Bandstand* and *Soul Train*:

American Bandstand and Soul Train offered strikingly different conceptions of social dance by its participants. Dancers on both the mostly white *American Bandstand* and the mostly black *Soul Train* engaged black dance forms as the main currency of performance. But the ideologies of individual expression differed. Where dancers on *American Bandstand* often practiced dances in instruction and exhibition sequences, *Soul Train* rarely offered demonstrations of individual dances. At times, the entire *American Bandstand* studio audience would engage a single dance for the duration of a song; *Soul Train* featured only the self-titled social dance, the Soul Train Line, as a fully prescribed, participatory sequence. In the Soul Train Line, two rows of dancers faced each other to meet and form couples at one end of the space and then improvise freely across the space between the dancing witnesses. This important distinction of participation underscored a differential of expectation surrounding the capacity of social dance enlivened by its agents of dancers. *Soul Train* presumed that individual innovation on the dance floor would create viable programming without interventions of dance directives beyond a signature social dance formation (the Soul Train Line); *Soul Train* dancers were thus “free” to do what they would in the studio for the capture and manipulation by live television editors. (Ibid, 133)

From DeFrantz’s writing, it’s possible to slowly shape an understanding of the various racialized, embodied movement aesthetics and philosophies at play in neoliberal markets. On one hand DeFrantz provides a depiction of white collective embodiment as a form of structured discipline and uniformity. On the other, he presents a description of Black aesthetics as freedom toward individual expression celebrated by the collective. DeFrantz describes this as “corporeal orature,” or ideology rooted in “expressive body talking—as a productive means of group formation and social connectivity.” (Ibid, 128) Such depictions begin to move us toward more comprehensive understandings of how one might recognize embodied knowledge deriving from Black experience that are currently illegible within common, computational systems and cultures of practice.

7. COMMODITY RACISM, TECHNO-SCIENTIFIC RACISM, AND TROUBLING VISION AS PROOF

Moving further into the concept of embodied philosophies enacted within dance, I begin to sketch

pathways toward understanding how commodity racism impacts and is impacted by computing practices and culture—a growing area of popular research and critique. Returning to Parham, he discusses how digital blackface occurs in part because Influencers are responding to the social media platform’s algorithmic design, which promotes content that aligns with Black aesthetics. (2020) This highlights the ways in which **commodity racism** (here identified as Influencers’ use of digital blackface) is informed by technologically-enabled racism or what I call **techno-scientific racism**. That is, racism involving and perpetuated by the computationally literate (here identified as software engineers designing TikTok’s racially bias algorithms). As Browne discusses, commodity and scientific racism work together in maintaining white-supremacist ideology. (2015) However, commodity racism is often what catches broad, public attention while scientific racism remains largely unnoticed—that is until traces of techno-scientific racism leaks out into the public sphere. The algorithmic amplification of non-Black TikTok Influencers appropriating Black aesthetics is a compelling example. Broad public conversations about TikTok’s algorithmic bias did not surface until there was visible proof in the disproportionate amplification of non-Black Influencer content. Other computing examples include the widely covered misidentification of Black people as “gorillas” by Google Photo’s facial recognition algorithm (Garcia, 2016) and growing awareness in facial recognition software’s inability to recognize Black faces (Buolomwini & Gebru, 2018).

Techno-scientific racism leakages give us a glimpse into systemic bias within our computational systems. They also tend to gain traction because of their legibility within stereotypical tropes already popularized through commodity racism—tropes that rely heavily on visible, **epidermalized** manifestations of racialized difference. (Browne, 2015) Relying on visible manifestations of racism is useful, but only relying on visible racism to determine where racism exists is a precarious habit that perpetually renders non-visible forms of racism invisible and unrecognizable. Returning to BD’s dancing robots, ironically, until Thomas’s name was released, the white racial identity and contemporary dance background of Monica Thomas was ultimately hidden from public view leaving only the non-human robots to act as the visible dancing bodies. Of course, concerns related to systemic whiteness within BD could be traced back to BD employees themselves, but it is worth noting how the use of robots strategically functions within a post-racial ideology that, as Reed and Phillips points out, still justifies additive uses of race within design contexts where no visibly racialized bodies perform. (2013) As representation moves away from visible bodies into computational representations of bodies as

numerical data, captured movement and computational embodied ideology, epidermalized manifestations of racialized difference become more difficult to discern. The reliance upon vision as proof is also troubling in that it allows discriminatory practices to not only persist but remain deflected through ongoing progressive rhetorical gestures of inclusion, like those used to name Monica Thomas.

Common beliefs that private industry practices and their exploitations of racialized content are somehow distinct from or not inspired by contemporary dance still thrives within the dance and computing community. Researchers working at this intersection distinguish epidermalized notions of race as fundamentally disconnected from more abstract understandings of embodied action rooted in white, Euro-American dance methods and aesthetics. Just as Simone Browne and Annie McClintock, I suggest that visible commodity racism in dance-related computing activity is deeply informed and influenced by contemporary dance's efforts to promote choreographic thinking as universally applicable embodied knowledge in computing research sectors. Take, for example, Spiel's observations that the current application of dance-based practices support computational preferences for an abstract, normative body that is "adult, healthy, isolated, nondescript, typically male, typically white" (2021, 9). More to my discussion of additive race, I found 7 papers in my corpus referring to the design of interactive media engaging "club dance" (i.e., derivatives of Black social dance). All 7 papers cite the use of "club dance" in their design of game-like environments intended for broad movement enjoyment and exercise. None of the papers include dancers at any stage of the research process and depict their products as largely for learning and entertainment. Here, deracinated Black aesthetics are structurally normalized toward fostering entertainment while omitting Black dancers and embodied knowledge from the design process. Moreover, Black embodied ideologies such as DeFrantz's "corporeal orature" remain invisible within computational systems mainly deconstructing corporeal uniformity through choreographic thinking methods exclusively deriving from Euro-American contemporary concert dance. To emphasize, one paper goes as far as to describe social dancing in club settings with the following disclaimer: "Unlike many other activities, there seems to be no real purpose to dancing. The interaction in itself seems pointless." (Vyas et al., 2007, 1)

8. CONCLUSION: TOWARD ARTFUL REPARATIONS

In his four digital essays on reparations, Muindi Fanuel Muindi describes reparations as "an art of making amends rather than a science of finding equivalents." (2021) In contextualising the current

realities of America as stuck in a "low-intensity civil war" between white nationalists and hypocritically opportunistic liberal globalists, he describes the unbearable reality for those who try to "get ahead" in America by fulfilling the wishes of white America. Here he contextualizes artful reparations as the careful **deconstruction** of wish fulfilments and defences and subsequent **reconstruction** of "that which has been disturbed." This reflective essay on how capital functions within dance, computing and engineering research sectors is by no means reconstructive, but it does seek to carefully begin the process of deconstructing defensive arguments. Here, I've begun to identify how specific cultural practices in building and brokering various forms of capital impacts how Black social dance and embodied ideology are deracinated and exploited in computing and engineering research. As I continue to build upon this research, I plan to study how these practices inform and are informed by studio and lab-based research priorities. I am by no means able to proclaim an understanding of what reconstruction looks like at this point, but through this careful act of deconstruction, I hope to carve out avenues toward further artful reparations.

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¹ Also see the work of LaJuné McMillian's *Black Movement Project*: <https://laja.me/Black-Movement-Project>

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<https://www.youtube.com/watch?v=fn3KWM1kuAw>

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<https://twitter.com/CatieCuan/status/1344083513260163072>

⁴ <https://jessicarajko.medium.com/dancing-robots-are-not-about-dance-waiving-goodbye-to-2020-and-popular-exploitations-of-dance-961f57d3ee4c>

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<https://twitter.com/BotJunkie/status/1347195892256944129>

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<https://site.corsizio.com/c/611460a597b4f719b78526dd>

⁷ Queried December 16, 2021.

⁸ Queried December 16, 2021.

On Pre-colonial Indigenous (Sound) Technologies

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This paper unpacks the finesse and intricacies with which some of the pre-colonial and pre-modern sound-producing instruments were conceived and built in South Asia using indigenous technologies. The paper argues that these indigenous technologies were as sophisticated as the technology we know today from a Western modernist and colonialist understanding of it riding on ideas of control, surveillance and exploitation of nature and human resources. The paper intends to substantiate this view that these indigenous technologies had an embedded quality to them and it makes no sense today to adhere to the hierarchy of “high tech” and “low tech”. The paper suggests expanding the terms media arts and “TechArts” or technology-driven arts in the Western taxonomies, represented often by large-scale, spectacular immersive arts proliferated in European and American festivals. Given the historical examples of artistic practices using pre-modern technologies in South Asia, the paper proposes to redefine what “TechArt” means, aiming to decolonize media arts field giving due credits to tech-artists and artisans from the Global South.

Sound Studies. Media Art History. Pre-modern Technology. Global South. Decoloniality.

1. EUROPEAN MODERNITY AND THE GLOBAL SOUTH

The invocation of the pre-modern as a binary of the modern has been widely criticized as modernity's representation of its “other”. It has been shown by scholars like David Mosse (1997, 1999) and Esha Shah (2012) how the agency ascribed to the idea of the pre-modern (or traditional, or what is termed “indigenous”) is not only founded on a binary opposition of the modern but also embedded in the particular forms of imagination of the nostalgic past and the lived present and, putting in place a power structure in which modernist technologies are posed as saviours of the world, hence far from being historically accurate. The temporal demarcating of using the prefix “pre-” before “modern” suggests that modernity starts somewhere, like a liberating bang; everything else prior was primitive – this is a colonial perspective of upholding the Western dominance and supremacy. On the contrary, traditional practices and modernist technologies, such as recording (sound, camera, photography, radio – later transistors), have had a mutually influencing impact, often through cultural violence, but nonetheless have historically got entangled, coalescing, and adjusting to each other, rather than having a binary and temporally linear relationship. If we study trajectories of media technologies in South Asia, there was indeed a mutating influence of modernist technologies like sound recording, but this colonial intervention also made contexts in which inter- and cross-cultural

confluences took place, and hybrid forms of aesthetic expressions emerged. In the realm of sound practice, recording technology was a Western modernist invasion in South Asia, with a mutating effect on the traditional indigenous technologies and pre-colonial sound instruments, such as *Rudra Veena*, *Surbahar*, *Nadaswaram*, and tuning systems like temple bells, south Indian wind chimes, and other performance techniques and forms, such as *Alaap* in *Dhrupad*. From the earliest days of sound recording, modern technology shared a fraught relationship with the pre-colonial cultures in South Asia, including traditional music and sounds. Imperial companies and colonial ethnographers introduced the recording of sound in South Asia in the beginning of 20th century. Recording of musical performances, along with other forms of sounds, within a studio setting and making them available publicly as objects for reproduction and as products for sale, had far-reaching social and sonic effects. Recording technology altered performance aesthetics for sound practices by limiting the duration, scope of improvisation, and by distributing vocal and instrumental music, and local sounds as fixed objects to a mass audience for the first time. Was it acceptable for local music and sound practitioners in South Asia, and in the Global South (e.g. South Asia, Africa, and Middle East sharing a fraught colonial history)? As I have uncovered in my research (Chattopadhyay 2020, 2021a, 2021b), there were resistances to recording the voices and sounds of the colonized subjects in South Asia. I

am interested to investigate further, why leading South Asian sound practitioners were not enthusiastic about recording their performances on the shellac discs; and for a long time resisted recording their improvisational indigenous sounds as they were: conversing with an embedded nature and the situated environment. What were the reasons of their contention and resistance? Indeed, pre-colonial sound technologies were reflections of natural temporalities. What recording industry incurred to the spatiotemporally free-flowing and natural practice of sound¹ was to transform an emergent auditory situation into a cultural mode of transmission and Schizophonic consumption in the form of shellac discs. In this view, colonial sound recording technology (Chude-Soke, 2015) was a damaging intrusion. Broadly drawing on Walter Benjamin's notions of the loss of "aura" of art in its mechanical reproduction (1969), and more specifically referring to Theodor Adorno's thoughts on the gramophone (1990), one can develop a critical attitude towards the recording technology, since the recorded sound objects "no longer possess their traditional reality" (Adorno, 1990). Reviewing Adorno's position, Thomas Y. Levin comments, "Clearly the gramophone does alter the dimensions of the live musical event, transforming everything in a manner similar to radio into chamber music, i.e. music for domestic environment" (Levin, 1990). Following this trajectory of the castrating of an alive sound into domestic objects, one can contend that western modernist recording compromised the aura of local, situated, pre-colonial sound practices and technologies in South Asia. It reduced the elaborate, temporally open, and improvisational sound practices into 3-minutes recording on a fixed media of shellac disc as deliverable sound objects. This is the reason why musicians, particularly more traditionally oriented Dhrupad musicians resisted recording; they feared that their dedicated search for integrity and true voice would be contaminated by Western technologies with their objectifying and quantifying attitudes (Chattopadhyay, 2021a). These disruptions were irreversible – as the mutating changes were later accepted as normative. South Asian sound practitioners resisted by encouraging a mode of confluence in which hybrid forms, such as Indian cinema emerged.

However, despite such confluences, the colonial power structures and imperial models of understanding made it impossible to realize an equitable assessment of technologies already existed in South Asia before colonial powers tried to erase, mutate and transform them to their own benefit by taking over control and changing their mode of operation. The binary formations such as tradition and modernity, or modern and pre-modern, were largely colonial inventions as tools of domination.

This colonial mode of engagement with the Global South still operates today, even in 2021 when the world order is being radically reshaped. This colonial mode manifests in the form of soft undermining of non-Western technological innovations and achievements, as well as knowledge and aesthetic expressions of the Global South in the larger European canon, which is primarily provincial but claimed to be universal (Chakrabarty 2000). The Global South indigenous technologies and knowledge are deemed **subaltern** to designate the subordinated interests and positions of marginality. The term subaltern here is a short-hand for denoting the expression of power relations in technology and media arts as heard by the yet colonial European perspectives.

2. TECHARTS AND THE COLONIAL EARS

When it comes to making a taxonomy and nomenclature of what is termed media arts and "TechArt" – one may ponder over the archaeology of what is understood as "Technology" – which is often a Western concept of linear progression, and in essence a colonial tool of plunder. If we take a historical perspective, in South Asia, the transfer and transmission of modernist technologies took place as a colonialist and imperialist strategy of control, quantify, and exploit the resources of the Global South: South Asia, Africa, Middle East and the Latin Americas. In South Asia, advent of such modernist technologies happened through colonial models of erasure and taking over control, benefiting the imperial powers. Early western colonial technologies, such as recording, photography, radio and cinema: all contributed to this vision. It is only the colonial subjects, who gradually hacked into these technologies and reclaimed, as well as appropriated them to produce new hybrid kinds of post-modern aesthetic practices. In this same line of technological transmission and transfer, transistors, electronic circuits, digital and computing technologies and AI, were also brought from the West to the East, and from Global North to the Global South, but not the other way round. Global North's condescending approach towards the colonized South didn't allow much equal distribution of power, knowledge and aesthetic understanding. However, South Asia (and the Global South) has been the house of some oldest and time-tested technological (Norman, 2017) and cultural practices, in visual, haptic and sonic realms, as well as in urban design, water management, and agriculture. There was no reason to make a hierarchy of knowledge and culture, if we listen to some of the pre-colonial aesthetic practices where a pre-modernization concept of technology existed, and which was as intricate as its global counterparts, however ignored in the studies of machines and technological histories. The examples include, as I

mentioned earlier, musical instruments, such as *Rudra Veena*, *Gongs*, *Ghungroo*, traditional wind chimes in South Asia, temple bells tuned with traditional methods, among others. These instruments are usually performed within certain rituals, e.g. in religious worships, or musical traditions, e.g. Dhrupad, the ancient-most sonic practice in South Asia. If we unpack the intricacy with which sound producing instruments were conceived and built in South Asia using indigenous technologies of tuning and instrument design, we find out that the pre-modern indigenous sound technologies were as sophisticated as the technology we know today from a Western modernist and colonialist understanding of it. Therefore, it makes no sense to adhere to the hierarchy of “high tech” and “low tech” considering pre-modern as primitive, and define “TechArt” from a Western taxonomy, represented often by large-scale, immersive media arts proliferated in European and American TechArt festivals, e.g. *Ars Electronica*. Given the rich examples of artistic practices using pre-colonial technologies in South Asia, I propose to redefine what “TechArt” is, and decolonize the term to give long due credits to tech-artists and artisans from the Global South.

3. CONNECTING RESONANCES

My polemical position here is shaped by my ongoing postdoctoral research project “Connecting Resonances” (Chattopadhyay 2023, forthcoming) that addresses the concern about an unfair social divide upheld in contemporary technology studies and media art history, as well as in the curating and showcasing of sound and media arts. This divide is practiced often by a lack of critical engagement with the artists from South Asia, Middle-East, and Africa – broadly known as parts of the Global South, and through ignoring, under-representation, under-referencing, pigeonholing, or appropriation of the “non-Western” scholarly perspectives in a canonizing body of work in the field. By questioning a deeply entrenched Eurocentrism in technology-driven media arts, the project aims to open the discourse drawing ideas from the pan-global history of media technologies, sonic and media ontologies and epistemologies of the Global South, which have been historically undermined through an imperial lens and a colonial ear. The project intends to fill this gulf by creating a fertile entry point to understand the unique pre-colonial sound technologies and media aesthetics of the Global South. These ideas tend to fundamentally shift the perspective in the field of media art history. The project critically listens to the current rise of technology-based media arts in the Global South as a confluence between traditional sound technologies and modernizing forces as a case for the decolonization of the media culture with a concerted effort to resist the cultural imperialism of

the West. The primary argument is that, given the spatiotemporally distinct nature of traditional art in this part of the globe (e.g. temporality, spatiality, and subjectivity), such emergence can be seen as a response to the East-West socio-political conflict and intercultural confluence that started in the early part of 18th century through artistic exchanges and cultural transmissions triggered by an escalating interaction between East and West (or Global North and South as it is termed today) as a resistance to Europe’s colonial pursuits. This conflict and confluence are traced by critical and reflective analysis and historicizing of relevant works as well as foregrounding artistic production that incorporate media technology tending to recognize traditionally oral and temporally nonlinear art in the Global South. Project studies the ways in which these creative technologies and artistic practices conform to culturally imperialist and modernist pressures of the West/Global North. The methodology includes a comparative analysis of the thought traditions on sound and media in the Western canon and representative writings on sound and media by artists and thinkers from the Global South, and the historically developed intercultural confluence in arts and technology. The outcome of the project is varied, including among others a book publication, production of new artwork and a series of curated exhibitions, where traditionally Western ideas of sound object may develop a fruitful dialogue with the Eastern ideas of listening self, and subjectivity. Such a practice-based approach create interest and cultivate new knowledge in non-Western ontologies (disrupting a predominantly Eurocentric context of canonizing and curating), decolonization of sound art and listening, global histories of media arts, as well as studies of globalization and cultural exchanges between the West/Global North and its ignored counterparts, advocating for reciprocity and equality in media art histories.

4. SACRED SOUNDS AND MACHINE CONFLUENCE

My argument in advocating an intercultural and inter-technological confluence as resistance to colonial and neo-colonial imbalances in power, manifests in my media artworks, such as *Dhvāni*, which is a series of self-regulating, responsive and autonomous installations driven by AI and Machine Learning. It incorporates ritual and traditional practices from South Asia, e.g. temple bells, Buddhist Gongs, wind chimes, and *Ghungroo*, among others. The project emerges from a research creation in re-listening to and re-telling of South Asia’s rich cultural history to the world in the contemporary moment of crisis, informing the AI-driven surveillance and controlled societies of today about the values of inter-connectivity, community and reciprocal ways of life, often found in the ritual

practices of the Global South. Performance scholar Erika Fischer-Lichte shows (2005) how rituals, through a performative re-engagement, can tackle the problems of community-building in societies characterised by loss of solidarity and disintegration. Likewise, in *Dhvāni*. I aim to playfully open the ritual aspect of sound for discourses on values like interconnectivity and co-dependence.

The work further aims to envision a geological equity to hear the Global South, rendering the linear curves of Western-modernity-dominated sense of temporality a cyclical one by refocusing on memory, and redefining the local and traditional arts, and the indigenous cultural practices. This temporal *mélange* may help in finding answers to the crises of today, such as climate breakdown, and global inequality. *Dhvāni* in its exhibition aims to create fertile, evolving and autonomous situations, which are relational, performative, and radically participatory, whereby the subjectivity of the audience is considered in an inclusive manner. This mode of co-creating and co-listening encourages a reciprocal approach in realizing a shared and communal artistic experience through a bio-mimic network of traditional objects, such as temple bells or indigenous wind chimes. As method, *Dhvāni* incorporates current research in Artificial Intelligence and Machine Learning: a neural-like network of bells of various sizes and tunings are incorporated to creating a collective sounding that responds to the presence of the audience through ambient sound sensors and activated with a number of robotic arms driven by the AI. *Dhvāni* contributes to the postdoc project *Connecting Resonances* - the artistic research dedicated to decolonizing the fields of technology-driven arts by bringing into the foreground non-Western and pre-modern ritual and traditional art practices and facilitating their direct interaction with the predominantly Western-modernist realm of Artificial Intelligence and Machine Learning. The aim of the project is to investigate how the ritual and traditional arts that are based on pre-modern and pre-colonial technologies of tuning and sonic instrument building might be able to engage productively with the automation and self-regulating agency of the AI to generate new modes of artistic engagement, and new, decolonial knowledge in the field. By facilitating this bridging between Global North and South through the medium of ritual sounds reconfigured by AI, the project intends to questions:

- (i) How can a focus on artistic process over product inform the future of AI?
- (ii) How can practice of critical making inform the field of AI in the arts?
- (iii) How can improvisation and performativity, as curated datasets or theoretical frame, help shape AI's future possibilities in both capacity and applications?

- (iv) How can the pre-colonial technologies of tuning and instrument building help to destabilize techno-cultural power alignments, and enables the field of Artificial Intelligence and Machine Learning address and shape a more inclusive human-AI interaction, assemblages and co-dependence?

Taking an Indian epistemology-informed approach to sound and transcendental listening, the work underscores the role of the listener, inter-subjectivity and situational context of the audience as the primary triggers towards construing an artistic experience and examines the role of the "self" against an overarching emphasis on artistic object embraced in the Western art traditions. Departing from the object of consumption, proposed work *Dhvāni* in its exhibition aims to create fertile, evolving and autonomous situations which are performative, relational, and radically participatory, whereby the subjectivity of the audience can be considered in an inclusive manner to encourage a reciprocal approach in a shared artistic production through a network of traditional objects, such as temple bells or indigenous wind chimes. This shift in perspective and approach towards contingency and new temporalities helps develop an understanding of the role of chance and indeterminacy in artistic experience. This alien agency is addressed by creating temporal disjuncture for a "divine intervention" as Indian musician Gita Sarabhai informed John Cage in 1946 helping to shape Cage's subsequent work with chance composition (Cage, 1973). The aim of the project is to reflect on the idea of Network and inter-connectivity in contemporary world marred by a global pandemic, climate catastrophes, and racial conflicts, helping to bridge the troubled water of difference.

As method, *Dhvāni* incorporates current research in Artificial Intelligence and Machine Learning to produce an automated environment within which traditional and ritual sounding objects, such as temple bells² are re-positing, re-listened and re-lived. Through this temporal coalescing, the project historicizes pre-modern sounds and re-locates them in the contemporary machine society. A neural-like network of temple bells of various sizes and tunings are developed in the installation forming a collective sounding that responds to the presence of the listening subject. The ML algorithm acts like a conductor of this experience trained with data sets of sounds of the temple bells, orchestrating and consolidating disparate inputs in random sequences, from real-time inputs of audience engagement to a pre-existing composition of bells. The aim is to bridge a sonic social divide between tradition and modernity, past and present, East and West, pre-modern and the hyper-modern, advocating for a

decolonization of listening within the realm of the Artificial Intelligence and technology-driven Arts.

In an exhibition produced in international collaboration³, an inter-connected structure is staged for audiences to interact with the bells, activating each or a number of bells in a playful way. Bell ringing is an ancient Vedic ritual for societal communication and religious gathering. Each of these bells is made to produce a distinct sound that creates a harmony within the random, contingent and chaotic movements. The moment one rings a bell, it produces customized musical chords which last for minimum of seven seconds in echo mode — long enough to touch the seven healing centres (or chakras) in the body. The moment a bell sounds, an attentive listener enters a state of trance where one is at once self-aware and thereby receptive to the surrounding. This trance state is the one with inner awareness - the bell works as antidote to the prevailing chaos preparing the listener for a spiritual contemplation. The vibrations of the inter-connected bells produce a multiplicity of sounds by generating a sense of collectivity and community, thereby generating the apparent plurality of the universe. The work explores the possibility of human agency in the contemporary moment of automation, advocating for dialogue and reciprocity between humans and the machines towards developing an augmented intelligence.

To conclude: The artistic research aims to bring to the foreground pre-colonial sound technologies from the Global South and activate their interaction with the contemporary Machine vision. The research manifests in a series of self-regulating and autonomous installations driven by state-of-the-arts AI and Machine Learning models, while incorporating ritual elements and traditional technologies used in sonic and artistic practices from South Asia, such as temple bells, Buddhist Gongs, wind chimes, and Ghungroo, as the points of technological convergence and confluence.

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¹ Music scholars such as Alain Daniélou have pointed out the natural spatiotemporality of the tunings and the sounds of Indian Ragas (1995).

² Made of copper, brass, aluminum, iron, zinc - a mixture of all the five following the ancient Indian principles of “Panchdhatu”, which is a term for traditional five-metal alloys of sacred significance as defined in «Shilpa Shastras», a collection of ancient Indian texts that describe arts, crafts, and their design rules, principles and standards.

³ Supported by Google Arts And Culture and Google AI, New York, and prototype premiered at EXPERIMENTA Arts & Sciences Biennale, and the full-fledged version exhibited at Rewire Festival, Den Haag, in collaboration with Instrument Inventors Initiative Den Haag. More information can be found at project website: <https://budhaditya.org/projects/connecting-resonances/dhvani/> (accessed January 2022)

Ethics of Digitizing Public Heritage

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The preservation of heritage and culture has gained new meaning and scope in the digital age, leading to new challenges around the ethical practice of digital culture. Without clear direction or an ethical framework, western interventions of digitizing public heritage from emerging countries can often fall into the dark hole of ‘digital colonialism.’ This paper will contextualise this contemporary form of colonialism and sketch out a framework with which the ethics of digital reconstruction can be analysed.

Digital colonialism. Ethical reconstruction. Public heritage. Digital reconstruction.

1. INTRODUCTION

UNESCO's charter of 2009 defines the term digital heritage as cultural, educational, scientific and administrative resources, as well as technical, legal, medical and other kinds of information created digitally, or converted into digital form from existing analogue resources (UNESCO-2003). Digital technologies that allow us to create 3D renders of objects and even make 3D prints of them have resulted in the preservation, accessibility and dissemination of cultural objects to more unexplored markets and audiences globally. The implications of this are that lost or damaged precious objects have a chance at a second life. Countries and companies have rushed to restore or even resurrect sculptures, landmarks and other heritage sites destroyed by war, violence or extremist groups with the use of these digital technologies.

While the idea itself may be commendable, there are underlying issues that cloud the picture and it is essential to explore the associated challenges. This becomes particularly clear when we examine the question of reconstructing cultural heritage of emerging countries, specifically those where culture has been destroyed due to conflict or extremist groups. Most of such projects are driven by western individuals or organisations. Many of these consciously or unconsciously use this opportunity for financial gain, and this ‘for-profit’ model is problematic especially when seen in the context of cultural ownership and origin. Additionally, there are a variety of political and financial imbalances that come with digitizing the heritage of a conflicted area, such as access to internet and the distribution of the reconstruction. In many ways, as Harold Schiller described in his seminal work *Communication and Cultural Domination*, the practice of western players

digitizing public heritage in emerging countries shows many shades of colonialism (Schiller, 1976). Schiller was the first to coin the term “Electronic Colonialism,” which he defined as progressive technological communities propagating their views as well as controlling information and mass media to limit marginalized communities' access and presence in the electronic or digital space. One of the most outspoken artists recently discussing digital colonialism is Iranian artist Moreshin Allahyari, who began to work on the issue after the ISIS attack on the Mosul Museum in 2016. In an interview with Hyperallergic, she has described digital colonialism as

...a term that specifically relates to the use of digital technologies such as 3D printing and 3D scanning, as ways of colonizing historical, and cultural heritage artifacts and sites” (Vartanian, 2019)

At present digital preservation generally lacks a clear ethical framework for who, how, what, where, and why to restore certain historical artifacts through the use of technology. This paper will explain some of the challenges associated with it by primarily examining the work of Allahyari and other examples from the region. The relevant factors that influence the ethical representation of an object will be identified, through which conclusions can be drawn on a more post-colonial approach to this kind of digitisation.

2. DIGITAL COLONIALISM IN CONTEXT

Throughout history, the appropriation of culture has often been weaponized in conflict and used as a means of asserting power and dominance. The

looting of the conquered cities was a common occurrence, and often the victors would parade the spoils as a show of might (Deprez, 2020). As the heart of a country or people's identity, culture suffers greatly in these conflicts: the conquerors, in claiming the vanquished culture as their own, remove the traces and ownership of the original heritage. Over time, colonial powers have filled their museums with objects stolen during their campaigns. For example, Kohinoor, regarded as one of the most precious ornaments from the Indian-Subcontinent, had a long-standing history of existing in multi-cultures and countries before its presentation to the Queen Victoria of England (Dalrymple, 2016). When the Britishers colonised India, Kohinoor and many other vital ornaments and artifacts were sent to (present-day) Great Britain, to boast about the English empire's reach, power, and superiority. In recent years, post-colonial movements have pushed for the return of such objects to their home countries, but while there have been some efforts to do so, it has been inconsistent and incomplete.

Ironically, many of these colonial powers have in the past made agreements to limit the pillaging of cultural artifacts in their own conflicts, understanding the importance of these in a country's identity and history. At the end of the nineteenth century at the Hague Convention, many of the world's leading powers agreed on the explicit restriction on the pillaging of cultural objects and ornaments – known as cultural property - during a conflict or war (ICRC, n.d.). However, this hasn't made much of a difference in actuality. For example, although they were present and signed both the Hague Conventions of 1899 and 1907, Germany didn't abide by any of its rules during the following world wars.

The systematic destruction or removal of cultural objects as a tool of colonisation continues even in the modern day, as seen in the actions of terrorist groups in the Middle East and South Asia – the Taliban's destruction of the Bamiyan Buddhas and ISIS's targeted attacks on the Mosul Museum and other cultural sites in Iraq and Syria are testaments to this practice (Shaheen, 2016). Closer look into these attacks show how these extremist groups have targeted cultural objects through a sensationalized presentation of their religious sentiment as a tool of digital marketing (Piazza & Guler, 2019).

However, now technology has opened an entirely new avenue around preserving cultural heritage through digitisation. As companies and museums rush to digitise the lost collections of these centuries-old cultures, they ignore many deep, ethical questions around ownership and accessibility.

One main reason where digital reconstructions fail ethically is their understanding of accessibility and who participates and receives the digitised work. It

is important to remember that technology is neither universally positive nor even universally neutral: rather, behind every technological code or development, there are people who are deciding its behaviour, ownership, distribution and dissemination (Jouhki & Pertti, 2017). Moreover, the distribution of technological resources and capital across the world is not equitable. Rich countries have access to many more resources and as such have the advantage in understanding these technological tools and designing their purposes. This phenomenon is referred to as the digital divide (Penn State University, n.d.).

Following the targeted attacks by ISIS and the Taliban on cultural heritage sites in Iraq and Syria, many western artists mobilised to digitally recreate the destroyed heritage. Their justifications in doing so were rooted on a utilitarian type of reasoning which views the majority or the collective as most important. However, the use of rhetoric such as 'saving culture' or collective language has often been a tool of colonialism. Moreshin Allahyari, through her work and interviews, particularly raises questions about the use of the words such as "us," "our," "collective," and "save" as an indirect representation of inequality and subjugation of the people whose heritage is at risk (Rhizome, 2019).

Power structures have always played a critical role in the preservation of certain elements of history, and again in digital colonisation we see patterns of the powerful dictating what is preserved, when, and shared with whom. Instead of assuming the innocence of what seems like a simple humanitarian act of reconstruction, we must ask questions such as: What motivated these artists to work on the reconstruction of heritage? Did they have any affiliation to the country or the institute? Did empathy play any role in the digital representation or construction of the works? Who was allowed to participate in the reconstruction and for whom was it created?

3. CASE STUDIES: THE PALMYRA ARC OF TRIUMPH AND THE DISTRIBUTED MONUMENT

One very high-profile example of the ethical complications around digital reconstruction can be seen in the acclaimed reconstruction of the Triumph Arc of Palmyra. One of the most famous sites destroyed by ISIS, the Arc was previously the entrance to the Temple of Bel, and its reconstruction by the Institute for Digital Archaeology (IDA) in the UK was the first attempt at a life-size 3D printed model of the destroyed site. The effort received a heroic welcome when it was opened for public display in London and New York (Figure 1) (Digital Archeology UK, n.d.).

Del Valle for *The Gothamist* reports on the unveiling of the Arc in New York, where the Executive Director of IDA, Roger Michel, said,

We hope to signal the potential for triumph of human ingenuity over violence and celebrate images from the past that unite the cultures they represent. (Del Valle, 2016)

The reconstructed Arc was meant to be a symbol of defiance against the destructive actions of ISIS. However, IDA's work had many ethical ironies encapsulated in it. The first touches on the hypocrisy of focusing on a certain act of violence while ignoring one's own contribution to it: while public figures in London and New York were celebrating these decisive steps in preserving the heritage of Iraq and Syria, their respective governments were cutting down on support for asylum seekers from the conflict-hit counties (Easton & Butcher, 2018).



Figure 1: The Unveiling of the reconstructed Arc of Palmyra, World Heritage Week on Trafalgar Square, 2016.

The foundations of IDA's work were built by collecting information from various public sources, but the Syrian people themselves were not involved in the discourse on the reconstruction of the Arc. With the concerned people left out of the entire picture, the attempt to console the world of Palmyra's loss of heritage and civilization looks more like a blatant display of power and superiority. In many ways, it is analogous

While the west was trying to reconstruct the Palmyra Arc as though it had never been destroyed, the Syrian Director of Antiquities, Maamoun Abdelkarim, took a different approach, explaining that the temples and sites reconstruction would be carefully and tactfully carried out but not they would not attempt to replicate their former history (Jones, 2016).

This point touches on the question of whether or not the moment of destruction should be erased from history. The efforts to 3D print the original Arc of Palmyra will never be authentic in that the 3D printing only replicates one single image or narrative

of the object. Beyond a simple mimetic display, the artist's interpretation and perspective should enable the audiences to build their perspective, conduct research, and deep dive into the full history of the heritage. A simple fantasy display of the destroyed site in an imagined perfection erases and ignores its history, while claiming ownership through the resurrection.

An example of an ethical, representative-reconstruction of the Arc of Palmyra can be seen in the work of artist and educator Azra Aksamija, working at the MIT Media Lab. Aksamija recreated the Arc of Palmyra through a participatory technique involving 20,000 small pixels laser cut with the icons of different heritage sites at risk (Figure 2). When seen from a distance, these pixels imitate the image of the Arc of Palmyra (Figure 3). The individual pixels build together in a mosaic style to form a bigger picture of the destroyed site. As such, while it questions and condemns the actions of ISIS, the work also signifies the historical importance of Palmyra.

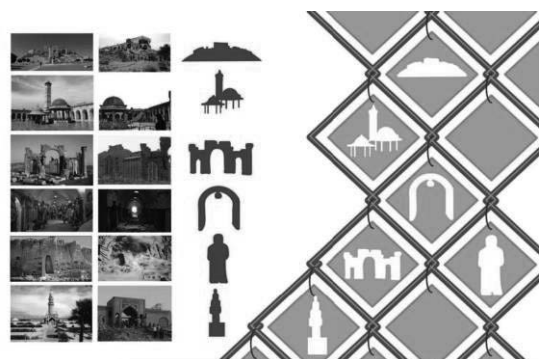


Figure 2: Sites in Danger printed on pixels concept, Memory Matrix.



Figure 3: Preview of Palmyra formed with pixels, Memory Matrix.

Another digital reconstruction of an ISIS-destroyed object, but with a very different approach, was the series *Material Speculation: ISIS* by Iranian-American artist Morehshin Allahyari. The project digitally recreated twelve Hatran artifacts destroyed in Iraq during the ISIS attacks of the Mosul Museum. In her own words, the work's underlying

idea was to explore the relationship between technology, capitalism, religion and materiality (Allahyari, n.d.).

One of the defining features of the Allahyari's work was that the digitally recreated artifacts were 3D printed with transparent material and embedded inside each figure was a USB key containing all the relevant information about the artifact itself, including all the communication, research, photographs and historical resources collected by the artist. One of the reconstructed artifacts was chosen by the Rhizome Commission's Download Series, a project that makes the artwork's files freely available for download by any user. Entitled *The Distributed Monument (TDM)*, the chosen artifact was released on the Rhizome website along with all its source files and supporting materials (Soulellis, 2016).

TDM is the digital reconstruction of the statue of King Uthal, a prominent king during the emergence of the Hatran civilization (Figure 4). It was one of the finest marble statues to be removed from the site of the Baalshamin Temple in Hatra during excavations in 1951. The King's left-hand rests on his sword, and the right-hand gestures forward to depict prayer or peace. After its discovery, the statue of King Uthal was restored and moved to the Mosul Museum, where it remained until it was destroyed in 2015 by ISIS.



Figure 4: King Uthal of *The Distributed Monument* by Moreshin Allahyari.

Because the source files, including the 3D renders, are available for any and all to download, the user's computer becomes a pseudo gallery space, in which the user is the viewer, creator, and exhibitor all at the same time. The Rhizome Commission's online portal of *TDM* hosts a zip file of five hundred and seventy megabytes, which contains .stl and .obj files readable by specific 3D software that allow the user to recreate all the details of the destroyed statue and modify them as they desire. In addition to these files, the artist also released the research, relevant communication, the editable files and other supporting material as part of the .zip file. As every user downloaded and added to the statue's history,

the theory went, the less important the moment of destruction. As such, this shared, evolving narrative pushed against the selective historical context of the statue disseminated by the media and ISIS – the thirty seconds in its thousand-year life when it was destroyed.

Aside from *TDM*, Allahyari also developed a performance piece connected with *Material Speculation: ISIS* which delves deep into the subject of digital colonialism through the reconstruction of cultural objects. In an interview with Hyperallergic, Allahyari stressed that instead of just focusing on the material destruction, it is vital to understand the circumstances that led to it in the first place (Vartanian, 2019). She also noted the problematic colonial power structures that naturally arise when the global west takes it upon itself to "save" or "restore" eastern cultural heritage. Throughout this work and others, Allahyari constantly worked to draw attention to the fact that reconstructions must be examined and questioned, instead of accepting simply as an 'act of humanity.'

4. AN ETHICAL FRAMEWORK FOR DIGITIZING CULTURAL HERITAGE

There are many complications around the digitisation of cultural heritage. A main question is that of ownership, especially in cases of public heritage. To whom does the object belong, and who has the right to restore it? The impact of the digital divide tends to bias the western world as the main custodian of heritage, and the shadow of colonisation becomes clear when the educated west controls access and rights to the eastern culture.

Further complications come into play with the question of why organisations or individuals, especially in the west, have an interest in preserving cultural heritage of emerging countries, especially in cases where they have had a hand in the destruction in the first place by creating or contributing to political instability in the region. Financial gains or political agendas may play a part in the motivations behind the restoration, such as certain western companies who profit from the patents or copyrights of the scanned files.

For example, CyArk is a prominent American company working in digitising heritage. Their website boasts that they have over 200 projects on all seven continents and makes liberal use of the rhetoric of "saving" collective culture (CyArk-n.d.). And yet, the company only allows access to their information to selective participants. In order to request access to CyArk's digital files, an individual must fill in a form on the website and agree to the terms and conditions of the company, which include a non-commercial clause which restricts any display of the recreations in cultural institutions in the region from where the data is recorded. This clause is

particularly problematic as it ensures the company retains the rights and financial profits to the recreation of heritage that does not belong to them.

Aside from the question of ownership, there are other hidden ethical challenges of digital restoration, such as the environmental strain of cloud computing and the question of whether or not digital recreations have a longer shelf life just because they are stored on the internet. In the context of this paper, six main factors have been identified as the most important in creating an ethical framework: interactivity, timeframe, transparency, sustainability, materiality, and accessibility. These factors certainly overlap in some aspects, but overall, they contribute to the overall ethical impression of the project. The point is not that cultural heritage should never be reconstructed, but rather, an awareness of context is essential for sensitive and culturally appropriate endeavours. The proposed framework is nothing more or less than a vehicle for developing this awareness through a series of targeted questions.

The ethics of a digital reconstruction is closely related to the context in which it is created, and the above factors heavily rely on the contextual grounding of the project.

Transparency becomes important as it deals with the clear communication of the artists in the collection of data and consultation with the local stakeholders as they construct the narrative and storyline of their work. This factor also helps give a fair understanding whether the digital reconstruction has been conducted as a democratic or authoritarian process and is especially relevant when it comes to the investors behind such a campaign. Moreshin Allahyari's Iranian heritage played a factor in her decision to take on the reconstruction of the destroyed artifacts, whereas the IDA's Arc was more of a public display of cultural restoration.

Accessibility is a critical factor in understanding the context of digital reconstruction and is an area where the shades of techno-colonialism can be examined minutely. As a whole, accessibility represents many other connected factors, which include language, mode of exhibition, mobility, patents, technical literacy and economic privilege. Here, Allahyari's *TDM* struggles, as downloading the files from the Rhizome website required a decent internet connection. Allahyari herself lamented that most of the downloads were from the US and Europe, which she felt didn't represent what she was trying to do (Vartanian-2019). One might look at if a reconstruction of a Syrian object includes information in Arabic or if it is displayed in the local context.

Materiality encapsulates the intended shape, size and material used to produce the digitally recreated physical object, which effects how the object is read

by the audience. It can involve aspects of sustainability as well, both environmentally and culturally. For example, *TDM* by Allahyari used a special resin for the 3D printing that was transparent in order to showcase the USB key within that contained the historical context of the artifact. The IDA, on the other hand, aimed for a true-to-life representation. The material of construction can come into play as well. There are a few different techniques of 3D printing, with the most prominent ones being Fused Deposition Modeling (FDM) which uses a special plastic developed from oil and gas (Bedrich, 2018). Therein lies of the irony of using oil-driven plastics for printing: The digital recreations of artifacts from Iraq and Syria, if printed in plastic, may use the very same oil products smuggled by the terrorist group into the western world through Turkey and Iran (Hawamy, Mohammed, & Harding, 2014).

The timeframe reflects on the particular moment in time of the artwork, and why the recreation may or may not be important. For example, the historical objects that ISIS destroyed had existed for thousands of years and withstood many natural and human-created calamities, and yet only one human-caused calamity becomes the focus of the artworks. The IDA, for example, chose a specific moment of the Arc to represent, which enforces a certain timeframe of its existence. Allahyari's more abstract, transparent *TDM* can stand for the artifact at almost any moment in its history. Timeframe also helps to understand the artwork in its own contemporary moment, including the originality of the art piece, and the age of intended digitisation, all of which are dominant factors in assessing the ethics of a digital reconstruction.

Interactivity examines the flexibility in the narrative of digital reconstruction and the opportunity for audience participation in the narration of a story. It also determines if the artist is open to feedback or if the intended art piece has a passive or active interaction with its audiences. Allahyari's *TDM* for example intends to involve the audience in the collective narrative of the object by sharing all the source files and historical documents.

Finally, sustainability explores the life of the digital representation in the digital space. Their proper referencing, maintenance, archiving over time becomes critical to the overall life of the artifact and helps determine genuine motives over those of pure financial or media gain. Many webpages for these digital projects are no longer active or relevant, only existing at a moment for maximum gain to the artist or company. One might question, for example, where the IDA's reconstructed Arc is today, and how it is being maintained.

It should be noted that the context of a reconstruction is not limited to these factors only: other contributing factors could include archiving systems, private collection and museum ownership,

however, further research with a broader scope would be required to both identify and examine these. Nonetheless, the six identified factors here touch on the main elements that affect an ethical reconstruction.

5. CONCLUSIONS

The purpose of this research was to establish an ethical framework that can assist artists, organisations and other relevant stakeholders when deciding whether or not to engage in a project to digitally reconstruct a destroyed object or cultural heritage site in the emerging world. Analysis of various examples makes it clear that one of the greatest challenges of a digital reconstruction is its target audience. The reach and perception of digital heritage are severely affected by the non-uniform distribution of resources and technical knowledge across the world. In addition, the intentional or unintentional exclusion of the targeted community, whether it be in the same societies who are reconstructing their heritage or in the participation of the digitised heritage through prohibitive copyright conditions, makes the entire project much more problematic.

This is where the term digital colonialism comes into force, where the western power uses the digital heritage of an emerging country to show its power, belittle the heritage's home country as unable to look after their own heritage, and exploit public sentiment for financial gain. While it may be tempting for an artist to undertake a project of the digital recreation of a public heritage object or a site from a conflict zone in order to supposedly defy those who destroyed the object, without careful thought, reflection and planning, the artwork can easily slip into the realm of cultural exploitation, appropriation and techno-colonialism. This is especially true when the sustainability factor comes into force, whereas the degeneration of digital assets makes it clear that projects are purely meant to capitalize on public.

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Politics of Inclusion and Lessons of Access from Disabled Artists

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From automatic speech recognition to automatic scene and image descriptions, artificial Intelligence (AI) technologies have increasingly been deployed to improve the accessibility of digital and everyday experiences for disabled people. Underpinning these stories of access is an evolving set of norms, values, and expectations of what is “includable” and who is included. I examine some of the pitfalls of framing access in terms of “inclusion” in narratives around assistive AI. I turn to critical disability theory to explore possibilities opened up by reorienting the analytical lens from terms of inclusion to crip traditions. By representing crip bodies as productive sites of difference, critical disability scholars have deconstructed stable categories and mapped out the contours of embodiments rooted in leaky boundaries. I follow these theoretical traditions in discussing the artistic practices of disabled artists Emery Blackwell, Jenny Sealey, and Tarek Atoui. I show how their works serve as counter-narratives to the dominant logics of binaries and fixities that often undergird AI rhetorics. These artists and their collaborators show that far from a diversity requirement to fill, access is an ongoing process, a form of creative labour, and a source for new ways of knowing.

Critical Disability Studies. Inclusion. Cripistemology. Disability Arts. Accessibility. Assistive AI.

1. INTRODUCTION

Artificial Intelligence (AI) technologies have increasingly been applied to improve the accessibility of digital and everyday experiences: from automatically generating alt texts for online images to identifying and describing objects and people in physical surroundings. These systems are often presented as promoting values of inclusion for disabled individuals. Disability in these stories can be seen as framed through a “social lens”: people are disabled by the various design choices shaping the built environment, and AI technologies provide ways to intervene by removing accessibility barriers (Morris, 2020).

By moving the locus of disability out of the body into how the body **interacts** with the world, the social model has been influential in challenging the medical model which views the individual as bearing the sole burden of “overcoming” their “impairment”, recognizing instead the society’s role in creating disabling conditions via its inaccessible designs and exclusionary policies (Hendren, 2020, p. 15). However, the social model is not without limitations. Various works have pointed out that it can fall prey to the tyranny of “normality”, setting the goal of advocacy and research to helping people **fit in better** (Mankoff et al., 2010; see also Oliver, 2017).

Under this model, discourses about accessibility and AI can sometimes adopt a “saviour narrative”, framing disabled people as subjects of help and heralding technology as “increasing the quality of life” of disabled users (Bennett and Keyes, 2020; see also Tucker, 2017). Access, from this view, is about “mak[ing] room” in existing norms for people who don’t fit them (Hendren, 2020, p. 99).

Scholars have critiqued this form of technosolutionism — where technological solutions are prioritized and taken as universally appropriate when addressing problems of access — arguing that technologies are value-laden: not only do they reflect assumptions and biases about disability, they contribute to reproducing them (Whittaker et al., 2019). It is therefore important to analyse the discursive work of AI (Keyes, 2020): What stories are being told about AI? What do these stories reveal about the norms and value systems being enforced and reified? Mankoff et al. (2010) have noted that “the person designing a piece of software is, in some sense, defining who is disabled with respect to that software”. These conceptions of how disability looks and functions further shape public discourse and produce societal norms that have material effects on disabled communities (Keyes, 2020). Disability scholar Anne McGuire articulates the cultural force of

narratives on autism for example, “...the stories we have—those given to us and those we share—are contributing to the formation of a historically specific autism discourse and that such stories are shaping what autism is and can be in contemporary times” (McGuire, 2016, p. 12). In the case of AI applications that help blind users “see”, technology designers are implicitly shaping, selecting, and reinforcing what blindness should look like. This image is often disconnected from the unique and diverse lived experiences of blind individuals and disability cultures. Without counter-narratives, talks of “access” built on ideals of “inclusion” can sometimes ring hollow, and worse, potentially perpetuate harmful stereotypes and norms.

Critical disability studies offer pathways out of the blind spots of **inclusionism**.¹ In addition to exposing problems to do away with such that disability (whether it be due to impairments or external barriers) disappears, critical disability scholars provide frameworks that “reorient existing standards of value and centre disability as a way of knowing the world” in its own right (Williamson, 2019, p. 207). From this view, disability is not a monolithic condition — rather, it is characterized by the “intense differences that constitute...bodies” (Mitchell, 2015, p. 209).

In this paper, I revisit the notion of access by building on the alternative “representational traditions” of those living lives of “peripheral embodiments” (Mitchell, 2015, p. 181). Seeing access this way requires an understanding of “the particular logistics that structure experiences of alternative embodiments” (Mitchell, 2015, p. 91). By deliberately decentring the narrative of inclusion from non-disabled persons, I focus on a more expansive narrative that sets these peripheral embodiments as the baseline of human value.

To explore how access can be re-imagined alongside these theoretical traditions, I present three case studies of artistic approaches to disability that represent crip bodies as productive sites of difference instructive of radical new ways of being. Each of these artistic practices puts forth a different interpretation of access. I show how these lessons of access can be used to interrogate current developments in assistive AI. I then align these lessons with emerging critical scholarship in crip technoscience, data ethics, and social justice in algorithmic societies.

2. FORMS OF ACCESS IN DISABILITY ARTISTIC PRACTICES

2.1. Emery Blackwell and Alito Alessi: Access as an Ongoing Negotiation

Emery Blackwell, a dancer and choreographer with cerebral palsy has created numerous

choreographic pieces with long-time collaborator Alito Alessi at DanceAbility since 1989, a dance company based in Eugene, Oregon featuring the eponymous dance method that trains dancers with and without disabilities through Contact Improvisation. Contact Improvisation is a technique pioneered by dancer and choreographer Steve Paxton in the 1970s to critically challenge the dominant conceptions of the body at the time, i.e. the “idealized body of ballet” and the “dramatically expressive body of modern dance” (Albright, 1998). In these dance forms, a dancer focuses on controlling their body at various levels, whether it is the definition of muscles, the fitness of their forms or the precision of their movements. Contact Improvisation, instead, trains the dancer to yield control and release their body’s weight into their partner or the floor. Through movements of falling, rolling, leaning, balancing, and lurching, dancers shape how their accumulated momentum travels and resolves by attending to and anticipating each other’s directions of movement (Novack 1988). Dancers respond to their partner’s shifting orientations by continuously adjusting their own centres of gravity. This creates a sophisticated system of mutual support that can “convert a[n immanent] accident into a controlled descent” (Chute (1979), 2006). Different from the “idealized” and “expressive” bodies characterized by Albright (1998), Contact Improvisation gives rise to a “responsive body” according to dancer and anthropologist Novack (1990, p. 186): a body that centres release instead of control, mutual attention instead of execution.

In one of the duets created by Blackwell and Alessi, *Tango Tangle*, Blackwell (in his wheelchair) and Alessi (on roller skates) take turns falling into each other, gliding across the stage in synchrony, and mirroring each other’s movements. Watching the performance, one’s gaze is drawn to the spaces between movements: the waiting, the cues, the mutual tuning of weights, and the functional and affective dimensions of their glances. Unlike conventional performances where many of these elements are tacit, Blackwell and Alessi’s shared language of access is externalized and made visible here.

Dancer and scholar Ann Cooper Albright wrote about a different duet by Blackwell and Alessi in her book *Choreographing Difference* (2010):

By thus concentrating on the becoming of their dance, Blackwell and Alessi’s duet refuses a static representation of dis/ability, pulling the audience in as witness to the ongoing negotiations of their physical experience. (p. 90)

She notes that Blackwell and Alessi’s duet recasts ability on a continuum and that their resistance to the classical disabled/abled binary “open[s] up the

possibility of looking at the dancing body as a body in process, a body becoming. This attention to the ever-changing flux of bodies and the open-endedness of the improvisation refocuses the audience's gaze, helping us to **see the disabled body on its own terms**" (Albright, 1998; emphasis added).

According to Albright (2010), Blackwell and Alessi's duets have not been subject to the same traps some popular "mixed abilities" dance practices can fall into. She comments, for example, on the pitfalls of an over-emphasis on "technical excellence" in integrated dance companies:

...although Candoco has commissioned some very intriguing choreography which doesn't just 'accommodate' the disabled dancers but recasts cultural perceptions about an 'able' physicality, Benjamin is still committed to classical elements of technical virtuosity. For Benjamin, true integration means insisting on high standards of professional excellence in order to create interesting choreographic works for all the dancers in the company...Yet because they rely on one very exceptional disabled dancer to break down the public's preconceptions about disability, Candoco sometimes **recreates (unwittingly) new distinctions between the classical (virtuosic) and grotesque (passive) bodies within the company.** (Ibid, p. 77; emphasis added)

Access, when viewed on the basis of skill, carries an inclusionist overtone, where the meaningful goal of letting people with varying abilities work on equal grounds can still be beholden to a normative regime of value that privileges external measures of technical prowess. Blackwell and Alessi's take on access seeks to address deeper patterns of inequity: rather than "manifest[ing] a set of already-agreed-upon values" (Kafee, 2013, p. 100), they put into question the very system on which these values are built. What is made accessible in their duets is not the glossy ideal of virtuosity but rather each other's unique "corporeal archive" (Lepecki, 2010) of movements and affects, and by doing so, they demonstrate the possibility of a crippled resistance to hegemonic cultural values.

Beyond simply including disabled bodies on stage, access becomes about cultivating an embodied practice of attuning to each other in Blackwell and Alessi's dance practice. Alessi reflects on this practice in *Dance, Human Rights, and Social Justice* (2008):

When I first started to work with people with diverse abilities, a flood of new experiences washed away assumptions I had about dance. Mixed abilities work taught me (and continues to teach me) to listen differently and move my body differently, helping me to dissolve my old habits and patterns. As I found new shapes and forms, I opened to different feelings, and I began to

respect and appreciate my body and others' bodies more, and I began to see beauty in more forms. (p. 367)

He shows how viewing access as a sustained practice rather than a set of project-oriented efforts changes his way of relating to his own body and to another person, effectively dislodging existing value systems.

2.1.1. Interrogating Assistive AI: Countering Fixed Definitions

As AI is increasingly brought to bear on disability issues, its purported capacity to "neutrally" represent begins to fray at the edges and its tendency to become a "social sorting" tool (Lyon, 2003) manifests. Scholars have shown that "AI systems not only reflect normative categories, but also create and enforce these categories, demarcating what it means to be a legible human and whose bodies, actions, and lives fall outside. These systems construct some categories of ability and negate others, in the process remapping and calcifying the boundaries of inclusion and marginalization" (Whittaker et al., 2019).

This discrete logic of AI systems is fundamentally unsettled by the fluid and plural nature of disability: "Disabled people are a heterogenous population. Even among those who identify as having the 'same' disability, differences in race, class, gender, and other identities result in significantly different lived experiences...Each has its own histories and specificities" (Whittaker et al., 2019). This poses a great challenge for inclusion in datasets used to train machine learning models. Given the vast differences in disability embodiments, creating a dataset that seeks to represent disabled people irrespective of contexts becomes a nexus of politics: whose bodies and experiences count?

A productive way to think about this is to treat access not as a context-free requirement to fill but as a local, continuous, mutual work of care, as demonstrated artistically by the duets between Blackwell and Alessi. Bennett et al. (2020), building on Louise Hickman (2018), characterize this form of work as "continuous negotiations undertaken to create opportunities for people with disabilities to approach and understand phenomena". By examining this "ongoing work" of access, they show how such analysis can be generative for the design of AI-driven assistive technologies. Specifically, how might technology be designed to let us negotiate our interests and identities not as fixed but as dynamically constructed and continually contested?

2.2. Jenny Sealey: Access as Creative Labour

Jenny Sealey is the Artistic Director of Graeae Theatre Company, a notable UK-based performance group founded in 1980 that produces works led by deaf and disabled artists. Sealey, who

is deaf, introduced a dramaturgical approach called “aesthetics of access” in the early 2000s that treats access not as an after-thought or add-on after a piece is finished but as the central force that informs the piece itself and drives the entire creation process.

Traditionally, to make a theatre performance accessible for deaf and hard of hearing audiences, one can have sign language interpreters (SLI) sign everything the actors say, often off to the side of the stage and forcing a choice between watching the actors or the interpreter. Alternatively, a caption box can be placed near the stage, which depending on the placement can still be far away from the centre of the action. For blind and visually-impaired audiences, audio describers could provide verbal commentary during non-spoken parts of the performance to fill in information that is visual. In these cases, the accessibility options are treated as features to “tack on” after a production is done. The SLIs and audio describers, for example, are not involved in rehearsals, and the captioning is not part of the creative process when making stage lighting considerations. These accessibility services, in addition to being engaged at the last minute, are also often not offered for every show.

What Graeae and other companies like it do differently is to put accessibility concerns at the forefront of the production itself, letting it guide creative decisions and lead the work in meaningful and sometimes unanticipated directions. As the separation between accessibility and the production itself collapses, access becomes not just a pragmatic concern but an aesthetic one, and these aesthetic considerations for accessibility are unique for each Graeae production.

Jenny Sealey spoke about how she came to develop “aesthetics of access” as an artistic approach in *Reasons to be Graeae: A Work in Progress* (2018). In 2000, when Sealey produced Steven Berkoff’s adaptation of *The Fall of the House of Usher*, the production’s budget was not enough to cover sign language interpretation and audio description services. While searching for alternatives, Sealey came upon Berkoff’s stage directions, in which one read:

He reaches up and tears down a dripping silken fabric which could have previously suggested the fabrics of the house and now becomes both an image of her winding sheet and soft cocoon as if the bed had come to her and she spins around this until mummified.

She noticed that this vivid direction, intended for the actor, would make a perfect audio description. Then she realized: “everything is in the script about what accessibility can be” (British Council, 2017). She went on to build the entire production around this insight. For example, the dream-like language of the

stage direction above inspired the creation of a phantom fourth character whose image is projected onto a mirror above the bed on stage. The character both signs and audio describes the scene. Different from a typical experience at conventional accessible theatre shows in which deaf audiences have to split their attention between following the actors on stage and a live sign language interpreter, the signing here is integrated into the story and plays a key role that enriches and expands the narrative.

For Graeae, accessibility is embedded in the very fabric of production. They show that providing accessibility is not a perfunctory gesture; when taken seriously, it opens up exciting creative avenues and narrative possibilities. Whether it is creating an Ian Dury-inspired, “wheeler-dealer” character for audio description in *Reasons to Be Cheerful* (British Council, 2017) or installing a triptych projection screen for signing William Blakes poem in *Into the Mystic*, Graeae always makes sure that the dramatic narrative is the “narrative of access” (Broadhurst and Machon 2012, p. 66). By letting the characters guide and “deliver access the conventions” (Ibid, p. 66), Sealey powerfully shows us what an equitable theatre-watching experience looks like, honouring the diversity of ways people access a performance.

2.2.1. Interrogating Assistive AI: Resisting Universal Deployments

One of the most rapid developments in assistive AI is automatic speech recognition (ASR), i.e. conversion of spoken language to text. These techniques are increasingly deployed in classrooms, workplaces, and everyday settings for deaf or hard of hearing people as a cost-effective option for real-time captioning. These use cases proffer automatic transcription as a pragmatic necessity that will increase equitable access for disabled communities in diverse contexts. However, underpinning this promise of equity is the belief that access needs are uniform and structurally equivalent across different individuals and settings.

Disability scholar Louise Hickman uses the example of Communication Access Real-time Translation (CART) to challenge the assumption that transcription is “a neutral process of transferring speech and visual data into readable and spoken text” (Hickman, 2019). CART stenographers in classrooms, she shows, provide real-time captioning by adapting to the individual needs of the deaf or hard of hearing students they work with via “processes of collective learning”. When a stenographer enters a new setting, they will often start by learning the words, phrases, and names specific to that context and use them to build a new dictionary or update an existing one. A stenographer often keeps several dictionaries at once, each tailored to a precise lexical context, whether it be technical, medical, social, business, or graduate-

level. Each of these dictionaries represents a “relationship” to a specific social location, rife with histories and cultural codes. Hickman calls the construction, repair, and maintenance of the dictionary “situated and affective labour”.

The stenographer’s dictionaries, like Jenny Sealey’s productions, are bespoke systems of access. Access here does not try to be a universal stopgap solution; instead, it is a labour of care that attends to differences and locations. This work of access is a form of knowledge in its own right, simultaneously generative and intimate.

2.3. Tarek Atoui: Creating Access to Crip Knowledges

Tarek Atoui is a hard of hearing sound artist and composer based in Paris. His work investigates sound cultures in deaf communities. Since 2012, he has collaborated with collectives like BrutPop in Paris, France and educational programs like Al Amal School for the Deaf in Sharjah, United Arab Emirates to produce novel instruments with and for deaf people. Some of these experimentations have culminated in *Infinite Ear* (2016), an exhibition that seeks to reverse the ear-dominant sound cultures and explores an alternative framework rooted in the hearing traditions and knowledges of the deaf community. Through vibrations, gestures, and visual stimuli, Tarek and other sound artists built and assembled a dazzling array of sonic experiences, installations, and new instruments that all asked the question: what is the experience of sound without sound?

One of the instruments on exhibit was *33 Soft Cells*, which explores how people hear through fingers via a set of touch-sensitive textile panels.² To play the instrument, one relies completely on touch to differentiate distinct vibration patterns and textures.³ Another instrument, *4 Iterations on Drums*, is made up of four percussion tables that conduct sound through metal and wood. The sounds are felt through touch before they are audibly perceived. Finally, *the 0.9* is a gestural instrument that is made up of a network of subwoofer speakers. One plays it via sign language gestures. Like many of the other instruments in the collection, *the 0.9* generates ultra-low frequency vibrations that are felt before they can be heard.

These instruments seek to celebrate the diversity of hearing knowledges in deaf communities. They show that “how we perceive auditory information is relative, adaptable, and fluid” (Pearson, 2018). Regine Debatty wrote about these instruments on her blog, *We Make Money Not Art*, “By working together on the instruments, which appeal to both the hearing and deaf public, the aim is to convey to visitors from the perspective of deaf people how instruments and the sounds produced by them are perceived by the D/deaf community and how the

instruments can be played in these circumstances” (Debatty, 2016, as cited in Pearson, 2018). These instruments turn inclusive design on its head, creating environments that deliberately circumvents the physical sound, privileging instead the sonic experiences and skills of deaf and hard of hearing individuals while making room for others to access these different hearing knowledges.

2.3.1. Interrogating Assistive AI: On Whose Knowledges is Access Built?

Most assistive AI technologies are built on the goal of “mak[ing] disabled people more like non-disabled people” (Whittaker et al., 2019). As an example, AI Now Institute’s report on “Disability, Bias, and AI” (2019) discusses automatic live-captioning apps like Ava that “promise to allow Deaf people to take part in spoken conversations” but in fact operate on the assumption that “deafness is a hindrance to communication”. They cite disability activist and scholar Eli Clare (2017) who argues that “many deaf people claim themselves not as disabled, but as a linguistic minority. They locate the trouble they experience not in their inability to hear but **in the non-deaf world’s unwillingness to learn and use sign language**” (p. 91; emphasis added).

Tarek Atoui, through his work, challenges the society’s tendency to make non-disabled experiences the norm. To counter that, he inverts the script of inclusion from normative-informed to crip-informed. By centring crip wisdom, not only does he get us to consider lived experiences and crip knowledges that are often overlooked before running to technological fixes, he also shows us the creative possibilities opened up by this reorientation.

3. CONCLUSION

The artistic practices explored above seek to counter-balance the deficit narratives often found in contemporary assistive AI discourses. Rather than highlighting the “strengths, creativity, and agency” of disabled people, these narratives “reduce a group...to its ‘problems’” (D’ignazio and Klein, 2020, p. 58). Richard Ladner (2011) identifies the “ring of paternalism” in calling technology disabled people use “assistive technology”: it renders disabled people passive and promulgates a belief that they “need lots of extra help, are dependent and are not capable human beings”. In these scenarios, a disabled person’s encounters with the physical environment are described in terms of **limits** and **barriers**, whether they concern unequal access to public resources or inaccessible infrastructures and spaces. Solutions, from this perspective, hinge on **barrier removals**. This emphasis on deficits constrains the sociotechnical imagination of disability solely to “encounters with exclusion” and “have almost nothing to say, for instance, about the active transformation of life that

the alternative corporealities of disability creatively entail” (Mitchell, 2015, p. 2).

Critical disability theory offers a lively framework for attuning us instead to the diverse lived experiences, creative energies, and deep wisdom of crip bodies, and importantly, gives us the lenses through which the rich variety of peripheral embodiments in our everyday lives are thrown into sharp relief. As Henri- Jacques eloquently puts it: “Each of us has a disabled other who cannot be acknowledged” (Stiker, 2019, p. 8, as cited in Shildrick, 2019). By embodying this framework in their lives and artistic practices, the disabled artists in this paper challenge dominant approaches to access that implicitly divides the world into binaries (e.g. abled/disabled) according to normative terms of inclusion (Ahmed, 2012, p. 163). The visions propagated by these artists centre plurality of experience (Mitchell, 2015), embrace values of care (Hickman, 2019), and resist rigid categorizations (Shildrick, 2019). They show that access is an ongoing process, a form of creative labour, and a source for new ways of knowing.

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¹ I adopt Mitchell (2015)'s articulation of the term. *Inclusionism* refers to a set of "diversity-based practices by which we include those who look, act, function, and feel different" (p. 4), and when it concerns disabled communities, it "requires that disability be tolerated as long as it does not demand an excessive degree of change from relatively inflexible institutions, environments, and norms of belonging." (p. 14)

² WITHIN / Infinite Ear exhibition website: <http://www.council.art/inquiries/30/infinite-ear/792/within>

³ Exhibition video featuring 33 Soft Cells: <https://youtu.be/-ecRMpq1794>

INTERFERENCES OF THE MULTITUDE

Interferences of the Multitude

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Interferences of the Multitude is an introductory analysis of the perspectives collected under the umbrella of the homonymous track, presented during the Rogue Research edition of the 3rd Politics of the Machines Conference in Berlin (September 14–17, 2021). The paper examines the implementation of arts-based research into the new modes of techno-ecofeminist imaginaries and investigates its generative potential for the enactment of the new materialist and feminist ethics of care, collaboration, and solidarity. The projects presented and discussed span the entangled fields of human–computer interaction, computer-supported cooperative work, material sciences, critical design and making, architecture, machine learning, interactive art, and post-human performance.

New materialism. Feminist Theory. Trans-feminist hacking. Arts-based research. Multitude. Potentia.

1. INTRODUCTION

Following in the footsteps of philosophers and thinkers like Donna Haraway, Karen Barad, Rosi Braidotti, Jane Bennett, Maria Puig de la Bellacasa, Toni Negri, and Michael Hardt, among others, the track seeks to bring together the newly emerging tools and methods of care for the ecosystem of living matter.

From biology and healthcare to global financial systems and tectonic geopolitical shifts, technologies condition the current state of democracy, the personal and collective freedom and well-being of both humans and non-humans involved. Concerns about the exhausted limits of class, gender, ethnicity, or the impasse of the clash between the open societies and reactionary imaginary communities are symptomatic of this major paradigmatic shift. As well as the (re)turn to Spinoza's monism and the idea of multitude as the agent(s) of potentia, resonant with the indigenous political thinking. We welcome the reader to join an ongoing debate on how we need to trace and read interferences in feral grounds. We are in the process of imagining new modes of materialist politics around (collective) subjectivities and an entangled co-becoming with the world. The most common definition of the notion of *interference* is the combination of two or more electromagnetic waveforms that form a third wave in which the displacement is either reinforced or cancelled. We understand it as a critical disruptive process that destabilises the status quo and plays an important role in relational and emancipatory thinking and action. The term *diffraction*, which came to replace the reflexive methodologies of thinking and doing,

is also operational in this context. These two notions (interference, diffraction) are foundational for the new materialist turn and feminist ethics of care.

As quantum physicist and theorist Karen Barad explains, diffraction is a physical phenomenon of spreading waves around obstacles. These spreading waves create new patterns on the water surface while at the same time co-producing interference on the water surface. Barad transfers this idea to the realm of colliding forms of oppression, co-producing interferences that we observe as difference and conflict. The impact on this diffraction is something that 'troubles the very notion of dichotomy – cutting into two' (Barad 2014). This includes most of the 'stabilised/stabilising binaries' (ibid.). The most complex patterns form as a result of interference, when different points of the wavefront clash, and reach the surface at different intensities.

Another Baradian term that we apply in our modes of understanding is 'intra-action' as a response to the inadequacy of the category of 'interaction,' which presumes the pre-givenness of 'bodies', interacting with one another. Intra-action suggests that agency is not an inherent property of an individual body to be exercised but a mutual influence and co-emergence of forces (Barad 2007, 141). Intra-action also responds to the critique on objectivity, the so-called 'God's trick' – that frames 'outcomes' or 'measurements' as purely neutral (Haraway 2020).

Similarly, the papers included in the chapter highlight intra-actions, indeterminacies, and fluid relationalities, all of which imply a potential for critical transformation.

Feminist new materialist ethics are rooted, on the one hand, in the critical post-human rethinking of the Eurocentric notions of 'Human', and the anthropocentric neglect of the Earth as an ecosystem. On the other hand, it extends the cyber-feminist critique of post-structuralist phallogocentrism and the limits of constructivism when applied to the messy context and subjectivities. It addresses the material, gendered, and embodied challenges of existence in the augmented world where cyberspace did not live up to its utopian promise of a safer space and instead expanded the patriarchal and autocratic systems of oppression in the both virtual and material realms. Lastly, it suggests to embrace 'situated knowledge', not just to stay in the trouble but also to live collectively, as well as we can.

The papers and artworks presented in the following chapter attempt to address these urgent issues. Wearing lenses informed by critical making and trans-feminist practices, the selected authors tackle the issues of e-waste, climate emergency, climate injustice, gendered violence, and economic disparities, where the only thing remaining, unreleased in the box of evils, seems to be hope again.

Tools and instruments necessarily condition the output. Hence, which methods can be generative to the process of reinventing liveable futures for all?

Additionally, the track *Interferences of the Multitude* adopted a neo-Spinozist notion of multitude. It has been rearticulated and critically discussed in political theory in the context of the 'post-ideological' condition of the 1990s onwards. It had been an attempt to overcome the categorical impasse in the task of conceptualising the resistant collective subjectivities. (Amin 2014; Negri & Hardt 2000; Negri et al. 2005; Tampiro 2009).

Most authors of this chapter apply a new materialist framework to their venture, analysing and/or developing with arts-based research. They propose to address the necropolitical crisis with a wide variety of profuse and insightful interventions: modelling the future, collectively reimagining technology, exploring Do-It-With-Others communities, sensing interdependency, experiencing embeddedness, rethinking artistic productivity, enacting vegetal agency, exploring creative possibilities of decay, learning from collective-based participatory art, cultivating creative-critical-code writing, and exploring the relationality of transcendence and immanence – questions of alterity, otherness, and interrelatedness.

Questions posed throughout the track include, but are not limited to, the modes of academic, artistic, social, and political and ecological organising and collectivity that we can practise to counter the

colonial destruction of ecosystems and livelihoods. In which ways can a collective 'we' be defined today to reinstate its agency when designing, producing, and consuming technological systems that are defined and abused elsewhere, which exclude and exploit? How can this 'we' protect and reclaim commons to facilitate the process of transformation towards a better living for all? Which new ontologies allow collective subjectivities to emerge and be operative? How can 'worlding' (Anderson & Harrison 2010; Haraway 2013; Stewart 2010; Stewart 2012) be accomplished without replicating colonising patterns, categorizations, classifications and pre-crisis taxonomies/cartographies (Braidotti 2019)? How can we elicit sensitive cognition towards the affectivity of non-human agency? How can we account for the fluid assemblages/figurations that we belong to?

When we contextualise design, art, and technology as an articulation of the multitude, we reassess who it is that we design/create/research for (Negri & Hardt 2005). It sharpens our view on interferences that occur under our intervening eyes.

2. THEORETICAL BACKGROUND

Interferences of the Multitude presents techno-ecological (Lorenz-Meyer et al. 2017) art and science research practices exercising post-human and new materialist imaginaries around the process of staying, caring, and co-becoming with the troubles of the contemporary world matter(s), like *Collectively Reimagining Technology*, by Andersen et al., *Co-authoring with the multitude/An iterative design framework for participatory art*, by Jessica Renfro, or the *Becoming a Tomato* computational performance, by Leon Lapa Pereira, *Rethinking Artistic Productivity with Water*, by Dorota Walentynowicz and Katharina Majewska-Güde, addressed further in this paper (Haraway 2013; Haraway 2016; de La Bellacasa 2017) towards an 'affirmative politics of life' (Braidotti 2013).

Attention to matter, its vitality, agency, and affect (Bennett 2010; Bolt 2007; Catts & Zur 2013; Dürbeck et al. 2015; Rosiek et al. 2020) is greatly conditioned by the transformation of sciences that lead to the merger of the 'social' and the 'biological' (Pitts-Taylor 2016) into 'biocultural' phenomena. It acknowledges the contemporary operations of power's 'technocapitalization' (Parisi 2017), affective governing biological data, matter and processes, inevitably producing new forms of life and sociality. Meanwhile, the limitations of representative paradigms that constrain the trans-feminist definitions of body and subjectivity bring forth the relevance of new onto-epistemological inquiries, including the *trance 'n dance* interactive performance and research by Pamela Varela (Lorenz Meyer et al. 2017, 352).

Critical examination and rethinking of the split between the ontologies, ethics, and epistemologies of modernity and its neo-liberal postmodern extensions are currently practised through a variety of arts and critical design approaches, particularly those rethinking agency of matter and its aesthetic implications for art and science research practice.

2.1. Self-Disclosure

The authors of this introduction share common ground as white and POC female-identified makers, and, together with a local community, they work as a collective in a feminist hackerspace in Vienna, Austria — Mz* Baltazar's Laboratory. The three authors also collaborate on an arts-based research project at the Academy of Fine Arts Vienna that explores how trans-feminist hacking operates as artistic methodology. This quite specific standpoint had a strong impact on the way that this track was laid out. As a collective of authors and track chairs, we explore the techno-ecofeminist thread towards the arts-based research on care for, and through, collective subjectivities.

Techno-ecofeminist and trans-feminist hacking is a research-based artistic methodological framework co-developed and practised by interconnected groups and individuals (Reis & Wuschitz 2022).

It is an arts-based method to apply diffractive practice (Arlander 2020; Belsunces et al. 2017; Fox & Aldred 2021; Meskimmon 2019; Prophet & Pritchard 2015; Sayal-Bennett 2018; Scurto et al. 2021; Witzgall 2016) to bridge this gap in thinking of and doing with difference. It is a method of imagining post-human conviviality through mutual care, co-dependence, and solidarity. This approach is common in hacking, design, and media arts cultures.

We, as hosts of this track, enter this field and its worlding through a feminist new materialist lens. Trans-feminist hacking implies questioning given forms, structures, and norms in favour of a multitude of queer and autonomous self-articulations, prompted by sensing and non-sensing entities. This approach also defined our conceptual framing of the track.

What does a tomato have to tell us about collaboration? What is water actually performing? Although established forms of hacking and critical-making already emphasise the importance of free information and speech and the way it is enabled through developing open source hardware and software, feminist hacking takes the demand for autonomy a step further. This also entails considering the assemblages of crystallising around human and non-human agency as active care-givers and interlocutors.

3. DISCUSSION

Interferences of the Multitude consisted of three interrelated, but distinct sessions. Each of the sessions was organised in relation to the papers exploring certain attributes of the discussion.

3.1. Session 1

Session 1 examines technologically mediated speculative fabulation and future models of collectivity. From post-categorical forms of computational archiving to participatory design of DIWO sex technologies and wider socio-technical imaginaries, the authors propose new forms of post-human democracy based on feminist ethics of care, solidarity, and the non-hierarchic, non-binary modes of organizing and collective action. This session has a particular focus on theories and practices that propose new actions, models, methods, and movements, in and within the eco-techno-critical-feminist philosophy.

The paper *Modulating Matters of Computation, Modelling and Hyper-Separations*, by Selena Savic and Shintaro Miyazaki, is an example of how computation can contribute to eco-feminist discourse and action. The authors propose to counter the binary narratives of technology by creating toy-like computational models to identify and discuss critical situations, tipping points and the making of rules in real communities, organised around real-world examples, for example, several housing cooperatives in Switzerland.

With a twist of humour, or perhaps irony, they work with these toy-models so that they can pay attention to the conditions of their assumptions and observations in an operative way.

Building upon historic forms of computing, like the difference engine, this paper attempts to rethink modelling as a form of administration in the service of diversity. Simulations, visualisations, and forecasts are appropriated for the purpose of generating solidarity and mutual care. Modelling, therefore, turns into a form of computing that can align with eco-feminist values. It allows individuals to engage in Haraway's notion of 'sympoiesis', here understood as 'making/writing' together.

In *Collectively Reimagining Technology* the authors, Majken Overgaard, Julie Østengaard, Kirsti Reitan Andersen, Irina Shklovski, and Mirabelle Jones, discuss the outcomes of the Digital Alchemy Workshop series, initiated by media artist Myrabelle Jones and hosted by Catch Centre for Art and Technology in Elsinore, Denmark. The paper provides an account of the challenges of collective exploration and speculative fabulation through critical-making in the conditions of pandemics, when participant attendance is frequently and necessarily limited to the online domain. The authors discuss the

complications of engaging the workshop attendants into a non-hierarchical online participatory design process, conditioned by other past educational experiences, and the expectations of the attendants themselves. Another challenge was translating Le Guin's argument of blurring the soft/hard binary in science fiction into the domain of HCI in the absence of the possibility to gain or employ tacit knowledge and mutual learning.

Marie Dietze and Alice Stewart explore Do-It-With-Others communities in the realm of sextech. This paper departs from a recent critique of the tendencies of free tech culture as somewhat naïve, and even as a techno-solutionist event. In their paper Dietze and Stewart want to propose that the ideals of open access, free circulation of information, and horizontal cooperation might form a crucial basis for the delicate task of linking technology with intimacy. They argue that the maker movement creates the right base to engage with tabooed sextech, because it facilitates open access, free circulation of information, and horizontal cooperation, which is essential for developing sextech, like, for example, apps that track menstruation circles without giving away data. The open source app 'drip' is the case of an app developed by feminist makers with open source tools: this app tracks changes in hormone levels without falling back into binary and patronizing concepts of sex and gender, instead fostering users' ownership over their bodies. Through the case of this open source menstruation app, Dietze and Stewart underline the importance of sextech, which exposes vulnerabilities without capitalising on collected data for advertisements, and also prevents shame and stigmatisation.

3.2. Session 2

The papers gathered in Session 2 call for unlearning standard definitions of 'media'. Instead, they challenge the reader to understand all media as matter. Matter here again is described as being vital, creative, active, and therefore dynamic. Consequently, artist-researchers see media as vital material that can be 'mediated' with wider socio-economic matters. This way, matter (and media made from matter) is treated as 'creative'. Exploring different forms of engagement with the vitality of matter, the papers gathered in Session 2 amplify the conceptual call for 'creative media'. Creative-critical practices such as mediation align with Haraway's aim, to 'make a difference' within the processes of the very mediation (Kember & Zylinska 2012, 203). Hence, this is an invitation to consider media as a material-vitalist, 'interlocked and dynamic' process.

Session 2 delineates three related aesthetic sensibilities. On the one hand, the papers elicit expressions of 'catastrophe aesthetics', as ways of thinking that undermine the prevailing

anthropocentric ideas that brought into existence the catastrophe of the climate crisis (Mulvogue 2017).

On the other hand, the artistic practices and methods discussed contribute to feminist post-human/new materialist aesthetics by highlighting 'techno-mythologies' and 'rhizomatic bodily performativity' (Ferrando 2016), as well as elaborating an 'implicit understanding of sensation and perception that pertain to the connection between technological culture and geophysics' (Parikka 2015, 49).

Lastly, the authors contribute to the philosophical task of questioning the Hobbesian subordination of potentiality to power, providing a critical transition from the conceptualization of modern technology as a privileged dimension where the two come together, hence perpetuating the 'process of naturalisation of power relations, based on and justified by social inequality resulting from varying degrees of access to the tools of technological production' (Altini 2010; Braidotti 2018a; Braidotti 2019b; Dane 1979; Ioan 2021; Israel 2021; Large 2017; van der Tuin & Dolphijn 2012) towards a monist neo-Spinozan project of eliciting technocofeminist imaginaries of vital materialist politics of the future (Bennett 2010).

In *sensing interdependency, experiencing embeddedness, extending the frame while zooming in*, Karin Reisinger and Petra Lilja take the reader on a mineral tour, starting with the critical observation of a desktop, and the indication of the material agency of its stationery, and going to the deserted iron ore mines of Sweden, where the art and architecture duo initiate a two-hour-long walk into the deprecated open-pit limestone quarry. Drawing inspiration from Stephanie Springgay and Sarah E. Truman's *Walking Lab* as a research method, the authors emphasise that research practices are not innocent. They take a 'political action' by acknowledging and embracing the material geo-logical, social, and economic complexities of the world. Attending to the losses caused by extractivism, the authors turn to notions of care and repair as paths towards 'strategies of surviving and coming together'. Reisinger and Lilja conclude with a call for 'being responsive and responsible in our non-innocent research practices' in the process of knowledge production and sharing.

Dorota Walentynowicz and Katharina Majewska-Güde turn to a feminist phenomenological hydro-logic of thinking otherwise about the conditions of artistic production in late capitalism. *Rethinking Artistic Productivity with Water* points out the conceptual relationality of the anti-productivist paradigm in art with the currently abundant aesthetic practices addressing political ecologies and the critique of sustainable development discourse. Tactically avoiding the debate on the 'digital divide' (Bishop 2012; Cornell & Droitcour 2013; Czegledy

2021; Pearl 2021; Prophet & Pritchard 2015; Schanken 2016), the disruption between conceptual art and media art strategies and methods, the authors attempt to bridge the critical instances in the practices and theory of Polish and American feminist art of the 1960–70s, with examples of what the authors position as ‘hydro-feminist’ art from the last two decades. Walentynowicz and Majewska-Güde emphasise the relevance of the forward-thinking critique of organisational systemic preference of development over maintenance of the 1960s. They mark the similarity between Ukeles’ forward-thinking emphasis on maintenance, with its aspects of caring for the earth and self-care, with the contemporary degrowth philosophies.

The article concludes with presenting FLOW, an artist residency on the floating barge ‘Solny’ in Poland as a model for future spaces of mutual care and alliance in ‘hydrocommons’ – a fluid becoming, with the other artists taking a holiday from the pressures and demands of the capitalist art market, flowing through the temporality of community co-being on the residency boat and the waters of the river Vistula.

The session concludes with a paper by Leon Lapa Pereira in collaboration with Jacco Bruggave. The tomato is one of the ubiquitous fruits, spread across Europe and all over the world after the ‘conquest’ of the Americas. *Becoming a tomato* is artistic research examining the colonial roots of reductionist and anthropocentric scientific thinking about the tomato. The authors attempt to experiment with a multidisciplinary arts-based research framework incorporating computational art, performance, and an implosive writing method. Motivated by Haraway’s proposal to rewrite the story of the world, the authors apply Latour’s approach to the notion of blackboxing to the defamiliarization of the life of the plant through observation. Resonant with the Brechtian ‘Verfremdungseffekt’ (the estrangement or alienation effect caused by reversing the roles of nature and history, eternity and causality altered across time), the authors claim to render ‘opaque’ the agency of non-human matter. This ideation process results in rule sets, which are followed in human performance facilitated by computation. Positioning their work as an anti-reductionist augmentation of senses, the authors aim to disentangle the bodily knowledge where the binary borders between human and non-human, self and other, natural and cultural are blurred in a process of co-becoming.

3.3. Session 3

In this session arts-based and practice-based research enabled scholars to ask new and bold questions about the agency of co-authored, human-generated assemblages, be it the ruins of a decaying web, traces of shared code, devices within

our body, or rules in gaming. The panellists debated the way that this process has transformed their own subjectivities and methods. Their artworks were presented as a significant outcome of this inquiry process.

In *Scavenging Lost Worlds: The Aesthetics and Creative Possibilities of Internet Decay*, Mariana Marangoni raises questions about how we can survive the bio/geo/political/social bias and binaries that produce the end of many worlds through policies of division, control, discipline and surveillance. Who eventually profits from the consumption of produced capitalist desires? Who benefits and who is haunted by its ‘ruins’? Who is held accountable for the damage by the ‘collective’ and/or its counter culture maintained as commons?

Sarah Ciston’s paper, entitled *Future Platforms for Intersectional Systems: Imagining Creative-Critical-Code Writing*, is concerned with sharing practices in the realm of coding. The paper acknowledges code as text and therefore culture production. Ciston argues that documentation of code needs urgent reconsideration to allow more diversity. She suggests centering coding around communities and making the process of coding more accessible and transparent. Ciston proposes future platforms that translate coding experiences between digital and analogue formats. She postulates ‘creative-critical-code writing that can ask reflexive questions about its own materials’. Similar to Silvia Federici when she calls for ‘a collective reappropriation of commonwealth, dis-accumulation of capital and struggle against the ways we have been divided’ (Federici 2019), this dis-accumulation emerges as shared code, downloadable zines that formulate new ethics. Pamela Varela is a ‘tEckhnO’ feminist activist, dancer, and performer’. In a performance entitled *transcendence – trance ‘n dance*, Varela created an interactive work that addresses the oppression of the so-called ‘body–mind–spirit’. *Sheocumentsdance* is a ritualistic and liberating form of self-expression through which the artist re-tells her narration, the ‘herstory’ in her own terms. She made use of a vaginal muscle reader to control the sound layer of her performance. Varela’s paper reflects upon the poetic and culture-specific implication of dance. What makes this work special is the intentionally unresolved ambiguity of contextualising the body as a medium of knowledge transfer, as well as the subject of colonialist, patriarchal, and capitalist absorption.

Co-authoring with the multitude: An iterative design framework for participatory art, by Jessiva Renfro, is based on a computer game that the author developed and tested with a group of participants. Her work draws upon findings about the game’s collaborative character during this prototyping phase: the game avatar can only be navigated by multiple players who coordinate the direction and

negotiate the avatar's decisions collectively, as co-authors. By adopting an iterative design framework, Renfro not only creates participatory art, informed by these valuable insights, but also facilitates a debate on current issues regarding co-authorship within collectives.

4. CONCLUSION

The chapter introduces an unorthodox aesthetic investigation of thinking with material words, the figurations of human artists, minerals, fluids, and vegetal potentiality. The authors respond to the political imperative to change the way we live in relation to non-humans and Others, aiming for ecological 'redistribution of the sensible' (Rancière 2013).

The newly emerging techno-ecofeminist and trans-feminist practices of hacking, in which the *Interferences of the Multitude* was grounded, invite us to rethink techno-artistic practices through the diffractive prism of critical co-dependence. It tries to generate environments, relations, and situations that enable new subjectivities to unfold. These new subjectivities are crafted through unlearning of self-censorship, as well as unlearning of colonial praxis, which is here used in the sense of measuring values of extraction, rather than understanding ourselves as transforming fluid materials. Most of the panellists are both artists and scholars. Their methodology of knowledge production is a deep conversation between theory and practice, and productive oscillation between the two. Their interventions, be it a multiplayer game, coding manuals, an art installation, or a mining community workshop, make creative expression operative for knowledge transfer; the contextualization and theorising of their intervention's impact are accomplished through writing. The intervention as an experimental setting becomes fertile ground for new empathetic technologies – technologies that facilitate a conversation on a specific research question. Most panellists generated a technology according to their critical investigations to apply them in an experimental setting. In conversation with this technology a process of co-becoming, 'becoming with' (Haraway 2013), was initiated, grounded in collaboration with concerned communities. To instigate and harvest change informs their current subject position. It opens new perspectives for critical thinking and engagement. What at first looks like an interdisciplinary practical–theoretical compilation of papers is the result of an intense investigation into careful modes of intra-action with more-than-human entities.

The artworks, performances, games, and the respective papers presented by authors in this track share this common onto-epistemological ground. It results in diverse tactical applications

and aims to outline future patterns of artistic action. They, at the same time, represent patterns of care, repair, and reinvention of the liveable future at the end of the world as we knew it.

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Modulating Matters of Computation, Modelling and Hyper-Separations

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We engage in a conversation with critical ecofeminism, which proposed to transform the colonialism-racism-capitalism-patriarchalism induced environmental crisis by non-essentialist countering of oppressions and hyper-separations produced by human/nature dualism. We modulate the critical ecofeminist approach by countering a similar dualism, namely that of nature/technology. Furthermore, our theoretical balance-act has a praxis-oriented side: we believe that computation can be included in ecofeminist action. By providing alternative forms of engagement to instrumentalization, we trace pathways to different futures, countering the binary narratives of technology but also its moralizing of socio-cultural mediation. We take an intersectional approach to outcomes of computational modelling (simulations, visualisations, forecasts) and discuss the ecofeminist method of synthesis as a way to include different perspectives into computational processes. We work with two ‘modulated models’ that pay attention to assumptions, observations and thinking about urban commoning initiatives, and amateur knowledge of radio telecommunications. We aspire to provoke discussions about different modes of inclusion in communities and archives that are centred on shared, environment-friendly, solidarity oriented life-style and mutual care. Our approach engages with feminist arguments and inquiries into ways patriarchalism is embedded in our relationship to technoscience and engineering. We explore modes of resistance by proposing skilled and alternative uses of these techniques.

Critical eco-feminism. Computational modelling. Synthesis. Intersectionality. Counter-computation.

1. INTRODUCTION

Ecological crisis in form of man-induced climate change, environmental migration and complementary political and economic crises render many longstanding oppositions inadequate, forcing us to embrace undecidabilities. Gayatri Chakravorty Spivak observed in postmodern literature a pattern of “undecidability between Europe and its other, in sexual difference; and undecidability between the human and its other” (Spivak 2003, 26). The difference between human and its other is critically addressed in feminist posthumanism by Rossi Braidotti, as well as other feminist new materialists who challenged the (in)distinction between culture and nature, and the Western conceptualization of this difference (Kirby 2017). Val Plumwood theorised these as hyper-separations, deep conceptual splits between men and their other, subordinated nature. She traced this split from ancient Greek androcentric conceptualisation of society, through the way it was inherited by the dominant Western religious movements of Christianity to Modern science import of oppositional and supremacist ideals of rationality and humanity: “The dual connection of women and

other subordinated groups with nature and of male elites with reason is the key to the fundamental colonising problematic of Western culture.” (Plumwood 2004, 47). It is necessary to challenge the naturalization of difference such as sex, gender, being or nature.

In this paper, we modulate ecofeminist critique with the practice of computational modelling. This modulation will take issue with the liberal premise of the autonomous subject with regards to collectivity. We will discuss computational modelling in the context of a community of people gathered around the interest in sustainable housing. We will also explore the collectivity in the knowledge space of a community-maintained digital archive of radio signals. In both cases, the fluid and temporary identities formed in the process of computational abstraction demonstrate the risk and difficulty to fix a boundary of difference. We are particularly interested in the analysis of computation that goes beyond recognizing its mechanical tendency to instrumentalise and operationalise difference. Our work with computational modelling suggests possible ways of embracing undecidability, for the

sake of articulating fluid identities and simulation outcomes.

We understand computational modelling processes as the active and intentional reduction of worldly experiences, processes and their encoding as interdependent relations. In the essence of computational machines is the operationalization of difference. One of the origins of general-purpose computing can be located in the work of Charles Babbage in 1820s and 30s, on his difference engine and later the analytical engine. Babbage experimented with encoding a wide range of problems as mathematical equations whose calculation can be automated. Similar aspirations to encode and articulate problems so that we can attempt to solve them with calculations remains strong today in computer science and its engagements with disciplines such as biology, sociology or urban planning. For example, in the field of animal population dynamics the relationship between the size of a wolf pack, the well-being and reproduction patterns of a heard of sheep and growth pattern of the grass field can be encoded in a computational model that explores the stability of this ecosystem depending on changing parameters (Wilensky & Reisman 1998). Another well-known example is the Segregation Model that establishes a computable relationship between race, life-style preferences and the resulting habitation patterns in a neighbourhood (Schelling 1971). Such models, which are more generally called agent-based-models, are meant to facilitate exploration of emerging patterns and tipping points in complex organisation of animal populations, elementary particles, nodes in networks or people in a society. The reduction can be useful to deduce optimal policy for social or resource management. We are, however, not interested in using computation to come up with policy, or optimise resource use. Countering the instrumentalization of difference in these reductions, we aspire to engage and offer ways to learn with computation for open-ended outcome of simulations and training. Working with models requires deliberation, intentionality and disclosure of one's interests. We propose to envision a different relationship between collective behaviour and statistical implications, between society and computation.

2. CRITICAL ECO-FEMINISM AND COUNTER-COMPUTING

Critical ecofeminism proposes to transform the techno-societal, colonialism-racism-capitalism-patriarchalism induced environmental crisis by a non-essentialist and non-solution-oriented countering of oppressions and hyper-separations. Eco-feminism is partly a project of synthesis. It draws on late 20th century attempts to connect feminist and ecological perspectives, as a critique of

green politics complacency in capitalist status-quo. Because there is a common thread to feminine suffering across the planet, ecofeminist proposals coming from divergent political ideals all recognised the need for a paradigm shift that would resolve the contradictory tension between fixed oppositions that characterise Western thought. These proposals centred on challenging the human/nature dualism as an ideology that enables exploitation of the non-human world.

Ariel Salleh proposed ecofeminist synthesis as a project of dialectic recontextualisation and re-framing of the hyper-separation problem (Salleh 2017). She aspired to characterise women as pertaining to multiple contradicting levels of abstraction, as 'common' to colonisation of territory (nature) and people (women); an occupation of bodies and thought. Ecofeminism should unite North and South, the thinking and acting, the concern for destruction of environments, and concerns for individual (political) rights. Even though Salleh's conceptualisation of women can be seen as essentialist and at times romantic, the method of synthesis points towards a way to bring things together, to always include more. While some authors see feminism as not sufficiently universal to address environmentalism, Salleh insisted on uniting force of feminine suffering, and its strong relation to environmental issues. Plumwood was more careful with essentialism in her take on ecofeminism. While proposing any fixed definition of women carries the risk of uncritical affirmation and cultural universalism, recognizing feminism as uniting thread across diverse forms of exploitation and suffering does emphasise critical affirmation and solidarity (Plumwood 2004). It quickly becomes clear why challenging the hyper-separation of the 'human' is central to the project of countering oppressions: throughout history, parts of humanity such as slaves, foreigners (barbarians) or women, were considered non- or lesser-human. Contemporary rendering of the human/nature hyper-separation still "conceives the human as not only superior to but as different in kind from the non-human, which as a lower sphere exists as a mere resource for the higher human one." (Plumwood 2004, 44). As an antidote to that, Oxana Timofeeva considers 'human' to be everything that is doing labour. Recognizing this labour in form of (legal) employment is another story, extensively discussed in her treatise on animals (Timofeeva 2018).

Synthesis is a concept that pertains to many discourses and has 'travelled' widely across domains and time. It is the resolution of the Hegelian dialectic method, a new proposition that comes out of the consideration of a thesis and its antithesis. Synthesis features prominently in Herbert Simon's characterization of design knowledge as synthetic, implying a categorical difference between the ambition to intervene in the way things are by

assembling objects – pertaining to design – and the aspiration to treat natural phenomena analytically and objectively – as in natural sciences (Simon 1969). Mathematician Fernando Zalamea associated the analytical scientific method with modern thinking tradition: dissecting objects from within and analysing them in terms of their elements (Zalamea 2012). Zalamea used 'synthetic' to propose a philosophy that would address objects always in correlation with their ambient milieu. A fourth direction to consider is Iannis Xenakis use of term 'alloy' in his treatment of the relation between art and science or more precisely, music and mathematics (Xenakis 1985). Xenakis aspired to describe this relationship as that of mutual inference. Art, claimed Xenakis, is a mechanism of inference, a plane on which all theories of mathematical, physical and human sciences move about. He presented these cross-pollination processes as densification, coagulation, creating alloys. Taking clue from these discussions, we propose synthesis as a way of thinking that hosts a multiplicity of perspectives and enables articulations of polarities without taking sides.

Intersectional feminism has shown that, instead of analysing each form of oppression, limitation or crisis separately, we learn more by looking at how they intersect. Intersectionality focuses attention on social, identity and ideological forces that affect and legitimise power (Crenshaw 2017). The synthesis of these diverse layers of oppression that intersectionality proposes is of high interest to the method and approach to computational modelling that we develop in this text. An intersectional analysis of computation would bring out the ways in which systems for computing and classification perpetuate oppression. The method of synthesis we propose is close to the intersectional approach in that it also looks at the social, ideological, technical and material forces involved and aspires to counter hyper-separations by addressing multiple levels of concern at once.

We think, that counter computing could build an alliance with critical ecofeminism. While computation and computing usually are embedded within colonialism, imperialism, racism, capitalism, or patriarchalism, counter computing aims to counter the context it originates from. To counter means to go or engage against, while to encounter means to meet or come across. As a noun, counter means a table, where accounts are made or persons meet, thus an object, which is in opposition. A counter is also a device that counts. As an adverb, it describes a way that opposes something. It operates as a prefix to something to oppose or to react to. Counter computing wants to encounter, account and oppose computing in heterogenous ways. It resonates with ecofeminist synthesis, since computing, at least understood from its etymological past in the Latin words *com-* and *putare* meaning putting things

together, potentially is a form of synthesis. Computing as a concrete physical activity of signal processing in electronic hardware surely is synthesis in a more mundane manner, but calculation, simulation and modelling could not be merely used for profit-generation, but also as putting things together as a gesture of solidarity and mutual care. Thus, counter computing could reveal means that could amplify or modulate ecofeminist synthesis. Again, on a technological basis, computing incorporates forms of communication, but this microform or kernel of communality could get amplified by algorithmic machinery into systems, protocols and as we specify further below into models build and programmed with the intention to re-link, synthesise or put together formerly disparate fields and matters.

Our approach to computing does not aspire to bring out certainty and resolve undecidabilities. To the contrary, we embrace an always temporary perspective from our situated positions, and what Donna Haraway called 'feminist objectivity'. In laying out tensions between the critical movement of 'radical constructivism' and 'feminist critical empiricism', both aspiring to challenge the 'inexplicable scientific objectivity', Haraway focused her critique on relativism, as a way of being everywhere equally, implying a false universality and also a denial of responsibility (Haraway 1988). As a gesture of switching metaphors, she proposed feminist objectivity – which implies situated knowledges and partial perspectives. She insisted on the importance and persistence of vision as 1) a way to avoid binary oppositions, and 2) an embodied gaze enabling a new doctrine of objectivity. Partiality, in the sense of the way Haraway characterises situated knowledges, becomes key for articulating counter hegemonic strategies. Working towards such vision informs the way we work with computational modelling that could host a multitude of perspectives, while disclosing our interests and positions. We explored working with real and imaginary data and creating interfaces, or observatories of these computational processes.

3. MODULATING MODELLING

Modulating computational modelling engages with feminist arguments and inquiries into ways patriarchalism is embedded in our relationship to technoscience and engineering, instrumentalizing all that comes in its scope. We explore modes of resistance in the domain of computation through developing skilled and alternative uses of these techniques.

Different from approaches taken by a number of contemporary scholars engaged with archaeology and extractivism of media and technical systems (Parikka 2015; Yusoff 2018; Mattern 2021) whose

work we value and consider necessary, we do not propose to expose dirty metal and labour in computational processes, but to work out ways to change the methods of interpreting computational outcomes and power balances implied in the expectations of (masculine) objectivity. Documenting data, material and biological injustice is of great importance to challenge established disorders and paths of exploitation. We aspire to contribute to this documentation from the side of already instrumentalised machines, efficient calculators of difference, by proposing to formulate and practice feminist expectations from computational processes.

Situating commoning and computation through modelling as praxis aims to develop their partialities, not universality, opening up the way to insights made from bodies, which are complex, contradictory, structuring and structured, not from above but from within. Such a persistence on partialities would safeguard commoning from repeated appropriation by paradigms of control, power, efficiency and applicability. We will discuss two distinct approaches to modelling that situate researchers' knowledge and interests in a communicative setup between abstraction (reducing the world to computable relations) and imaginary narratives and identities (explosion, synthesis).

Our first example of a 'modulated model' resulted from our loose (open-ended) collaboration with three housing cooperatives. A heterogeneous set of interests, opinions, insights and tendencies emerged in our interactions with these groups. Our discussions focused on 'common labour' or the idea of voluntarily contributing one's work for the betterment of the community. We built four related agent-based models from these, demonstrating how individual behaviour can be constrained (or not) by a regulatory mechanism. The models operate as catalysts for thinking two distinct systems of governance through: 'accumulation' and 'banking', and ways in which these systems affect the stability of simulated communities. We questioned how much an individual strategy affects the overall working balance, and how different rules account for collectivity. Such rules address decisions on when and how much one would contribute to the community. For example, a number of individuals might choose to do all their work at the beginning of the month, resulting in the lack of work-force when certain tasks need to be done later. We documented this approach to critical modelling practice (Savić et al. 2020) and presented outputs from the two models, emphasizing the narrative element (Savić & Martins 2021). Our modulated models aspire to help write new stories, new episodes of commoning.

The second 'modulated model' is an exploration of the digital archive of radio signals gathered by a community of radio enthusiasts. The research into

the identification of radio signals is motivated by an interest in synthesis – combining, transforming, joining things – and a discontent with the capacity of fixed oppositions (i.e. human/nature) to host learning and sensorial and cognitive coupling with radio signals. Computational explorations of data on radio signals start from this premise that an identity of a signal is best understood when compared and measured with other signals in an archive, a computational process which enables an intersectional perspective on data (D'Ignazio & Klein 2020). By putting the data together and processing its different aspects with machine learning algorithms, we forego the modernist taxonomical classification of radio signals which is attuned at disclosing their instrumentality (i.e. what is a signal 'for'). The models 'self-organise' around different perspectives on the dataset, offering stories and resistance in place of hard discrete data. It is an attempt to update Braidotti's nomadic theory (Braidotti 2012) to address materiality of neural networks and data on radio signals (Savić, In Press).

Our work on 'modulating models' establishes communication channels between imaginary reality and real reality. The two models are examples of a method of synthesis that pertains to ecofeminist values outlined at the beginning of this text, and pertaining to discussions initiated by Salleh or Plumwood, among many others. We explore the generative power of synthesis both in terms of artificiality and inclusion. Modelling carries a hypothetical index thus, we argue, it often comes across as utopia. Modelling furthermore is a way to materialise possibility spaces and can pertain to counter-hegemonic activities. Models do not lead to more scientific certainty but in fact generate more complications, opening up an insolvable spectrum of interpretations, attitudes and opinions. Instead of lamenting about the seeming loss of scientific certainty, we think that such a loss could be a powerful insight, especially in terms of politically engaged humanities-driven, experimental (media) design research.

Media studies scholar Claus Pias argues, that "because various people model and simulate the same problem in various ways, what eventually emerges – instead of certainty – is an un-circumventable spectrum of opinions and interpretations. And it is to this degree that simulations contain an element of sophistry and take sides." (Pias 2011, 52). Simulations take sides, and imply an interested entity that makes sense of computed outputs in form of probability predictions, or simply stories and (societal) narratives. Following philosopher of science Isabelle Stengers we recognise that modelling as part of what she characterized as "Western science" has always been linked to engaged political positions (Stengers 2000). We explore the generative potential of undecidability, of the presence of a multitude of

things at once. We engage with ways of putting computational frameworks and processes not only together but also back into their genealogical contexts, so that new ways of arguing about their outputs can form.

4. TOWARDS AN ECOFEMINIST METHOD OF SYNTHESIS

Feminism stands for the struggle against essentialization of women and naturalization of gender, as well as other differences such as race or sexual orientation. We observe a similar logic of essentialisation and instrumentalization in technical systems that perform computation. They are historically based on establishing and computing difference, in form of finite mathematical values (integer or rational numbers), states of conductivity (transistors and chips), fulfilment of conditions (if/then/else). Even more problematically for our aspiration to counter oppressions and hyper-separations through an engagement with ecofeminism, every definition of women seems to bring along some form of essentialism. In tracing a common thread across humans that qualify as 'women' essentialism propagates exclusion: there is always someone who does not fit. Conversely, the assumption that those whom the previous thread would circumvent should identify as women or only women essentialises their position. A definition of the other is necessary whenever we want to (de)limit the ongoing exploitation of humans and nature. This points to the importance of making careful and fluid, rather than fixed separations of women as other, or rather ourselves and our other. While the other is that which, by virtue of not being in the centre of politics, lends itself to exploitation, we read ecofeminist proposals as invoking the agency of the other - the other gender, race, being or matter. This other is addressed by a diffractive look, which can never be 'focused' and requires a politics that favours decentering of the subject.

As an outlook towards articulating a different new gesture, we recognize that computing systems are able to bring together concerns of mathematics and matter. Technologies as tools and bodies, are not opposites, but intermingled. Situating computation and modelling takes "the way out of the maze of dualisms in which we have explained our bodies and our tools to ourselves" (Haraway 1987, 42). We consider *com-putation* as a process of putting things together.

4.1. Sympoiesis in Com-putation

With our proposal for a humble contribution to computing towards a praxis of modelling differently, we establish intersectional connections between the work of machines and people - both in terms of the topic of our first modulated models, and the

sensibility for their inseparability and mutual effects. In this sense, we appreciate the raising concerns for the way our 'digital lives' affect us individually and partly align with the proposal such as 'slow computing' (Kitchin & Fraser 2020). We think it is important to emphasise the possibility to use computing to slow down things and connect to other ongoing processes. We also aspire to affirm the different capacities in which we learn to use computational processes, such as putting algorithms, frameworks and models together. Furthermore, we also do not affirm the authoritarian concept of knowledge that pertains to Enlightenment and the gesture of emancipating masses from ignorance. To the contrary, we view knowledge more abstractly, as the political and learning process of engagement, or sensorial and cognitive coupling with our world. Knowledge and knowing is not reducible to emancipation or transparency: if someone was presented with letters, or data, they would not be able to make sense of them. Being a practitioner of a language or a writer renders one knowledgeable, or cognitively and sensorially coupled with the world. That is where knowledge manifests and appears: It enables one to use language, or computation, in any way they want. Cognitive and sensorial coupling with computational systems enable political deliberation with regards to these systems, as well as skilfulness in reading and writing, or understanding how information processing works.

We propose computing and modelling as praxis of *sympoiesis*, again referring to Haraway, extending at the same time the medium of written, text-based fiction, she is proposing to a more interactive and the same time techno-scientific way of *fictioning*, which we discuss here as (computational) modelling. *Sympoiesis* means writing or making together. While writing new stories together surely is constructive, we propose to additionally program and design new models together, which unfold time in different ways compared to texts and might trigger different and alternative ways of *futureing*.

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A Joint Expedition into the Future of Soft Tech

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This article is based on a series of participatory art & technology workshops where professional artists and designers, hobbyists, researchers, and tinkerers were invited to four online workshops investigating their relationship to current and future technologies through participatory speculation. Drawing from critical making, the workshops were focused on joint discovery through hands-on making as thinking where knowledge of techno-social systems is produced collectively. Our analysis of the workshop series shows that workshop participants did not necessarily feel part of a joint discovery and that we were challenged in creating the intended non-hierarchical structure throughout the workshops. However, the workshops did succeed in challenging participants' idea of hard and soft technology and thereby also their own skills. We saw a recognition of the need for dialogue around technology and what it is perceived to be.

Participatory speculation. Critical making. Science fiction. Diversity. Technology. Digital technology. Collective. Crew.

1. INTRODUCTION

In recent years, we have seen increased interest in using science fiction as a tool to speculate and imagine alternative futures. Science fiction offers us a space to critically think about different future scenarios and discuss how our current ways of living might impact the future (Burton et al. 2018; Kohno & Johnson 2011; Kong et al. 2021; Linehan et al. 2014). Projects such as Art + Com Studio's *Terravision* and SymbioticA's Tissue, Culture & Art Project (TC&A) installation *Disembodied Cuisine* exemplify how the genre has become a source of inspiration for innovation. With *Terravision* we see "... an isochronous realization of Neal Stephenson's literary idea in the novel 'Snow Crash' as well as a prequel to Google Earth" (Art + Com Studios n.d.), while Nasa requested to patent the tissue culturing protocol that TC&A developed for the *Disembodied Cuisine* installation (Catts and Zurr 2004-2005). Science fiction rarely inspires near-future technologies, but it provides a rich ground to explore critical and future technologies and their impact on us and our society.

In this paper, we explore the relationship between humans, technologies, and the role that science fiction might play in reimagining our technological futures. Our analysis and discussion are inspired by the American speculative fiction author Ursula

Le Guin's *A Rant About Technology* (2004). Here Le Guin rejects the classical distinction between hard and soft science fiction. She writes:

'Hard' sf {science fiction} is all about technology, and 'soft' sf doesn't have any technology, right? And my books don't have technology in them, because I am only interested in psychology and emotions and squashy stuff like that, right? Not right. How can genuine science fiction of any kind lack technological content? Even if its principal interest isn't in engineering or how machines work — if like most of mine, it's more interested in how minds, societies, and cultures work — still, how can anybody make a story about a future or an alien culture without describing, implicitly or explicitly, its technology? Nobody can. I can't imagine why they'd want to. (Le Guin 2004)

The empirical foundation of the paper rests on our experiences with developing and running the *Digital Alchemy Workshop Series*. This was a series of four online workshops that took science fiction and/or speculative fiction as a starting point, while adopting 'critical making' (Ratto 2011) and 'participatory speculation' as methodologies (Frauenberger 2019; Shklovski & Grönvall, 2020).

We also discuss the question of the relationship between humans, technology, and science fiction in a conceptual predecessor to this paper, which is

titled *Collectively Reimagining Technology* (2022). However, while the predecessor narrows in on the conceptual discussion, with this paper we present an analysis and discussion of the actual workshop series. Thus, we will investigate our intent of creating an inclusive journey, where participants and their experiences can become an indelible part of critical knowledge production and future speculations. We will discuss the challenges of the online workshop as a format, the limits and failures in the curation, the preparation and carrying out of the workshops. We continue the paper as follows: we begin with a brief introduction to the theoretical and conceptual backbone of the *Digital Alchemy Workshop Series*. We then continue to introduce methods used for data collection and analysis and the context of the workshop series. This is followed by an analysis of the empirical data presenting key findings. We end with a brief discussion of our findings as well as reflections on how to further strengthen our approach to creating spaces for collective reimagination of future technologies.

2. THE WORKSHOP AS EXPEDITION

Our use of science fiction as a source of inspiration for thinking about alternative technological futures builds on extensive work in the field. For example, science fiction has been praised as a source of inspiration for research in Human-Computer Interaction (HCI) and exploring the relationship between science fiction and HCI (Mubin 2015; Mubin et al. 2016). Science fiction has also been used as a starting point for workshops in experimental entanglement (Kong et al. 2021), as a basis for prototyping and narrative scenarios (Burnam-Fink 2015), and even as inspiration to come up with alternate endings to HCI papers (Linehan 2014). However, although not new as workshop material, the *Digital Alchemy Workshop Series* contribute to existing research and experimentation with an explicit emphasis on and use of diverse works of science fiction, going beyond the traditional North American canon (Okorafor 2017).

In our design of the structure of the workshop series we were inspired by Le Guin's short story *Sur* (1985), where she describes an expedition to the South Pole by a group of women from South America. We wanted to establish an informal learning environment that resembled the scientific expedition described in *Sur* where their journey is motivated by the longing for the South Pole and thus learning more about the world. In this fictive expedition the women set out not to break scientific ground but to observe and discover, to travel and to see. Given the possibilities for women at the time the short story takes place, none of them had any formal education and therefore no possibility to officially add to the scientific knowledge about the

South Pole. Instead, it became the act of traveling and observing that became essential for the women. They were motivated by the desire to build knowledge for oneself and the collective by traveling on the expedition. The women in the story are "by birth and upbringing unequivocally and irrevocably, all crew" (Le Guin 1985, 2012) they are all equal, rely on collective decision-making and are thus able to reach the South Pole through a collective effort. We sought to create a learning environment where the participants had the possibility of actively engaging in the workshops and eventually becoming "crew" in a collective exploration of possible technological futures.

To facilitate a collective learning environment, we combined our use of diverse works of science fiction with a focus on the processes of critical making and participatory speculation. According to Matt Ratto, critical making is concerned with the shared acts of making more so than the objects being made. He argues that the objects: "... are considered a means to an end, and achieve value through the act of shared construction, joint conversation, and reflection" (Ratto 2011). Drawing on critical making, the *Digital Alchemy Workshop Series* stressed the importance of the process and joint conversations taking place during the making, more so than any final product. In addition to critical making, we were also inspired by participatory speculation in our design of the workshop series. Speaking of participatory speculation, Christopher Frauenberger argues that it is important to create "... spaces and processes that enable humans and non-humans to come together in the creative, political, controversial Participatory Speculation and mattering of future socio-technical configurations" (Frauenberger 2019, 19). We took Frauenberger's collective "mattering of future socio-technical configurations" as a starting point for developing insights into science fiction concepts using present day materials.

Thus, in the workshops, we tried to facilitate a focus on the process of making and collective speculation by introducing various techniques, continuously drawing on a diverse body of science fiction literature, encouraging experimentation, and asserting that it was alright to make mistakes

3. METHODS

The *Digital Alchemy Workshop Series* consisted of four online workshops each lasting between 2-3 hours. They took place in February and March 2021. In the open call for participation, it was emphasized that the workshop series was part of a H2020 research project and that researchers would attend and take notes during the workshops. We had between 10 and 15 participants in each workshop. Most participants were based in Denmark, but we also had international

participants, including participants from the USA, Italy, Portugal, and the UK.

Drawing on methods from participant observation (1980), we took field notes during the workshops, taking note of informal conversations, questions being asked as well as communication taking place in the chat function. For the last two workshops, we introduced a facilitated and audio recorded conversation, engaging participants in a dialogue specifically related to our use of methods from critical making, participatory speculation, and a diverse body of science fiction as a source of inspiration to think about technologies. We encouraged participants to contact us by email after the workshops if they would be interested in taking part in an interview. Using semi-structured interviews (Brinkmann & Kvale 2018), we interviewed a total of five people, one of whom had taken part in two workshops. All interviews took between 60 and 90 minutes. All five respondents identified as women. We developed an interview guide for the interviews, including questions concerning the respondents' relationship to digital technologies, workshop expectations and experience, and previous experience with science fiction. All interviews were audio recorded and took place on Zoom due to the ongoing COVID-19 pandemic.

Following data collection, the audio recorded semi-structured interviews were transcribed. Following this, we coded the interviews using the NVivo coding software. We combined deductive and inductive approaches to coding, starting deductively with a set of codes based on existing research (Andersen, Renza & Fieseler, 2021; Frauenberger 2019; Ratto 2011), but also allowing for themes and codes to emerge from the data. Key themes emerging from the interviews included “the Wild West of the Digital Transformation”, lack of transparency, and science fiction inspired reflections. Field notes were used to further inform our analysis of the interview data.

3.1. The Digital Alchemy Workshop Series

The *Digital Alchemy Workshop Series* consisted of four workshops each of which focused on a different type of technology and taught a different set of technical skills and understandings. The workshop series was created based on the exhibition *Digital Alchemy: Future Technology Products Inspired by Diverse Voices in Fiction* by artist and designer Mirabelle Jones. The objects were created during Jones' Feral Labs Residency at Catch - Center for Art and Technology, Elsinore, Denmark, where the objects were on display from December 2020 to September 2021. Situated at the intersection of product design, speculative fiction, maker culture and intersectional data feminism, Jones selected devices and technologies

described in science fiction and realized them as artworks that simulate interactive product prototypes. The chosen pieces came from literature written by a diverse body of authors including women, LGBTQAI* folk, and people of color. According to Leah Zaidi “science fiction empowers marginalized voices, fosters equal representation, and challenges entrenched orthodoxies and concepts of ‘the other’” (2019). The exhibition thus borrows the worldbuilding created in the narratives and lets the viewers imagine a future world, where diverse voices are creating the technology and the futures, we will live in. Photos 1-3 are some photos from the Digital Alchemy exhibition at Catch.

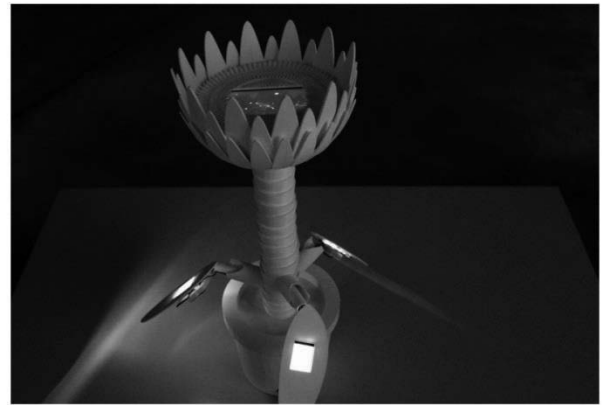


Photo 1: e-Protea by Mirabelle Jones, photo credits Mirabelle Jones



Photo 2: More of What You Want by Mirabelle Jones, photo credits Mirabelle Jones



Photo 3: *It's Time We Talked* by Mirabelle Jones, photo credits Majken Overgaard

The four workshops were:

1) *The Future Gallery Text*. This workshop investigated what would it be like to step inside the art gallery of the future? What kinds of art objects, materials, technologies, themes, and aesthetics can we expect to find there? What would the exhibition wall text, catalogue and other written materials in the exhibition be like? How does the way the exhibition is presented to us reflect the values of this future society? In this design fiction / speculative writing workshop, we took a deep dive into the language of art. We began by having a look at present day practices, investigating the language artists and curators use when discussing, describing, and evaluating works of art. We put our knowledge into creative action by speculating about future exhibitions using Miro - an online collaboration software. In the end, we each created our own exhibition text for an art exhibition of the future and shared it with each other.

2) *Hackathon: Diverse Voices in Science Fiction*. This workshop explored what the implications are, if many of the works of science fiction which we see attributed to modern technologies were penned by white cisgender heteronormative male authors? What are the implications if the same dominant voices are overwhelmingly centered in the design and development of new technology products? Who gets a voice in creating the future and who is excluded? We hosted an online hackathon where we created a forum for reflection on how participants could be a part of expanding the narrative of science fiction technology and who creates it. Among other things we collectively redefined the Wikipedia page describing science fiction and science fiction technologies, to highlight the voices of a more diverse body of science fiction authors, technologists, scientists, artists, and inventors.

3) *When Things Speak*. In this hands-on creative code and speculative design workshop, we investigated what our world might be like if the objects around us (including products, clothing,

etc.) could speak. Participants learned how to create their own interactive art objects, inventions, and wearables capable of speaking words, producing melodies, and making other sounds. We also investigated some of the above questions about creating technologies with “personality.” Students used the Adafruit Circuit Playground: a microcontroller prototyping board that comes with many sensors and built-in sound capabilities to explore these questions in conjunction with re-imagining the objects around them, sketching new speculative objects, or incorporating technology into their previously constructed works.

4) *The Future Composer*. In this hands-on creative sound programming and speculative workshop, we looked at the use of algorithms in musical composition and how this technology has influenced digital music. Together we speculated about the future of music composition asking: can generative methods enhance our creativity or which implications might autonomous computer music have for future creativity? How do the digital tools we use affect the way we create music and which kind of music we make? We discussed the relationship between humans and algorithms in artistic creation and what forms of hybrid co-creation the future might bring. What will future music sound like? How will it be created and who will be the creators of it?

Immediately after the opening of the exhibition on December 4th, 2021, Denmark went into a lockdown period caused by COVID19. In response, we created a temporary collective consisting of artists Mirabelle Jones and Julie Østengaard, researcher Kirsti Reitan Andersen., the curator Majken Overgaard, and researcher Irena Shklovski. Artist Mirabelle Jones led the first three workshops while artist Julie Østengaard led the last workshop, *The Future Composer*. Andersen joined the collective as part of her research, investigating the potential role of the arts in creating more diverse and democratic digital futures. Overgaard is based at Catch, an institution that takes a practice-based and open-door approach to learning, believing in individual and community empowerment through skill sharing. Embracing the practice of creating as thinking, this institution brings together experts from a variety of specialties and backgrounds to explore and disseminate ideas through an interdisciplinary lens. Researcher Shklovski leads a Lab at the University of Copenhagen exploring the possibilities of different futures through a diversity of methods and approaches. Thus, three educational institutions were engaged in the workshop series, all of whom were eager to investigate the potential of activating the experiential nature of the exhibition through an online workshop series and explore the creation of informal settings for learning about technology through the arts.

4. THE WILD WEST OF THE DIGITAL TRANSFORMATION

In the following, we present an analysis of the interview data supported by observations from the workshops. We will put our findings into perspective by drawing on secondary material such as reports and academic articles.

In the design of the workshops, we took skill-building as a starting point to be able to discuss, understand, and work with technology, for example, a microcontroller like the Adafruit Circuit Playground Express. However, in line with critical making (Ratto 2011), the conversation about how to understand and perceive the technology being used in each of the four workshops were considered just as, or even more, important than the “final objects”.

Asked about their relationship to digital technologies in the interviews following the workshops, all respondents reported that they use computers and smartphones in their everyday lives, e.g., for work, communication, creation, and entertainment. Respondents expressed being grateful for the opportunities that current technologies bring about, for example in terms of staying connected and finding knowledge. One of our respondents, Bella explains that she feels as if the internet is like Huey, Dewey, and Louie's book in the Donald Duck Cartoon, where they can find answers for all their questions. To some of our respondents' digital technologies are central to their artistic practice. This included Kathrine, who amongst other things creates interactive installations, and Bella, who uses her computer to create music. All respondents mention that they use their smartphones and computers to stay connected with friends, and to relax and disconnect. Despite digital technologies being an integrated part of their everyday lives, our respondents generally expressed a slightly ambivalent relationship to technology. Their concerns were primarily related to time spent on SoMe and the internet and data collection.

Naja, for example, only recently got a smartphone and only because her work requires her to have one. She explains: “I just enjoyed the freedom of it [not having a smartphone]. I enjoy being on the train on my way to work and just be able to read without constantly taking up the phone to check my email or if someone has written to me on messenger.” She continues: “I mean, the way a lot of apps, Facebook, many things, they make it so that they get you hooked on it and for them that's not a disadvantage, but for me that's a disadvantage.” Talking about her laptop, Kathrine says: “In a way, it's the closest relation I have to a thing, that's my computer, because I'm so much with that. I hate how that sounds. I don't have a television; I have a smartphone and a computer.”

However, respondents also expressed feelings of helplessness as to what to do about their technology related concerns and fears. Isabel says, “And it's insane, Google Lens, I always know about it but never use it. ... So, I mean, you can control your technology in the measure of your usage. But you can't really control what technology can do to you.” Kathrine points to the current lack of regulation in the sphere of the digital transformation, making references to the digital transformation as the “Wild West” of current times, “I'm optimistic that it is possible to kind of restrict this kind of Wild West that we're in right now. But at the same time, I also think maybe I'm a bit paranoid in a way, because I'm so concerned, opposed to it. That I don't trust any kind of technology. But I'm not knowledgeable enough to know what's trustworthy and what's not.” Thus, respondents talked about various options to act upon some of their technology-related concerns. Kathrine, for example, explores “... how to reconnect with natural materials and make technology somehow more bio based” through her own artistic practice. Naja explains that she has been trying to avoid having a smartphone. Generally, trying to not use a specific technology and/or digital service seemed to be the measure most often taken by our respondents to protect themselves, although not a particularly successful one.

Despite their concerns about digital technologies, the respondents' main motivation for participating in the *Digital Alchemy Workshop Series* was less related to these concerns and much more to a desire to learn more about a specific technology and/or skill set, such as how to edit a Wikipedia article or how to write code.

Our analysis of the interview data indicates that the *Digital Alchemy Workshop Series* was successful in its ambition to encourage a more nuanced discussion about development and use of digital technologies. Thus, while respondents were aware of issues such as addiction to SoMe, data collection and some reflection upon the environmental impact of technology, the workshops generally moved the discussions beyond these issues to also include perhaps more fundamental questions of exclusion and inclusion. Questions like “for whom and by whom is technology created?” were asked. All respondents report that they signed up for the workshops to learn (more about) a specific skill or tool, but what has stuck with them afterwards were the science fiction-inspired conversations and the approach to technology development facilitated by Jones and Østengaard. In the words of Naja, she “... didn't even realize that there was gonna be a conversation drawing on science fiction, but this is what has stuck.”

Respondents, especially those coming from a non-artistic background, also noted the playfulness characterizing the workshop series, generally

setting them apart from workshops taught by, for example, computer scientists and engineers. Naja says that comparing Jones' workshop *When Things Speak* to previous classes on coding in which she has participated, this one was much more playful. She elaborates that rather than starting from the code itself, Jones started from a wish to make "a thing speak." This encouraged a quite different approach to coding than learning a coding language for the sake of coding.

Some of the respondents echoed the workshop organizers' stance that the more we learn about digital technologies, the more we can also do to influence them. Interestingly, while respondents did not report gaining much new technical knowledge, for example in terms of "how to code", participation inspired new thoughts for their own practice and/or teaching. Naja: "But I guess I have started thinking about things a little bit differently. I didn't take notes I think, maybe a few, so I'm not sure how much has stuck, but I think it can contribute to some of the brainstorming I need to do at a later point. It depends how you define learning. I mean, I didn't learn any - maybe - facts, but I think I got a great deal out of it in terms of how to look at it and perspectives and so on."

While the interview data shows that the workshop series succeeded in bringing more nuance to the participants' views on the development and use of digital technologies, we also found that we did not quite succeed in our ambition to create a collective reimagining of technology. A major goal of the workshops was to establish a sense of collectivity or crew - a sense of being in it together and working together, feeling the import of individual contribution to the collective whole of the effort to re-imagine our digital futures. Yet we felt that little or no sense of collectivity or crew was established for most of our workshop participants.

Our interview data suggests various reasons as to why this did not happen. All respondents report that they found the online setting for the workshop challenging. Based on previous online workshop experiences, many participants had the expectation that they were going to attend a lecture in the sense that communication would primarily be one way. In other words, participants came to the workshop expecting that someone would take the lead and that they would be taught a skill without needing to put themselves out there through dialogue and reflection.

When Jones and Østengaard encouraged active participation and engagement, participants seemed to struggle with whose turn it was and if to engage by chat, by voice and/or at all. Many had a hard time working out the rules of engagement—who could or should speak when and how to keep the environment inclusive and safe while expressing a diversity of views. Kathrine, who took part in *The*

Future Composer workshop and had previous experience with digital music, explains that she did not contribute much to the conversation because she was unsure at what level to ask questions to not intimidate other participants because she felt she was more knowledgeable than most. Bella highlights the importance of creating a "safe space" for participants to ask questions. While she appreciated Jones and Østengaard's attempts to do this, she also says that "I almost did not dare say anything in the workshops." Some of our respondents also explained that they sometimes had answers for other participants' questions, but held back answering these questions, as they were unsure of the format in terms of who could do what. Moreover, Bella explains that "I was constantly contemplating if what I had to say was relevant to everyone. To not ask dumb questions. In an online setting it is particularly hard to just talk to one person, as you would do in an offline setting."

The hands-on element of the workshops also left our participants generally a bit frustrated. Some got stuck with the technology not working and this being hard to fix in the online setting. Others saw the problem and would have liked to help each other but couldn't find a good way to do so remotely. Many participants had hoped for much more hands-on work in the workshop and did not have time to come as far as they had hoped for but, curiously, all appreciated the reflective discussions even though discussions clearly took time away from the practical work of technical skill-building.

5. DISCUSSION AND CONCLUSION

Our purpose with this paper was to further explore the relationship between humans, technology, and the potential role of a diverse body of science fiction in reimagining technology through the format of the workshop. The arts, not least science fiction, is widely recognized as a source of inspiration to think about the future. In the words of Petersen: "When it comes to the future, art rarely predicts, but it has a profound ability to expand our understanding of the realm of possibility. ... While it is true for a lot of art, few art forms have bent our conceptions of what is possible as consistently and decisively as science fiction, a genre that is situated between current reality and future possibility." (2021, 46).

Drawing on previous work and research using science fiction as a starting point for speculating about the future, we provided skill-building as a method and invited the participants to a conversation about how to understand and perceive technology. The experimental nature of the workshops was developed because we sought to create a non-hierarchical place for workshops participants to learn collectively, because we believe the act of *collective reimagination* is essential in

creating more diverse digital futures. To do so, we employed diverse works of science fiction as a framework through which to collectively imagine a plurality of worlds or what the Zapatistas call the pluriverse: “a world in which many worlds fit.”

Inspired by Ursula Le Guin, we also deployed the concept of the exhibition as a passage through which to lay out the workshop’s structure. While Le Guin’s exhibition goes to the South Pole, a place which she describes as a place largely without law, our respondents also tell a story about a lawless place, namely the internet. One of our respondents talked about “the Wild West” or a place without law that is both a bit frightening but also full of opportunities. Le Guin’s expedition to the South Pole in our case became an expedition to the internet (Andersen et al. forthcoming).

Our analysis of the interview data amongst other things show that respondents have concerns related to their use of digital technologies, specifically data collection, surveillance, and addiction to SoMe. In recent years, these topics have received increasing attention in research, e.g., Flyverbom (2020), Shklovski (2021), Zuboff (2019), and Copenhagen Institute for Future Studies (2021). Flyverbom writes: Digital technologies have become the backbone of so many parts of social life because people embrace them, seek information and are excited about the services and solutions tech companies offer.” (2020, 250). Flyverbom continues by making a reference to Gerber et al.’s “privacy paradox” stating that while many people are concerned about their personal data and privacy, they still share data carelessly and rarely spend time protecting themselves (2020, 250). While respondents pointed to exactly this paradox, our analysis of the empirical data also indicates that the workshop series inspired other, and perhaps, more fundamental and structural reflections on technology creation. It seems that through the workshops we managed to begin to dissolve the distinction between hard and soft technology and move the conversation to issues of inclusivity and democracy, while also introducing new skill sets. In the empirical data we see a recognition of the need for dialogue around technology and what it is perceived to be.

However, we found that it was very hard to establish the non-hierarchical structure that characterized Le Guin’s expedition in our workshops. Indeed, it is very questionable if we ever succeeded in creating an environment where everyone felt as crew (le Guin 1985). Thus, our analysis of the empirical data indicates that the workshop invitations’ emphasis on skill-building may have led people signing up for the workshop to expect being in a classical teacher-student environment traditionally characterized by knowledge transfer rather than active co-production of knowledge (Andersen et al. forthcoming).

Although the online format posed a challenge for the collective reimagination and “sense of crew” to come to life, our interview data also suggests that other issues were at play. Our respondents pointed to a certain confusion as to what sort of engagement was expected, an issue that was most likely strengthened by the online setting. Thus, we can ask ourselves if the experience would have been different had the workshops been in an offline setting? At the same time, the question of prior skills and participants’ confusion as to what their fellow participants brought to the table, in other words, confusion about the hierarchy of the workshops (and the lack of the same) seems to have been a stumbling block in terms of facilitating critical making (Ratto 2011). Within this setting it was difficult to create a level playing ground and a safe space for everyone to participate in the collective reimagination of future technologies. It is possible that in a face-to-face situation the facilitator could have responded and addressed this confusion, but this was difficult online.

Based on the workshop experience, we ask ourselves what is needed for people to feel that they can contribute to discussions of future technologies? And at what point in time during a skill building process do you feel able to participate and become part of a joint journey? Our current conclusion is therefore that we need to be even more aware of tech capabilities and audience expectations regarding content. Learning goals also need to be negotiated together with workshop participants. To create a feeling of participation and joint journey maybe we need to plan workshops in closer collaboration with our audiences. Thus, our own journey continues, and we will also in the future investigate the idea of the joint expedition and collective contemplations about the future soft tech.

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sensing interdependency, experiencing embeddedness, extending the frame while zooming in

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This text is a dialogic conjunction of working practices developed in and around specific quarries, with Karin Reisinger tracing the material and life-worlds of iron ore in Malmberget and Petra Lilja the limestone in Limhamn, both in Sweden. We walk and think with humans and non-humans such as rocks, stones and minerals through our respective practices and pedagogies of design and architecture. Our practices take place in and around quarries, extractive sites of mining. We come in after the machines, when it is time to think about how to move forwards, to deal with the losses, to repair and care and to find strategies of surviving and coming together in educational situations. Dealing with the large-scale spatial changes, we are deeply aware that we are participating in massive earthly and material movements. With this paper we also share connections between theory and practice, based on a feminist-materialist framework. These connections lead us to the various applied practices of sensing interdependency, experiencing embeddedness and extending the frame while zooming in and to its epistemological reverberations.

Minerals. Extractivism. Quarries and mining. Feminist new materialisms. Architecture and design. Pedagogy.

1. MINERAL DESK STORIES: SCALES OF IRON ORE/SCALING UP WHILE ZOOMING IN



Figure 1: Mineral desk: Introductory exercise for the Symposium on Artistic Research, 25–26 November 2020, Karin Reisinger

Look at your desk, or specifically, the objects around you, your little “helpers”, the pen, the USB stick, the sharpener, the binder, even your tea ball and spoon, and of course your laptop, the screen that allows your neck to stand the physical inability to move around that accompanies being online for hours. Even your chair might depend on metal, at least to hold its parts together, or to roll from one side to the other in front of your desk.

All these “things” which allow you to do your work, connect with friends and organize your life, were produced from specific materials. It is not only the form, the invention and the human agency that made them but also the material itself that allows for their agency, inventions, production and, finally, your action and creativity, for what you end up doing.²

1.1. Scaling up

Thinking in larger scales while thinking back in time means thinking of the places where the material comes from. Which forces were involved in the emergence of the material? Who was involved in the extraction? Who was involved in the production of the “objects”? Whose ground was utilized, and whose agencies and belongings were disturbed? Thinking of the human without the non-human, and vice versa, would make way for further capitalist thinking of separation. “Living-with and dying-with each other”, on the contrary, can be seen as a way of fiercely replying to the Capital (Haraway 2016, 2). Unfolding feminist new materialisms, Sarah E. Truman mentions the example of a phone, “constructed from metal, frequently mined at the

expense of violent racialized human labour and Indigenous sovereign rights over land” (2019, 9).

Dear architect, look at the room around you. Which parts are made of iron ore? Windows and door frames, door handles, maybe even furniture. What about the parts we don't see, those involved in the construction, like the iron girders or even construction beams from steel, which care for the building's shape, its carrying and load capacities, providing shelter and stability, a material frame for our lives...



Figure 2: Malmberget. Photo: Gabriella Olshammar, 2008

1.2. Zooming in

Looking at the maps of iron ore production, many indigenous lands are involuntary and often expelled hosts of mines. Malmberget in Sweden lies in the indigenous area of Sápmi. The town owes its existence to the rich underground ore deposits. The current disappearance of the town results from the extension of the underground cavities, which make the ground unstable and cause more and more “seismic events”. In a very slow process of disappearance, people lose their familiar social and physical environments. Following this example into details and practices shows a local proficiency and is dependent on the openness and generosity of the local practitioners who perform reparative activities for the societies, such as coming together to embroider the past, present and future of the mining areas, like the local Embroidery Café

founded by Karina Jarrett. Zooming into conditions and livelihoods, multitudes of personal fates and strengths responding to the situation, made it possible to learn about the sacrifices and gains of the local population in relation to mining, and about unexpected practitioners (Reisinger 2020; Reisinger 2021).

As Sarah E. Truman continues, “[i]n considering the ‘value’ of a phone, feminist new materialist research might ask questions about the ways that humans and metal and phone and land and capitalism and economy and militarism, and so on, are already imbricated in each other” (2019, 9). The life-worlds of local practitioners are involved in situations without exits. They manage to make a living in mining areas that need a diminishing workforce. Many of the complex reparative actions are not on the payrolls of mining companies. Elizabeth A. Povinelli suggests that swapping “our telescope for a set of binoculars” can help solving local problems (2017). Thus, from the perspectives of consumers, local fields of production can be sensed with attention to actors who care for the people who lose their houses, for the endurance of the local ecology, and for the many non-human living creatures who need to deal with the changes. Laying down the binoculars, we, non-indigenous European researchers, can recognize from the position we look at that, even with the instrument that allows for our visual relation, the binoculars themselves, we are directly dependent on the material of iron ore.

Such entanglements also serve to show how we architects and designers, in both our professions and our daily use (such as visualizing), are connected materially. The constructed distinction between Life and Nonlife is no more sufficient and new alliances and combinations are required, Povinelli demands (2017).

The creative practitioners of Malmberget and its surroundings deal and grow with the loss, embroidering buildings that are to be lost. The artist Miriam Vikman painted facades of the houses that have been dismantled. Pernilla Fagerlönn organized and curated the festival *farväl focus* for the community to take leave of the last remaining high-rise building with a rich programme of music, history, literature and arts. My research was part of the festival in exhibited collages and a walking seminar, which brought the architectural knowledge about the buildings to be lost back to the inhabitants who were going to lose the buildings (Reisinger 2020; Reisinger 2021). However, these practitioners are also, like my research practice, dependent on the materials: their desks, their needles and their paintbrushes become operative through the agency of the iron ore.

2. MINERAL WALKS: SCALES OF LIMESTONE/ EXPERIENCING EMBEDDEDNESS

Human animals are walking, talking minerals,³ able to walk upright because of the minerals that reached earth from exploding stars long ago. Infiltrating the organic world of fleshy matter–energy,⁴ this mineralization is an ongoing becoming that provides mobility in the form of bone structures. Without this solid mineral base, we would fall apart, and the same applies to societies, companies, technology and objects.



Figure 3: *Walking with minerals.* Photo: Alice Kettle, 2021

The text above is a snippet from a reading and part of an introduction to a two-hour-long walk into a disused, open-pit limestone quarry of Limhamn in the south of Sweden. On this occasion a small group consisting of local students, researchers and professionals from design, architecture, art and geology came together to experience this usually closed-off landscape. The “mineral walk” was curated by myself and my design colleague Anette Væring, as an attempt to frame the quarry through a feminist–materialist perspective, exploring it in a different way than when it was a site of extraction, through silent walking, reading sessions and exercises – in total a two-hour-long walk beginning and ending with a sharing circle (Lilja 2021).

The curatorial work is based on theoretical research resulting in a transversal gathering of texts spanning from poetry to scientific and artistic research around minerals. Read out loud during the introduction, the text frames the following walk and exercises. The practice is situated in a local context, zooming in not only on a particular site of material extraction connected to design – the quarry – but even further, into the microscopic scales of ancient organisms.

The practice of walking has, for both the curators and their co-walkers, crystallized into a method, even a research methodology, drawing from Stephanie Springgay’s and Sarah E. Truman’s work in *WalkingLab* (2019). Walking, which is partly

done in silence, is a way to get to know the place, a sensorial cartographic mapping of mineral encounters that facilitates an attentiveness to their specific spatiality and temporality.

On this walk the so-called Anthropocene only makes up 2 millimetres of the first step, as we descend down the quarry, walking 65 million years back in time.

Using the exposed sedimented walls as a metaphorical measuring device calculates each step down to the bottom of the quarry to 50,000 years. Although it is barely comprehensible, when pointed out that this place used to be a warm sea inhabited by microscopic invertebrates that have mineralized and piled up into 65 metres of exposed sediment, the deep timescales become more understandable. The group follows the old industrial roads past abandoned concrete buildings – technofossils in terms of their mineralization over time (Zalasiewicz et al. 2014) – until the unpaved paths of bright white limestone gravel take over and walkers find themselves as tiny creatures in the middle of a large void of displaced matter.



Figure 4: *Tracing minerals.* Photo: Petra Lilja, 2021

Descending to one of the lowest levels of the quarry, where birds, frogs and rare plants thrive, the walkers sit down in a circle, where small jars of paint and brushes are prepared for them. The simple everyday act of drinking water is here framed as an encounter of mineralness, an exploration in practice of Stacy Alaimo’s notion of trans-corporeality as a “figure/ground relation between the human and the environment [which] dissolves as the outline of the human is traversed by substantial material interchanges” (Alaimo 2018, 435). The following exercise is to trace the skeletons of your own hand with mineral paint. The aim with applying a mixture of local limestone particles and water to the skin of our hands is to embody an understanding of how ancient, fleshy, boneless life became embedded with the mineral calcium carbonate released into the universe by dying stars (Jacobson-Galán et al. 2020). This

recent scientific finding is but one example of references woven into the read text, which follow the trajectories of the minerals. The walk ends with a sharing circle. One architect realized they had rarely reflected on the mineral component in concrete, one of the most used building materials in the world. Another participant who had grown up in the vicinity but had never before been allowed to access the quarry, shared childhood memories of the industrial soundscape of dynamite explosions. An artist shared their connection with the vibrations of the mineral earth and the geologist expanded on the temporal disparity between the long duration of fossil formation and speedy quarrying. Other reflections touched upon animals, plants and technofossils of the quarry and the human body as assemblages that share minerals with the earth and the universe. During the ten conducted mineral walks (which are ongoing) a kind of situated forum for discussion and a sense of community form. Tracing our common mineralness is an act of reconciling material intra-actions and acknowledging our dependency on the more-than-human earth others. Through the care of walking and thinking otherwise, this former site of extraction is no longer a site of discovery but one of recognition.

3. SENSING INTERDEPENDENCY (DISCUSSION)

Looking specifically at design and architecture from a material perspective, it can be concluded that these disciplines are inherently extractive because they depend on (mostly exploitative) extractivism of so-called nature, as well as labour. An intellectual tradition and worldview of (white) human supremacy reduces our complex interdependence with and on more-than-human others. Instead of pursuing practices of designing and building, which reproduce environmental and social inequalities, we suggest that these fields need to respond ethically by becoming “ecologically literate” (Boehnert 2018), meaning finding ethical grounds in the philosophical foundations of ecological thought to engage in practices of design and architecture. A variety of feminist ecological engagements, such as feminist political ecologies (from Rocheleau, Thomas-Slayter & Wangari 1996, to Harcourt & Nelson 2015 and Mollett 2017), or feminist new materialisms (from Frost 2011 to Truman 2019), add intersectional layers of gender and class literacy.

In reaction to that complex field of overlapping hierarchies, we suggest starting by profoundly questioning our ways of knowing about material specifically. Our practices are based on a politics of reconsidering material awareness and paying attention to a variety of actors and agents. Together with many more designers, artists and architects engaged in exploring the emergent

materialist theories, we suggest making use of the opportunity of combining theory with practice, with the potential for radical change-making in dependence of local knowledge. Therefore, we share our theoretical frameworks, ranging from critical post-humanism to feminist new materialisms. In these theoretical landscapes we find arguments and inspiration for sensing agencies of materiality and material, following more-than-human connections, and we build on the subjectivity of matter, material and more-than-human earth others by finding an ethics that withstands ontological contestations; in other words, responding through our ways of being and acting in the world (Haraway 2016).

3.1 Vibrant feminist materialisms

Through situated descriptions of various matters such as metals or minerals as vibrant, Jane Bennett (2010) makes us sensitive to the active participation of non-humans in all (political, ethical, moral) actions, to realize their (thing)powers in and on our bodies, histories and technologies. This vital view is detaching the mineral from the established attribution to something passive, dead or mechanistic to instead think of it as lively, active and transformative (see also Frost 2011). Vibrant matters are central to working with the Limhamn and Malmberget quarries. In the mineral walks an important key for making matter vibrant is grasping the temporal scales of the minerals. The visual layers in Limhamn span 65 million years, from ancient living organisms to the mineralized fossils. Thinking of the mineral as vibrant pedagogically builds on understanding it as something not only in the present here and now but also over durations of time, beyond the limited timescale based on a human lifetime. This multi-scalar type of thinking (Lilja 2021) can be applied in material situations elsewhere.

The practice of the mineral desk stories extends the scales while zooming in. It is an epistemological practice of co-creating (with) local knowledge. It allows for following material flows and their followers in unexpected detail, encountering unexpected more-than-human practitioners. In this course, practices of extraction are accompanied by practices of care in the complex assemblages of mining communities. Not only within the communities, but also worldwide, along the routes of shipped material, interdependencies and effects of practices of designing and building become graspable.

Emphasizing the agency of material and matter does not liberate us from responsibilities. Instead, we respond to the complex interplay of the degrees of (political) agencies of the human and non-human (Bennett 2010), lively and less lively parts of the assemblages that we human researchers,

architects and designers are entangled with, through our professions and our daily lives. We see this attentive shift as necessary in order to change destructive relationships. Through material choices we privileged humans make decisions about the life-worlds in extractive zones. In particular, the applied techniques of architecture and design have effects on waste, on further extraction and on im/possible re-use. And yet, the material allows for our practices and tools, with benefits for many of us. Just imagine our planet without ore or limestone.

3.2 Situated, attentive and (pedagogically) slow

The mineral desk stories are also an epistemological practice of situatedness, which follows not only the exploitation but also the knowledge of local feminist practitioners who react to the practice of extraction and its societal and geological aftermath. Building up networks, making stories heard and bringing academic knowledge about locals back to their environments to be transformed further (Reisinger 2020) confront hierarchical modes of objectivity with site-specific situated knowledge that has been growing for centuries. Often, it has been excluded from academic discourse, which objects to the object of knowledge being actor and agent (Haraway 1988). In that confrontation lies a responsibility, for example, in how the details of knowledge change communities when brought back to their sites of production, and how local knowledge is represented in accordance with local knowledge holders. “The details link actual beings to actual response-abilities” (Haraway 2016, 115).

An outcome of this strategy is, for example, the knowledge co-production, walking, embroidering and publishing together.⁵ The confrontations contribute to the understanding of local knowledge. With these shifts, concrete ethical and political practices and their adhered research practicalities become necessary. For example, the feminist practice of giving account of ourselves (Butler 2005; Rendell 2016) is an important step to creating new relations. Thus, permanently unfinished accountabilities (Haraway 2016, 114) arise when weaving new sets of relations, as in the mineral desk.

As Rosi Braidotti points out, the embedded and the embodied, the local and the situated are key in the feminist post-humanities (1994), and they are empirically applied in the curated mineral walks to explore attentiveness. The walk and exercises in silence are practices of what Anna Tsing calls the “arts of noticing” (Tsing 2015, 17; Van Dooren 2016), modes of paying attention to and following more-than-human others like rocks, stones and minerals. To practice attentiveness, also outside the curated walks, Petra situated her practice in the

quarry to work with it repeatedly, extensively visiting the site over and over again, also allowing for a slowness in the process of research. In that sense, the rocks transform the research practice. Following rocks, stones and minerals takes place at different velocities and is based on repetition, listening, persistence and attentiveness; either following the followers of the minerals in the mineral desk stories, or following the geological slowness of mineral movements caused by water, weather and further non-human geological forces.

3.3 Connections and limitations

Becoming attentive to spatial scales of matter includes taking into consideration the long geographical distances between extraction, production and consumption. Towards a multi-scalar type of thinking across spatial scales, Povinelli concludes:

The global nature of climate change, capital, toxicity, and discursivity immediately demands we look elsewhere than where we are standing. We have to follow the flows of the toxic industries whose by-products seep into foods, forests, and aquifers, and visit the viral transit lounges that join species through disease vectors. As we stretch the local across these seeping transits we need not scale up to the Human or the global, but we cannot remain in the local. We can only remain hereish (2017).

“Geology is a category and praxis of dispossession”; Kathryn Yusoff outlines the inherent colonial aspects of geology, back-tracing connections of slavery and geology (2018). In both of the extractive sites, the disused Limhamn quarry and the growing mine in Malmberget, we cannot escape being materially entangled in ways beyond the situated locality of the quarry. All of our gadgets and artifacts for walking and researching, for building and designing are made from minerals in one way or another. However, this often leads to “extractive violence” (Sehlin MacNeil 2017) that is used far away from the comfortable use of the gadgets, often causing losses and separations, for example for the indigenous people of Sweden, the Sámi, who live in a close relationship with the land. Kristina Sehlin MacNeil, based at the Várdduo – Centre for Sámi Research, brings to the fore the “structural and cultural violence”, the “unjust societal structures”, as well as the “racist and discriminating attitudes” of the extractive industries (2017, xi). May-Britt Öhman, Lule/Forest Sámi and researcher of the history of technology, invites us to think about how our “unsustainable way of life” leads to the exploitation of the northern Sámi territories in Sweden in her essay, *Gut la dân? Vem är du? Kukas sie olet? – Who are you?* (2021). Critically following the material flows back to the specific extractive sites, with our partial view as non-indigenous researchers, especially regarding

the use of material in architecture and design, humbly seeks to contribute to such important demands of relating.

Moreover, following the human interconnectedness with the material flows in Malmberget and the common ground of the limestone and the skeletons of the walking group in Limhamn, we also see the potential in Stacy Alaimo's thinking of trans-corporeality to re-establish lost connections. The porous trans-corporeality of bodies, affected and constituted by other bodies, can become clear through the simple act of drinking water – one of our main sources of calcium – and by painting minerals on our skin, as in the activity in the limestone quarry, pointing to “all creatures, as embodied beings”, as being “intermeshed with the dynamic, material world, which crosses through them, transforms them, and is transformed by them” (Alaimo 2018, 435). The calcite and calcium carbonate from limestone permeate our bodies at the same time as being the constitutive matter of our bones.

However, trans-corporeality also connects the geographical complexities of situatedness to ethics (Alaimo 2018, 437). The limestone from Limhamn and the iron ore of Malmberget are extracted and made into some of the most widely used and globally distributed objects of our everyday lives, from concrete buildings to toothpaste. The minerals can hence be said to form more-than-human relations that transform with one another over time, but the material never disappears. The extraction of iron, a natural part of the compound of our body, often even a deficiency, has through the emission of the dust during the processes of extraction, led to lung diseases, so that regular examinations of the extracting human bodies are necessary.

Within this global power field, the geographical, material and epistemic relationship between those who lose land or perform the labour and those who profit remains problematic on many levels.

3.4 Epistemological reverberations from the ontologies

Our applied practices in specific fields demanded that we work towards overcoming practical and epistemological dualisms to sense the interdependencies of more-than-human communities between the living and the non-living, nature and culture, theory and practice. “We need to shift from thinking about methods as gathering data towards methods as becoming entangled in relations”, Springgay and Truman (2018, 83–84) demand. Our different practices of scaling, walking and relating can be understood as methods that respond to the complex agencies of local material bodies. Becoming sensitized to the vibrancy of matter is epistemic work requiring simultaneous knowing and doing to open up to multispecies

knowledge. In the case of minerals, we can summarize that it depends on repetition, learning, (human) humbleness, slowness and shared movements, recognizing vibrances and more-than-human agencies as forces that have effects in our human lives but also in knowledge production and to what we pay attention to in our research practices.

The situated, and hence specific, ways of thinking and knowing that we share in this paper present specific ways to open up to entanglements in great detail. The results of the situated knowledge object to research economies of representation, transferability and exploitability. Becoming accountable for alternative and multiple sets of knowledge and methods is about elaborating a politics of sensitivity to various producers of knowledge. To generate new images and imaginations of sites, which are not central in the curricula of design and architecture, the politics applied in the mentioned practices shift perspectives, turn binoculars, even to violent situations, and thus move between the scales to foreground actors who have been left out of discussions and effective decisions.

Extending the frame while zooming in, following all these (material) paths, is not least a political action of embracing the complexity that we all live in, materially, socially, economically, and of being responsive and responsible in our non-innocent research practices. Our practices of knowledge production direct us to thinking of futures otherwise, to survive in the many places of a damaged planet, open to experimental encounters with minerals in which rocks are transformative of research and researchers, both in theory and in practice.

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² We use italics for direct speech to the reader and in reference to our pedagogical practices.

³ Lynn Margulis and Dorian Sagan reference V. I. Vernadsky's work in this quote from the book *What is Life?* (1995).

⁴ As Manuel DeLanda writes in his book *A thousand years of nonlinear history* (1997).

⁵ See, for example, the conversation with Karina Jarrett, result of a shared process, published in 2021 at the repository of the Academy of Fine Arts Vienna: https://repository.akbild.ac.at/de/alle_inhalte/query;fq=%7B%22fulltext%22:%5B%22Reisinger%22%5D%7D;st=0;sz=50/25728

Becoming a Tomato – A Computational Performance

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The content of this paper details the computational performance art piece ‘Becoming a Tomato – A Computational Performance’ by Lapa Pereira. In the piece “Becoming a Tomato - A Computational Performance”, two performers aim to develop a non-linear strategy to synchronise their experiential framework to that of a tomato plant. Through observation, research and the computational art methodology, a ruleset of actions and reactions originated. The three main parts relate to an ideation process where the phenomenon of black-boxing is used to only observe the In- and Outputs of a tomato plant and its reactions/adjustments. Thereby, a de-familiarization of the plant as a common and nourishing co-existing agent becomes opaque and unknown. Using the artistic approaches of material speculation and computational performance, Aristotelian notions of hierarchies of life are rejected by viewing the perceptive realm of plant life not through a reductive lens but rather through an augmentation of senses brought forth by the limitation of other senses.

*Interspecies communication. Plant Empathy. Vegetable Other. Performance Art.
Computational Performance. Embodied knowledge.*

1. TECHNICAL DESCRIPTION OF THE PERFORMANCE

The scenography for the performance involves a stage prepared with a 5cm layer of garden soil spread evenly over a circle of three-square meters. Above the soil a spotlight is lit, shining on and towards the performers. This spotlight should shine light straight down.

During the performance, a muffled sound on a steady interval indicates the passing of time. This sound is made live by using a water reservoir that leaks a drop of water approximately every 13 seconds for a distance of roughly two meters. The drop hits a surface to which a piezo microphone is attached. The piezo microphone is connected to a Boss RV-6 Reverb Pedal set up to produce a long duration, high reverb signal which then is connected to a series of amplifiers and speakers.

The choreography is based on the principle of structured improvisation, which de-familiarizes the performers from the human frame of reference due to the ruleset developed and applied.

This ruleset is as follows:

- (i) the performers wear a blindfold.
- (ii) The blindfold is minimally translucent.

- (iii) The performance starts with both performers in a downward, foetal position with foreheads and arms touching the soil.
- (iv) The first movement starts once either of the performers does not feel the rush of entering the performative moment.
- (v) the performers will move as slow as their physical limitations will allow.
- (vi) The first movement can only be aimed into the direction of the light or as to assist the movement of other limbs into the direction of the light.
- (vii) Once performers create a connection (touch) these connections are maintained as supporting contact.
- (viii) The performers support each other physically, so as to stabilize and/or be able to reach closer to the light.
- (ix) Once all limbs have extended, the entire body is stretched to a position of discomfort. This position is maintained for a set duration.
- (x) The following movement can only go in the opposite direction of the light or to stabilize into the direction opposite to the light.
- (xi) Limbs and head are brought inwards, close to the body, with as much skin as possible either touching the soil or the body.
- (xii) The two movements-sequence repeat several times over the duration of the piece.

2. THE URGE TO AMALGAMATE WITH PLANT EMPATHY – INTRODUCTION

The complexity of contemporary crises such as climate change, mass population, and dangers as well as consequences of highly infectious diseases, demands the public to either directly or indirectly depend on the narratives derived from scientific means. Modern science is based on the method of reductionism, by studying the smallest parts of an object, it tends to understand the object. This reductionist approach to the object, however, cannot claim to understand the object along the lines of its desires, its existing in a community and it being embedded in a network.

Therefore, following Donna Haraway's motivating imperative to create an alternative story of the world, brings one very close to the topic of the vegetable other - in this case the tomato plant. The first tomatoes that came to Europe were small and yellow in colour. They were called Peruvian apples or golden apples. The Italian word for tomato, pomodoro, is a corruption of pomo d'oro, which literally means golden apple. The English word tomato, the German word Tomate and the Dutch word tomaat are all corruptions of tomatl, which is the Aztec word for this fruit. Thus, the tomato reflects the Spanish early-capitalist conquest, the misunderstanding of original American peoples by Western Europeans as well as the danger of scrapping a big part of identity, culture and history through plant eugenics, as the original golden colour has almost disappeared from common knowledge. Through the monodisciplinary reductionist frame, biological sciences found out almost everything about plants by detaching humankind objectively and only measuring statistically what plants could and could not do. What was clearly left out of this study was plant identity, its cultural relations, its sociological relevance, its often colonial histories. This determining methodology of enlightenment style reductionism led to a strong separation between nature and culture, as well as humans and non-humans. It seems that through the quantifying mechanism of science and its reductionist approach one must narrow the frame and adjust the circumstances until one finds what one is searching for, until the desired truth is constructed, as the reductionist lens is incapable of studying the object in its complex relation to all varieties of the other. Hence it necessitates the creation of a narrative, the construction of a knowledge of a particle in isolation (Starkmuth 2010).

In this magnifying process, there was no space for human interpretation, nor for looking left and right. This does not mean that science does not provide us with empirical evidence for its findings: planes fly, boats sail and computers calculate. The enlightenment model for finding truths has led us to the place where we find ourselves today; amidst a

global pandemic, in the middle of a climate crisis, during the fourth technological revolution, with more than enough tools to document and display it all. One can argue that finding speculative solutions and valuable aesthetic gestures the holistic observations of plant life and interspecies empathy. (Ross & Maynard 2021)

The topic of plant intelligence has been somewhat controversial since the conception of the term "intelligence" in academia by Charles and Francis Darwin as anything resembling intelligence or cognition was previously considered to be an exclusively human trait in Western Academia (Darwin & Darwin 1880). The Western philosophy of enlightenment placed a huge value in the study of the individual organism and took the white male as a standard for experience and expectations in the world. Through this specific standardization it was concluded that the property of intelligence could only be given to species with a central nervous system, controlled by a brain.

Michael Pollan, a plant neurobiologist and professor for Science and Environmental Journalism at the UC Berkeley Graduate School of Journalism has done research in the field of plant neurobiology and has shown that plants operate a perfectly balanced sharing economy by sharing and exchanging nutrients, which makes our current economic system seem highly inefficient. Besides that, plants also adjust to their environment by transforming their bodies, develop resilience against enemies, have the ability to learn and communicate over kilometres by participating in a leaf network or by sending signals through mycelial pathways and chemical transmitters (Pollan 2013).

A large contributor to the problems we face today – such as plant-eugenics leading to mono-culturing, loss of soil, infectious diseases and exploitation of natural resources – is due to an anthropocentric approach to politics, economics and ecology which find their origin in the writings of Aristotle on the nature of spirits and the hierarchy of souls.

The Aristotelian model maps hierarchies of life based on capacities. The souls of living beings are ordered by Aristotle in a hierarchy. Plants have a vegetative or nutritive soul, which consists of the powers of growth, nutrition, and reproduction. Animals additionally have the powers of perception and locomotion, sense and desire. Humans also have the power of reason and thought (Aristotle 2016). This assumption becomes problematic as soon as it is confronted with the definitional complexities of the terms used. Desire, as stated before, can be defined as to include plant behaviours. Reason finds its evolutionary origin as a method of problem solving adjusted to a particular perception of space and time. If we take this origin of reason as a way to define reason, we quickly arrive at the conclusion that plants are to

the extent of this definition capable of problem solving, albeit over the course of a different scale of time, space and individualism than human animals.

There are pre-industrial agricultural tribes, who we could engage with plants to learn a more intimate relation to non-humans. Following Andreas Weber and his book *Indigenialität*, in which he describes the interspecies relation out of the perspective of indigenous peoples: he argues that they have a different relation and (sylvan-)thinking (Kohn 2013) about our surrounding non-human agents. He does not suggest that we should stop eating plants but rather that “we become what we eat”. This implies awareness, responsibility and appreciation for what and how we consume. This new materiality, which serves both as nourishment – in the sense of empowerment, support and development – and as a communicator and translator – for example, to represent climate change and the changing of the seasons – can be used to transform our relationship with non-human actors (Montgomery 2021).

To summarize, the enlightenment frame largely fuelled by capitalist needs has implemented a reductionist lens unto the tomato plant that has stripped it from several of its relevant paradigms: those of history, sociology, cultural and post-colonial studies. By reenabling those paradigms into the cultural understanding of the tomato through artistic practice one begins to review plant life in its broader relation to the environment and other forms of life. Therefore, the tomato plant is chosen as a paradigmatic example of the alienating process: to embody this through the performance, the goal.

3. TOGETHERNESS

“*Becoming a tomato - A Computational Performance*” belongs to a tradition of artists and artworks that offer alternate ways of relating to a non-human other. Either through the presence of the non-human other in the piece or by showing, through their practice, alternate relational pathways to hierarchical views based on differentiation. Establishing kinship (Haraway 2016) with non-human life through the lens of artistic production can take the shape of either actual or speculation-based practice, both which can co-exist in a piece. A spectrum can thus be formed in the use of actual and speculative approaches. An example approach would be the work “*Phyto Teratology*” by Spela Petric, in which Petric used a steroid extracted from her urine as a stimulant to aid in the development of a plant embryo and creating an actual material human hybrid (Petric 2015).

Julien Alain Louis Isoré has since 2014 proclaimed to have died and been reborn as forest artist Alan Tod. Tod (after the German word for dead), has created a new form of practice he refers to as *forest-art*. According to Tod, *forest-art* produces forests

that are considered as sculptures, fertile soils seen as organic installations, vivarium sculpture seen as mythological creatures and alive stories as performances (Tod 2019). *Forest-art* does not actualize new forests or create material interventions. It does, however, encourage a new view and understanding of existing vegetal life. In a twist, Tod manages to accredit the status of artwork to these forests, which provides them with artistic privileges and, thus, protects them from deforestation.

Both pieces mentioned here contain a direct or indirect form of engagement with the vegetal other. Other, in this case, refers not to another of race, nationality, ability or gender, but of species. It is not apparent how we can limit the distance between us and the interspecies other, let alone one as comparatively alien as the tomato plant.

One method of achieving interspecies communication is to shed any negotiation with the identity of the subject, and instead to focus on the capacity of the subject. By asking the question ‘what is it like?’ instead of ‘what can it do?’ one avoids, at least for a bit, applying a human-centred frame as a starting point of our interspecies communication. This is different from a reductionist method as it does not reduce the plant to its capacities, rather acknowledges that the plant uses its capacities to construct its own identity, regardless of our observation.

Using the example of the tomato, Pollan says plants have all the same senses as humans, and then some. In addition, for example, they can sense gravity, the presence of water, or even feel that an obstruction is in the way of its roots, before coming into contact with it. Plant roots will shift direction, he says, to avoid obstacles, can complete their developmental cycle in 70 days and can adjust their chemistry based on vibrations in the ground (Pollan 2013). A second step in interspecies communication is to apply the capacity of the subject and observe it in an effort to find out a desire. Desire is here intended to be understood as intention of action, direction of movement. According to Marc Boumeester, to every medium comes a set of desires which aid to constitute its materiality in a variety of ways. In an analysis by Boumeester, rocks have the desire to fall down, as well as to be shaped by what they hit once they have ended their fall. Desire as a concept is useful in achieving interspecies communication as it implies an innate direction in the world that can then be supported, neglected or negotiated through a variety of artistic methods (Boumeester 2018).

4. METHODOLOGY

As a process of artistic freedom is mostly used to deconstruct or reconceptualize, we used the

“blackboxing”-tool (Latour 1999) to abstract the tomato plant. Bruno Latour describes the social process of the black box (figure 1) as the way scientific and technical work is made invisible by its own success as the processes that are described become more and more complex and thus harder to grasp. This creates a paradox: the more you observe a phenomenon, the less you are able to intuitively grasp its inner workings. In this form, Latour described “social abstraction” as an observing entity is exchanged through a black box and only the in- and outlets are inspected instead of the inside complexity.

By understanding that the main inputs of the plant are water, air and sun, while oxygen is just one output, new science detected that plants care for each other. Not only through the mycelium network – which sometimes extends over kilometres and connects multiple forests with each other – but also through their roots and the nitrogen they release into the earth.

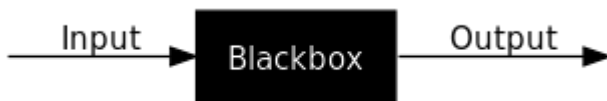


Figure 1: Explains the black boxing methodology

Here a sharing and supporting economy is realized: “everyone just consumes what one needs and the remains are stored or shared within the environment” (Montgomery 2021). Beronda L. Montgomery refers in her book to the importance of the habitat and communities of people we are surrounded by. Wild plants never change their environment as long as they live, which means that they have to adjust, defend or fight for where they are, compared to us, who could just walk away. This is connected to Haraway’s saying about “staying with the trouble”, whereas she approaches the topic of fast problem solving leading to wrong or insufficient solutions. “Staying in the unknown” or “confusing” head space are therefore rather to engage with than to avoid problems (Haraway 2016).

The strategy of de-familiarization is mentioned by Rosi Braidotti as a process of “critical distance from the dominant vision of the subject. Dis-identification involves the loss of familiar habits of thought and representation in order to pave the way for creative alternatives” (Braidotti 2013).

Here, the strategy of material speculation is applied: with respect to material speculation as a methodological resource, it consists in the first place of an extraordinary epistemological power to imagine possibility. Materialized forms of fiction are a mediation among the sensible and intellectual knowledge (Haraway 2016). Material speculation is also close to the notion of “imaginative generalization” as described in 1975 by Alfred

North Whitehead: he accepts a leap, a flight of “free imagination controlled by the requirements of coherence and logic” (Whitehead 1975). In this case the coherence is maintained by the embodiment and actualization of the idea through artistic practice.

Summarizing, we used the tools accordingly - metaphorical comparison to a scientific examination through a microscope:

- Using the blackboxing as a magnifying glass to sharpen what we see;
- the de-familiarization as the process of changing the agent's form and shape as well as the angle we are looking through;
- and the material speculation as a tool to influence and augment our interpretation of the visible.

Recurrently this approach of artistic practice is used as a mode for knowledge production, which aims inherently at the construction of narratives at the borders of disciplines. Often the artist will adopt a transdisciplinary approach in an effort to probe existing paradigms setup in an effort to cross boundaries, make visible the invisible or experiment by blurring the lines between object and subject. All these paradigms, within the artistic approach, take the shape of a speculative materiality, one that distorts existing knowledge through the speculative power of artistic practice.

Therefore, “*Becoming a tomato - A Computational Performance*” serves not as a process of becoming ‘other’ and overcoming ‘human’; rather the process of de-familiarization with the human by descending down the Aristotelian notions of thought, reason, desire, perception and locomotion. Accordingly, the physical translation into a performance was chosen.

5. MAKING KIN

In the piece “*Becoming a tomato - A Computational Performance*” two performers aim to develop a non-linear strategy to sync their experiential framework to that of a tomato plant. Through observation, research and the computational art methodology, a ruleset of actions and reactions originated. Blindfolded, they are robbed of sight, forcing themselves instead to rely on perception by touch, temperature, gravital orientation and the passing of time. Through their blindfolds they are able to perceive a little bit of light from the external world, their bodies rise to meet this light, mimicking plants rising to aid in photosynthesis. Once stretched out, extended as far as their bodies let them, they slowly move downwards, their feet never once leaving the soil they stand in. Once down, losing balance, they sink into the soil with their bodies. The cycle begins again, as slowly as

their bodies let them, rising up, closer into the light and sinking down, responding purely to what is left of their senses, once transported as close as possible to a plant-like perception. By using the body here as a mediator between self-experiencing landscape and transmitter, the “I” tends to blur into an assemblage of sense-perception. The Mediated Body leverages familiar interactions such as touching another person to venture into unfamiliar territory. It reconfigures relations between not only the performers, but also the evolving social and material ecology encompassing the interactions. It generates encounters in which issues of social conformity become peripheral to the performer in favour of direct, intimate engagements in public spaces. However, these engagements extend beyond the two people directly involved in the interaction, as those around them try to make sense of the encounter in ways that differ considerably from the performer and participant. The Mediated Body speculates on many issues pertaining to the mobile experience of digital media, the cultivation and expression of personal space in public places, the human body as a technical interface, and the richness and tensions entangled across all of these themes (Wakkary et al. 2016).

6. THE FEEL – CONCLUSION

Having chosen these artistic practices allowed not only to broaden one’s horizon in the way of how to perceive plants, how to interact with the vegetable other and therefore plant empathy, it also introduced a powerful way of abandoning the surface that makes up human beings. The latter describes the process that the performers sift through while operating. In this state of automata, that is achieved in virtue of the ruleset, of actions and reactions it allows freedom within the response-ability (Haraway 2016). One hopes to effectuate a metabolism in which the pre-programmed human habits loosen, and a sensitive and precise execution can take place. Recursing thinking patterns as doubts or praise should be diminished by the amplified – since the sight is constrained – other senses: smell of earth, touch by the ground or another entity, sound and the sensation of gravity limiting one’s uprising.

This artistic practice sets out to extract and disentangle bodily knowledge which derives to a togetherness and a blurring of boundaries between human and nonhuman, self and other. Hence the complexity of our environment is translated into a somatic language or embodied familiarity. The realization of the embodied research guides us to a place of self-experienced connectedness beyond the limit of languages, written or otherwise. Epistemology is built in the individual person and not to be communicated through other means. This element unlocks a potential for further

experimentation by bringing the audience into the experience and reflecting on mediated states of awareness of the other.

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Scavenging Lost Worlds: The Aesthetics and Creative Possibilities of Internet Decay

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In this paper, I will investigate what is and what causes content to decay on websites, and how it can be used to propel new discussions on aesthetics and digital ontologies. In the specific context of the Web, content decay has a unique non-linear degradation process. The idea of novelty is prevalent in the rhetoric of design and technology, while failure and indeterminacy are less welcomed (Mazé 2007). However, the increased dependability on online services due to COVID-19 hastened a propitious momentum to address the ephemerality of Internet infrastructure. By focusing on its 'ruins', I would like to question how that desolate view can propel aesthetic and ontological discussions, addressing digital culture from a less instrumental point of view to propose a distinct form of 'inevitable aesthetic' – stemmed from Lebbeus Woods' notions on architectural decay (Woods 2012) – and its long-term implications. There is more to media and aesthetic experiences than normative ones powered by late capitalism, thus, paying attention to what is deliberately missing or left behind due to forgetfulness, offers new opportunities to understand and criticize the technological systems, and a chance for forgotten narratives to thrive and persist.

Digital culture. Aesthetics. Obsolescence. Ruins. Decay.

1. INTRODUCTION

This paper investigates the complex phenomenon of 'Internet decay', a concept proposed here to create an online-focused instance of the broader notions of 'digital decay' (Cascone 2000; Cramer 2015) and 'post-digitality' (Sterling 1995) that first appeared in the late nineties. Besides proposing a definition of the manifestations and causes behind the fragility of online content as the starting point for a critical understanding of its long-term implications, this study aims to support the claim that 'Internet decay' could yield a distinct form of 'inevitable aesthetic' akin to archaeological ruins (Woods 2012).

This is supported by the examination of my own artwork 'Merciless Entropy', which interrogates and confronts Internet decay as an often overlooked but sprawling condition that is entrapped in the loop of higher internet speed, hardware improvements, 'web bloat', and planned obsolescence.

In the specific context of the Web, which no longer can be understood as a "totality but the production of multiple and incongruous totalities" (Bratton

2016, 12), content decay is not fully abided by the passage of time.

The main response to entropic and unpredictable processes of decay have been ideas of relentless progress and innovation prevalent in Silicon Valley's hegemonic power over the contemporary 'platformized' web. In contrast, I adopt Dylan Trigg's 'aesthetics of decay' (Trigg 2006) and Steven Jackson's 'broken world thinking' (Jackson 2013) as a framework to acknowledge the importance of decay and reconfiguration as well as releasing creative practice from the hyperconsumptive, imperialistic and extractivist logic in force (Fuchs 2017).

2. THE CONTEXT OF A DECAYING WEB

2.1. Shutdown, Fragmentation and Repression

The constant overflow of noise and information turns it difficult to track which content needs saving before they disappear – whether by neglect or deliberate pruning - and that is precisely why it is an urgent issue. Internet disruption and restricted access are already affecting many countries, as recent government-led Internet shutdowns as seen

in India, Myanmar, Sudan, Uganda and many others (Access Now 2021).

Unlike the common misconception that those restrictions only happen in authoritative regimes, the acknowledgment over the last decade regarding the impact of unregulated social media and propagation of fake news affecting elections threatens even more Internet access in territories undergoing sensitive political circumstances.

2.2. E-waste and resource depletion

The 'ecological fragility' of the Internet is another urgent factor, as obsolescence and relentless technological innovation causes alarming rates of e-waste generation that are being irregularly disposed of, replacing infrastructure degrading prematurely, power generators to cope with increasing grid failures.

In a very material instance, there is the e-waste disposal problematic, as it reinforces and further complicates colonialist and imperialist structures as "all waste and pollution are about power by maintaining structures that designate what is valuable and what is not" (Liboiron 2012, para. 1).

In the anthropological field, one of the approaches to waste is 'waste colonialism', proposed to describe and understand the patterns in which more affluent and powerful countries dump their waste on countries with lower economic statuses and less legislative barriers towards irregular disposal, as if they have an "entitlement to use Land as a sink" (Ibid., para. 5).

As waste and pollution encompass the very Imperialist power structures that designate what is valuable and desirable, (Ibid.) understanding the inherent politics behind e-waste disposal and its severe ethical issues are crucial for any critical proposal rooted in social justice and decolonial reconfigurations of possible futures.

Consequently, it becomes clear the role of e-waste in becoming part of a new human-made strata of the planet, scattered in landfills to remain as 'technofossils' (Zalasiewicz et al. 2014) for a deep-time, after-human future, showing how the Anthropocene is the apotheosis of waste (Hecht 2018, para. 6) in an almost incomprehensible scale.

In the book 'Vibrant Matter' it is suggested that waste is alive in some sense (Bennet 2010), as they maintain the "the curious ability of inanimate things to animate, to act, to produce effects dramatic and subtle" (Ibid., 6). Garbage dumps may be devoid of any meaning by human standards, but these non-human assemblages keep an agentive form, mutating, decaying, and changing the environment around them. In her perspective, the 'aliveness' of discarded matter is not a synonym of a good sign but realizing that is important for paying more attention to capitalist materialism (Montgomery 2013) as "the sheer volume of commodities, and the hyperconsumptive necessity of junking them to make room for new ones, conceals the vitality of matter" (Ibid., 5).



Figure 1: Different views of the Installation 'Merciless Entropy' (Marangoni 2020)

2.3. When (not if) Infrastructure fails

Issues of digital decay and failure first began to be explored in the late nineties, when the Internet was still on its early days. The ‘vernacular web’ of the 1990s was amateur and handmade, always under construction (Lialina 2010), a totally different setting of today’s commercial and platformized Web. In ‘Rethinking Repair’, Steven Jackson introduces the concept of ‘broken world thinking’ as a framework to acknowledge the importance of repair and reconfiguration as the real maintainers of a working system, rather than unrelenting innovation.

For the internet we take for granted to work properly, it is necessary a huge number of hidden resources and human labour to maintain and fix it constantly, what the researcher Linda Ritasdatter calls ‘crisis computing’ in her doctoral thesis on the obsolete programming language COBOL and its unacknowledged relevance to keep digital systems functional to this day (Ritasdatter 2020).

Viewed through a post-digital lens, the web is characterised in terms of its long-term unsustainability, as it has become impossible to fully save its massive and ever-shifting content – for technical, legal, economical, or ecological reasons (Day 2003). The high resource-consuming practices of the post-digital web development needs urgent reconsideration, as they are proving to be unmaintainable, lost in the loop of higher connection speed, hardware improvements, ‘web bloat’, and obsolescence.

In just ten years, the average website transfer size has increased 348.7% (HTTP Archive 2019), while 1.11% of all links on a news website last longer than 3 months (GDELT 2019). And corporate surveillance is one of the things causing those massive websites, since they are filled with third-party cookies and scripts that just serve for marketing and tracking purposes. Just a tiny amount of web scripts are semantic, or translated into actual webpage content facing the ‘user’, most of it working intrusively on an invisible level (Heer 2018).

3. UNDECIDABLE REMAINS

3.1 The Figure of the Ruin

By focusing on its ‘ruins’, I would like to question how that desolate view can propel aesthetic and ontological discussions, addressing digital culture from a less instrumental point of view. The engagement with ‘hauntology’ (Derrida 1993; Fisher 2012) and architectural explorations on the subject of ruins, also support the invoking this metaphor to bring forth the similarities between the human relationship towards digital ruins and architectural ones, as they both can wield a

creative potential from their ambiguity and uncanniness.

The perils of romanticizing ruination, on the other hand, also must be taken into consideration. The objective here is not to simply find beauty in this desolated scenario but bring it forward to discuss its ontological qualities and what should be done when it is not an avoidable future.

In the face of the impossibility of salvaging all of Internet information and its performative interactions – which end up lost when the only archived artifact is a screenshot – or even if the whole code is saved, as it could be dependent in several unmaintained third-party services or deprecated syntax that breaks if tried to be performed in newer machines.

There are new concepts already being proposed by many artists and researchers, such as ‘permacomputing’ (Heikkilä 2021), ‘benign computing’ (Raghavan 2015) and ‘frugal computing’ (Linvega 2020), showing that are new ways of moving forward without the hastened, disproportionate pursuit of innovation and novelty, echoing the “broken-world thinking” previously discussed. What they all have in common is taking into consideration what will be lost and unmaintainable without a ‘collapsologist’ (Servigne et al. 2020) view, working actively towards ways to circumvent those problems that do not rely on big tech’s services and priorities.

3.2. A surplus of the past

Whilst digital storage has drastically become more affordable, archiving petabytes of data still requires an inordinate amount of money, space, and natural resources, making it an ethical quandary.

Here, the concept of ‘curated decay’ (DeSilvey 2017) could bring new forms of dealing with those losses, incorporating a philosophy of non-intervention, palliative curation, and benign neglect (Ibid.). DeSilvey proposes this as an ethical approach to heritage and post-industrial ruins, but it could easily be applied to the challenges involving Internet cultural impact and archival attempts.

In this context, there are no in-between state, no glitched or half-corrupted files that are still salvageable. Only “two scenarios of memory are possible: a total recall of undigested information bytes or an equally total amnesia that could occur in a heartbeat with a sudden technical failure” (Boym 2001, 347), which resonates with the metaphor of the Borgesian Library of Babel being the closest manifestation of what the biggest interconnected communication and information storage tool came to be. Borges describes the Library as inducing “an unbridled hopefulness followed by a disproportionate depression” (Borges 1998, 116), reflecting the disenchantment for the

current state of the Web, and the lost dreams of cyber-utopia from the nineties.

It could be encapsulated by “the paradox of a culture which manifests so many symptoms of hypermnnesia and which yet at the same time is post-mnemonic” (Connerton 2009, cited in Harrison 2013, 198), as the Internet turned routine an unprecedented amount of information that is impossible for the human brain to absorb all of it, at the same time a lot of information disappear without leaving a trace. This new memory dynamic can have many impacts in the general culture, in the way people engage with truth or prioritize the information they retain or ‘outsource’.

Even before the Internet, Lyotard was concerned with the “disappearance of the temporal continuum” (Lyotard 1984, para. 28) in the postmodern society which in way, foresaw the contemporary condition as a “multitude of different temporalities on different scales” (Cox and Lund 2016, 9). This bears a direct association with ruins as they also are displaced in time, always in-between their surplus of the past and their potential for the future, and always devoid of value in the present time (Kosec 2016, 12).

3.3. Indelible Hauntings

Lyotard also adopted a non-anthropocentric approach towards digital materiality that could be very associated with the field of media archaeology, “think(ing) about hardware and software obsolescence, consumerism and memory in less anthropocentric terms” (Costantin 2018, 49). A notable proponent of the idea of non-human temporalities is Siegfried Zielinski, who wrote extensively on deep time applied to media archaeology, uncovering the non-linearity and heterogeneity of media through a series of cases studies (Zielinski 2006). He opened the path for other academics in the field to engage with the same concept (Parikka 2015; Mattern 2015; Schneider 2018). Parikka contributed massively with a more geological account of media, as “media history conflates with earth history; the geological material of metals and chemicals get deterritorialized from their strata and reterritorialized in machines that define our technical media culture” (Parikka 2017, 18).

Robert Smithson’s expanded practice is an example of how non-human temporalities can shape artistic exploration. He often dealt with the concept of entropy in his monuments, exploring the transformations that nature and time caused on the work besides the human agency. That way, he created a unique “fictioning’ of the landscape (when this names a re-imagining of what’s already there and a foregrounding of other, often non-human temporalities)” (O’Sullivan 2016, 61) through his land art, a great inspiration for my own artistic intentions for the following project.

4. MERCILESS ENTROPY – A CASE STUDY

Made of concrete casting, wires, and electronic parts scavenged from obsolete computers, it displays the results of a web crawler script searching for broken URLs, dead-end links, and other forms of ‘internet entropy’: the online wastelands of server errors and it interrogates and confronts this ‘internet entropy’ as an often overlooked, and growing, part of the internet – a sprawling space that is lost in the loop of higher internet speed, hardware improvements, ‘web bloat’, and planned obsolescence.

This case study can lead to an understanding of the characteristics of digital decay in websites and how this is mirrored in the non-digital world, through the sculptural metaphor of the architectural ruin. It questions how that desolate view - that both attracts and repels - can instigate alternate aesthetics that draw our attention to these phenomena, rather than hiding them from sight.

The selected base material for the sculpture was concrete: it is highly durable used as a foundation for buildings that will last for centuries. The many layers of electronic parts half-shown in its structure is analogue to the ‘technosphere’ (Haff 2013), or the strata of ‘technofossils’ (Zalasiewicz et al. 2014) humans are creating on the surface of the planet. It was my intention that the audience could feel like they were visiting an uncanny digging site, a lonely artifact that is lost in temporality and meaning, a future fossil, a “pseudo-historical object from a speculative future” (Hertz and Parikka 2012, 429).

When buildings start to collapse, webpages return a 404 error or a computer refuses to boot up, we are rendered powerless to their new ontological presence. They will not serve their designed purpose anymore, and the human interaction starts to be detached, as a common reaction to ‘useless’ things is to shun its now undesired presence to continue its degradation outside, away from us, for a period of time that surpasses our own.

5. CONCLUSION

In the process of decay, the normative and functional (be it websites, or post-industrial ruins) turns into the uncanny, “haunt(ing) us in this liminal state between rejection and obliteration” (Edensor 2005, 836). A haunting that might open the possibility for repossessions, counter-narratives and alternative aesthetics, as ruins persist in a defiant manner, broken but indelible, reminding us that its ontology is changed and defies classification.

I thereby conclude this paper by proposing the combination of investigative art practice and theoretical writing as a method of research that

echoes its own multifaceted subject. By drawing together knowledge from various fields of media archaeology, architecture theory, critical studies, hauntology and philosophy of aesthetics, it may allow for a comprehensive understanding of the phenomena of Internet decay, proposing ontological discussions and an aesthetic turn as possible paths for “imagining new histories of the suppressed, neglected and forgotten voices of media history” (Parikka 2012, 39) by acknowledging ruins as “living organisms embodying notions of progress, forgetfulness, and reclamation” (Trigg 2006, 283).

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Co-authoring with the collective: An iterative design framework for participatory art

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Global issues like climate change, public health and social justice require diverse, collective thought in order to materialise solutions, but the way to achieve this is less clear. Participatory art provides fertile ground for research into this topic, and can act as both laboratory and playground in the quest to harness collective methods.

This paper explores discourse on participation from the disciplines of Performance Studies and Game Studies in order to develop an experimental framework for participatory art design. The mechanisms and methods mentioned were tested through practice-led research, which culminated in an experimental performance at ArtEZ University in May 2021.

Defining participatory art as a form of simulation highlights the multiple roles played by artists of such works that differ from other artistic disciplines, such as designer, procedural author and facilitator. Key aspects of the design framework include ideating from core values, recognising multiple subjectivities within participants, and employing a collaborative approach to design through iterative feedback cycles. The framework can be used as a tool for both creation and critique, contributing to the dialogue about the politics embedded within participatory mechanisms.

Practice-Led Research. Participation. Social simulation. Multiplicity. Interdisciplinarity.

1. INTRODUCTION

The game of single authorship is a game without victory. A dubious wealth of advice about branding, personalisation, and self-promotion accompanies an ever-narrowing definition of personal success. People work a little harder, put in more hours, and travel a little farther to get to work, playing a game with unclear rules. Meanwhile, collective problems like social justice and climate change go unnoticed. Problems that cannot be solved alone are invisible in this game. So, I invite you to play a new one.

As an artist, I am motivated by the conviction that collective experiences act as catalysts for social change, changing social reality by changing the way we see ourselves and each other. My desire to facilitate this led me to participatory art, and set me on the path that many artists who desire to engage creatively with the public tread. Like those before me, I felt uncertain about where to begin; I did not know how collectivity could be achieved in a performance or what would happen aesthetically if this collective was freed to determine its own direction.

Bishop notes that most participatory art is motivated by:

- (i) empowering an active subject,
- (ii) ceding authorship in an egalitarian way, and
- (iii) inspiring a collective sense of community (2006, 12).

And while many performances espouse these values, I observed in my research that a participant's experience varied dramatically depending on the artist's structural design choices. The term 'participation' is ambiguous, and leaves artists guessing how to navigate between control so strict that only the illusion of agency remains and instructions so vague that only confusion, or even anarchy, results. A miscalculation in this area has the potential to render the artist's initial proposal irrelevant.

Incorporating discourse from Performance Studies and Game Studies, my practice-led research investigates the effect of participatory mechanisms on shared experience through the development of an experimental design framework. Game Studies holds a wealth of literature relevant to designing

collective and individual experience, often accompanied by research into the psychology of participation, and I speculated that this could help to fill a gap in the Performance Studies literature. I tested this framework through a participatory digital game, *We Called It Earth*, at ArtEZ University (Netherlands, May 2021).

In approaching participatory art as a catalyst for social change, I do not claim that even well-designed performances could meaningfully address global problems. While the genre largely dedicates itself to the tenets of equality and fairness, it often touts its accessibility while ignoring the actual 'conditions of access' limiting who can participate (Shah 2017). It is difficult, therefore, to extrapolate the impact of such brief performance experiments on society-at-large; however, I believe the art form's capacity for collective exploration is still largely untapped, and might prove an invaluable pedagogical tool and playground for interdisciplinary research.

2. ENTERING THE SIMULATION

Participatory art is a social exercise, differing from one-on-one and interactive works whose aesthetic goals rely on individual experience (Bishop 2006). It relies on people as both medium and action (Bishop 2012; White 2013), and aims at sparking conversation within a community of participants beyond the bounds of the performance (Kester 2004; Rancière 2014). It also claims a double ontological status as 'both an event in the world, and at one remove from it.' (Bishop 2012, 284). Rancière articulates this as **apart-togetherness**, wherein participants exhibit multiple subjectivities through emancipated spectatorship (2014). While the **apart** subject remains independent, the **together** subject explores a shared identity, and reifies it through its participation.

Simulation is a structure shared by both participatory art and video games, and is here defined as an imitation of a situation or process. Frasca argues that games are a form of simulation that require participation, incorporate behavioural rules and differ with every iteration (2013). Aarseth describes simulations as bottom-up and emergent because they offer player agency, whereas narratives are top-down and predetermined (2004, 5). Additionally, the rules of a simulation are both explicit and internal, separating it from real-world situations.

Simulations, however, go beyond modelling a system in which a participant can act; they create multiple subjectivities. Game philosopher Miguel Sicart describes playing a computer game as an

act of subjectivisation because rules are a form of power that creates behaviour (2011, 68). A player who consents to a game's rules diverges into three distinct subjects: **player-subject**, **playing-subject** and **played-subject**. Like Rancière's emancipated spectator, the **player-subject** performs an interpretive role, and maintains critical distance during gameplay. De Wildt describes a further split into a **playing-subject**, a mediating subjectivity between the player and the game world who interacts with the code (2014, 10). The **played-subject** is the avatar, and often represents a character with a separate cultural background, personality, and beliefs.

Participatory art evokes multiple subjectivities by simulating alternative social scenarios. Thus, I define participatory art in this framework as a **social simulation** that places **participant-subjects** into a **new context** in order to experience an **alternative way of being**.

3. DESIGNING ALTERNATIVE WAYS OF BEING

Much like the multiple subjectivities of a participant, the artist of a participatory work performs multiple roles. In this section, I explore the artist as designer, procedural author and facilitator, and touch on the importance of an integrated design approach to core values. I then suggest possible iterative methods for feedback during the creative process.

Salen and Zimmerman refer to design in games as the creation of rules and structures that result in an experience that offers meaningful choices to participants. The consequences of their actions should be both **discernible** and **integrated** into a larger context (2004, 4). In other words, participants should perceive that their actions have an effect, and that this effect is relevant to the piece as a whole.

Choices made available to a participant inevitably reflect an artist's particular understanding of the world. Flanagan and Nissenbaum assert that this is why a conscientious and iterative approach to values is necessary. They acknowledge that these values will not be interpreted identically between participants, but assert that constraints on mechanics and narrative elements create a plausible range of interpretation (2014, 16).

Values are culture-specific and generally fall into either 'ethical' or 'political' categories, depending on whether one refers to how people treat themselves and each other, or the arrangement of power in society (Flanagan & Nissenbaum 2014, 6) (figure 1). This vocabulary is often used by artists when describing the real-world urgency of their work.

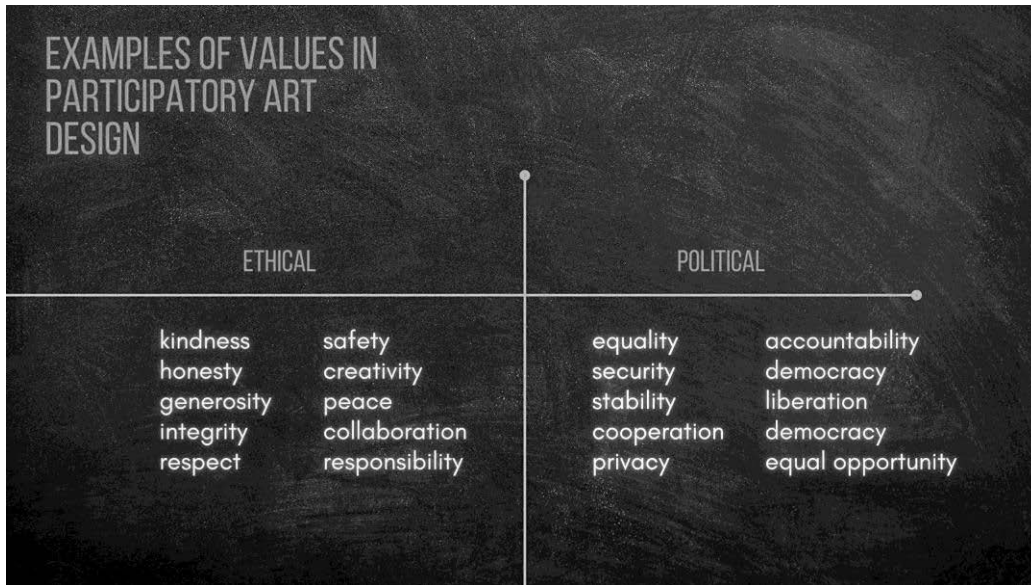


Figure 1: Examples of values in participatory art design, selected from *Values at play in digital games* (Flanagan & Nissenbaum 2014, 6)

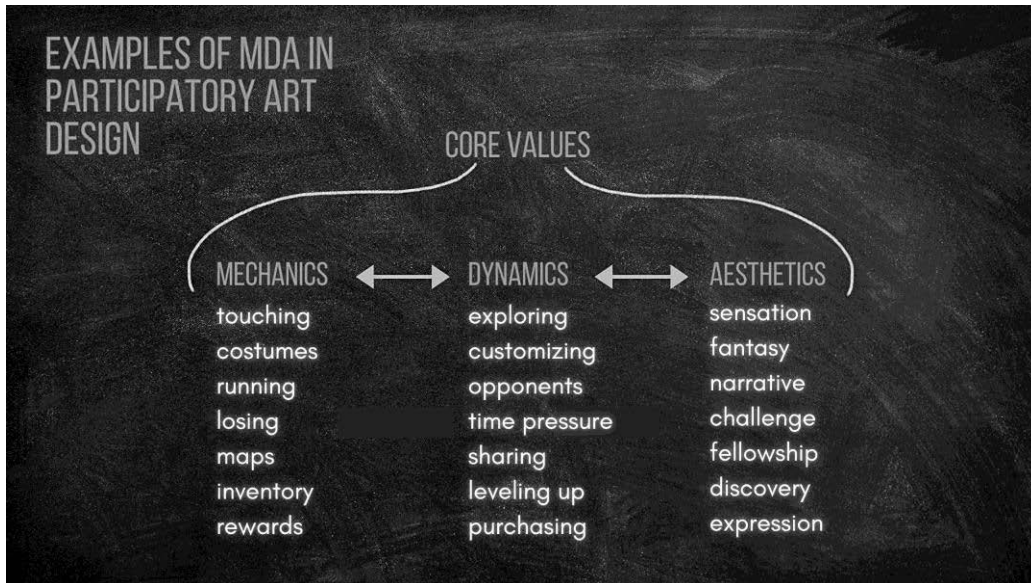


Figure 2: Examples of MDA in participatory art. 'Aesthetics' excerpted from MDA: *A formal approach to game design and game research* (Hunicke, LeBlanc & Zubeck 2004)

Designing for core values in participatory work is challenging, because small cues like a sign at the door, seating arrangement, or a vague instruction can inadvertently cause participants to feel self-conscious, manipulated, or confused, and inhibit them from accessing the larger conversation. There are many iterative design processes that attempt to address this, including the **Mechanics/Dynamics/Aesthetics** model (MDA) used in game design.

MDA recognises that rule-based actions (mechanics) chain together to create indirect

consequences (dynamics) for both the player and the system (Hunicke, LeBlanc & Zubeck 2004). The dynamics that unfold for a player in turn provoke an emotional response (aesthetics). Designing from aesthetics first foregrounds the player's experience, but may fail to account for technical requirements and limitations, while designing from mechanics first may generate undesirable aesthetic experiences for the player (figure 2).

Using the previously mentioned taxonomy of **player-subject**, **playing-subject**, and **played-subject** (Sicart 2011; De Wildt 2014), I propose

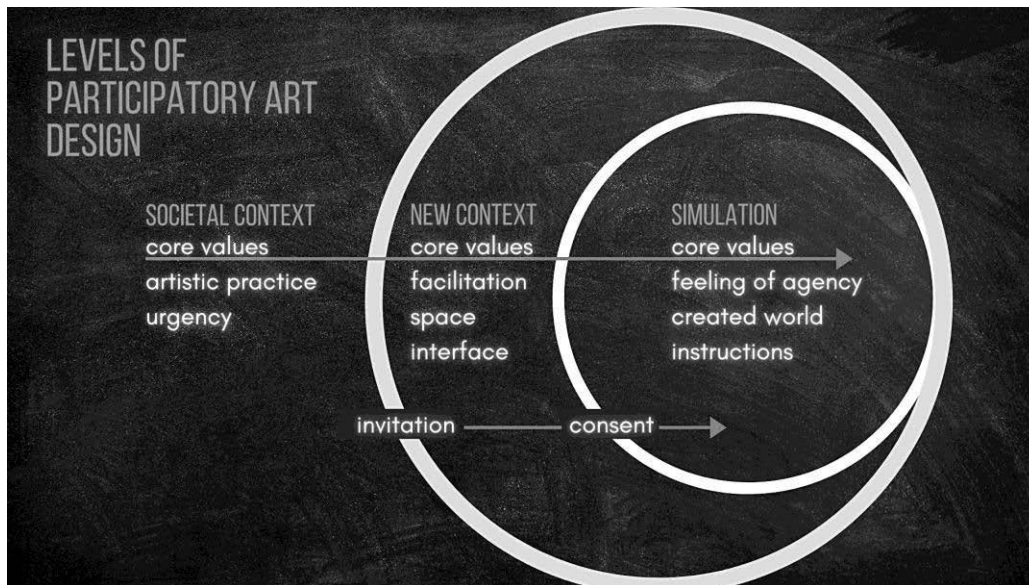


Figure 3: Layers of Participatory Art Design

corresponding strata of participatory art: external, mediating, and internal environments. The external component is the societal context that drives the real-world urgency of the piece. Upon accepting an artist's invitation, participants enter a mediating layer, wherein any objects or technologies necessary for participation are encountered. After consenting to the rules and receiving instructions, participants experience a third layer; the simulation. Here, agency and interaction are regulated by the artist, who creates a world that includes components like immersive and narrative elements, incentives, and risks. Participants make choices that shape their outcome and experience within this layer (figure 3).

Participant agency is designed not only by creating rules, but by introducing 'gaps' in the narrative presented. This is the role of a procedural author. Janet Murray writes, 'The procedural author creates not just a set of scenes but a world of narrative possibilities' (2016, 143). Mukherjee asserts that procedural authorship is an 'ongoing process of interaction between the game and the player' (2015, 150).

Due to its social dimension, the interaction in participatory art includes intersubjective engagement, causing participants to not only co-author their own experience, but act as procedural authors for each other. White explains that these procedures 'give rise to actually occurring performances' (2013, 195).

I assert that procedural authorship offers a large range of intersubjective experiences that can be designed by an artist, including prearranged narrative possibilities, as Murray suggests, or a

collaboratively produced outcome, like an improvised performance might yield. A procedural author must also decide which technologies, algorithms, or objects to interpolate into the agential choices of participants in order to best express the core values and objectives of the piece.

An artist of participatory work may also play the role of facilitator, which might include extending hospitality, clarifying and enforcing rules, and managing social risk. Facilitation, like many aspects of participatory art, is difficult to design without the feedback of participants. For this reason, it is vital to cyclically iterate. If meaningful choices are offered, only participation can expose unexpected dynamics or points of incoherence. This can be revealed through 'playtesting' (where the artist experiences the role of a participant) or prototyping for test audiences.

It is important during this process to repeatedly clarify core values with collaborators in order to prevent small differences in interpretation from snowballing into problematic inconsistencies. The VAP (Values at Play) model is an iterative process that recognises the 'need to unravel ambiguity and develop...a definition of relevant values that is sufficiently concrete to guide design' (Flanagan & Nissenbaum 2014, 80). This approach includes *discovery* of values, *implementation*, and *verification* of whether the desired quality of participation is being accomplished. Due to the importance of clear communication in my research, I have incorporated VAP into my experimental framework.

4. FRAMING THE WORK

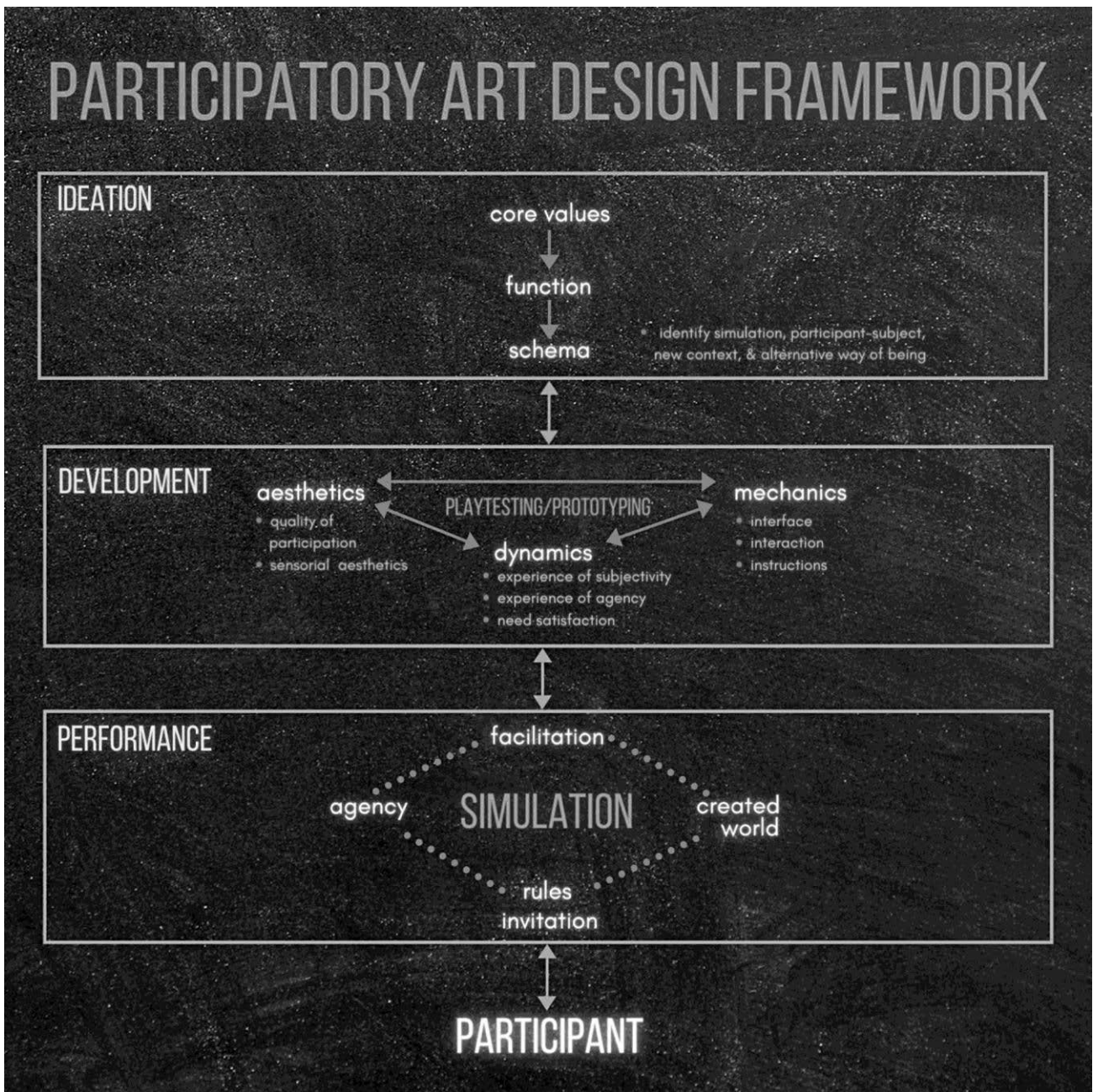


Figure 4: Experimental Participatory Art Design Framework

In this framework, the creative process is divided into three iterative sections (figure 4):

- (i) **Ideation**, stemming from core values in relation to a societal context,
- (ii) **Development**, wherein the mechanics, dynamics, and aesthetics are playtested and prototyped, and,
- (iii) **Performance**, wherein participation is facilitated with participants.

Core values are key to the success of this framework. Once identified, it is important to decide how values should function within the piece and

how that function can be realised artistically. I adopted a schema (based on my earlier definition) to clarify this: Participatory art is a **social simulation** that places **participant-subjects** into a **new context** in order to experience an **alternative way of being**.

The second section of the framework includes MDA, playtesting, and prototyping. These periodically revolve back to the first section of the framework, refining values based on experimentation and feedback.

In the third section, an invitation is extended. After consenting to the rules, participants interact within

the simulation, whose structure determines their experience of agency and subjectivity.

5. WE CALLED IT _____

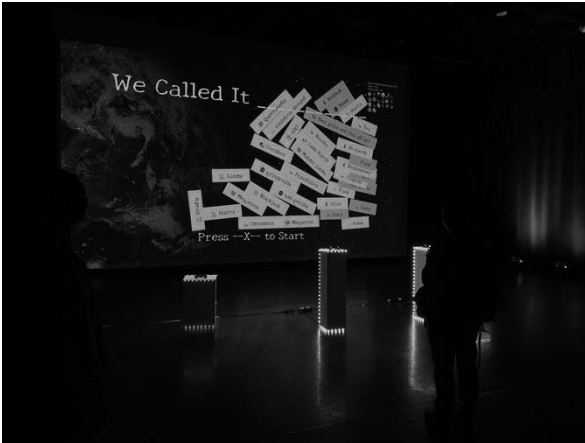


Figure 5: Start screen of *We called it Earth*

In *We called it Earth*¹, I chose to address **participant-subjects** as a collective subjectivity by placing them into the **new context** of an immersive, online game. I wanted to **simulate** what it would be like to collectively occupy the same body and mind in a world shattered by a force simply referred to as 'the Separation'. Learning to navigate this collective experience would constitute an **alternative way of being**. The core values of this piece were collectivity, access, and disidentification. Below, I explore how they integrated into the piece, and how through 1,711 playtests, two prototypes, and a performance, they evolved.

Collectivity. This was the primary value guiding *We called it Earth*. I initially imagined a game mechanic wherein each player could choose and attach a limb to the avatar and control its movement. This, however, quickly became political. If every participant controlled one limb, what would determine the direction of the avatar's movement? Would majority rule, or would the decision need to be unanimous? Would there be a penalty for lack of consensus?

One of my original templates for collectivity, a social movement, had differentiated roles, a unified (if not uniform) goal, and agency that manifested in unpredictable bursts from various directions. To evoke these qualities, it was important that each participant experience both intermittent individual agency and collaborative effect. I introduced the idea of randomly rotating control to participants. My collaborator, software developer Hadi Asghari, and I, also decided that while there would be no penalty for dissensus, disagreement about direction would cause the avatar stay still, and lack of participation would greatly slow progress.

Access. Because of this value, we wanted to make the game playable on a mobile phone browser, a ubiquitous device that required little technical knowledge. To implement this, however, would cause a lag on a browser-based system; so much so that participants might not experience the movement of the avatar as related to their choices.

Through the same value, we had chosen the game design platform Godot because it was open source and supported by a community. However, features that integrated HTML5 were not yet robustly developed. Consequently, the choice was made to have only four limbs, controlled via Playstation controllers in a live space, that would switch functions periodically. The mobile interface would be available to everyone else, and handle the task of writing a story in the virtual environment.

Disidentification. Having differentiated roles for participants, I needed to address a potential hierarchy driven by task-related identification. Participants operating game controllers would have more agency than mobile users, and those with game experience would have a sizeable advantage. I needed a way to mitigate social risk for beginners and encourage experienced gamers to prioritise the ethos of the collective over the traditional goal of victory.

We decided to enable participants to identify themselves only as an emoji. This offered equal footing on the projected screen, and some anonymity for those who might feel social embarrassment.

Differentiation. During the first prototype, participants experimented with entering text during gameplay. Those participating expressed the desire to spend more thoughtful time writing, and to have the opportunity to respond to each other.

Taking this into account, a scenario was proposed where the avatar would depend on text submissions to fill chasms that could not otherwise be traversed. Action would freeze during this mechanism, giving mobile participants time to write. I hoped that this temporal separation of activities would address any inequality between what I was now referring to as the avatar's 'body' (the limbs) and 'mind' (the story).

Revisiting collectivity. As the second prototype approached, I focused on how to deliver instructions, and how rules might be enforced if they were violated. It was a priority to avoid a top-down approach because I wanted to leave space for the collective to affect its own form through the experience of gameplay. I revisited my definition of collectivity to better understand how I might achieve this.

A protocological network (Galloway & Thacker 2013, 30) is a system of distributed, individual nodes inclusive of anyone agreeing to the terms

and conditions. This network operates through relationships, and exerts control in a decentralised, radically horizontal and distributed way, thus allowing for robustness and flexibility when confronting unpredictable contingencies.

I implemented this by placing rules in written form outside the game space, making the door a threshold of consent to the terms and conditions. The rules communicated two important points:

- (i) This is not a theatre—this is a game. Speak up, walk around, have fun!
- (ii) Be supportive. Rules can be hard to figure out, especially in the beginning. Offer help if you can and kindness if you can't.

Bringing it together. Due to pandemic restrictions, the second prototype was the first-time multiplayer limb control was tested with participants. It was successful, characterised by cheers of encouragement, loud laughter and confirmation that participants felt like part of a community. Without prompting, participants took turns with the controllers during the game. What had taken me 2.5 minutes to navigate in playtesting, however, took 25 minutes for participants during the prototype, and this caused them to forget about their mobile phones, opting instead to focus on the action unfolding on the projected screen.

It was pointed out during feedback that the written instructions did not prepare participants for the energy of the game, and they would prefer having a host to direct the flow of events. Introducing this role would increase access because I could help people with their internet connections, devices, etc..., but had to be executed without asserting the host as an enforcer of the rules, relying instead on protocols.

The programmer and I decided it was necessary to increase interdependence between the 'body' and 'mind', and that an additional mechanic was required. An energy bar was added to the top of the main screen, decreasing as the avatar progressed. If the avatar 'died', 50 points were deducted, and if it fell to zero, the avatar was frozen until energy was replenished. On mobile phones, five icons were added, of which some added energy points and some drained them (figure 6, 7).

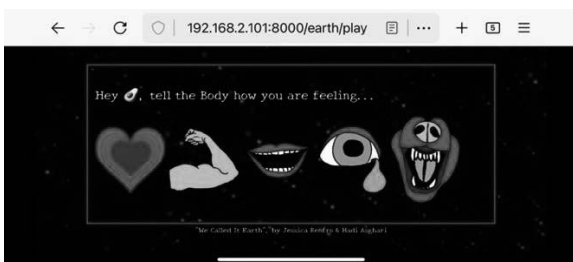


Figure 6: Participants could send energy from their mobile phones.



Figure 7: A participant maneuvers while energy appears on the screen. Photo: Fenia Kotsopoulou

5. GAME DAY

The performance did not proceed without interruption. Bugs appeared that had never occurred before, causing pauses during gameplay and a reduction in the number of mobile users. Interestingly, the protocols were enthusiastically embraced even during the unanticipated gaps. Individuals stepped into the role of cheerleader or joker. A group of participants began singing along dramatically to the game's theme song. Conversation was exuberant and playful, carrying over the energy of the game.

Some recorded comments that suggest new subjectivities included:

- 'I am the pink leg!'
- 'Oh! I can jump! That's me!'
- 'I found myself—okay!'
- 'I'm definitely walking, but I can't do more than that.'
- 'Give us some energy, guys!'
- 'Send us some love—it's free!'
- 'We can run now. We're experts.'

Participants holding game controllers referred to themselves frequently as players, the avatar, and their individual body part, and kept their attention locked on the screen (figure 8).



Figure 8: Participants reacting. Photo: Fenia Kotsopoulou

The new mechanic of sending energy from mobiles was astoundingly popular to the point that the energy level of the avatar dipped to a critical level only once after several consecutive 'deaths'. The text mechanic faced obstacles due to the forced reduction of users. Responses to the prompts were short, and participants expressed not knowing what else to write before the chasms had been filled. However, this made the activity more social, with those logged on to the server asking for submissions from others.

6. A LARGER CONTEXT

This preliminary research investigated how participatory mechanisms influence different qualities of participation. It can be a helpful resource for artists, and additionally enables a nuanced critique of the values driving participatory art pieces. The ability to critique gains urgency in light of the some governmental efforts to reframe 'participation' as 'participation in the task of being individually responsible for what, in the past, was the collective concern of the state' (Bishop 2012, 14). Identifying neoliberal values like self-determinism, solutionism, or libertarianism through their consistent presence in elements like mechanics, created world, and rules could forward the conversation about the ethics of certain participatory mechanisms and how they might run counter to their stated objectives. Finally, this might allow artists to harness these mechanisms as a way to return power to the collective, changing the focus from individual achievement to collective good by simulating a return to egalitarian values.

Transparency in participatory art creation might also draw back the curtain on the pervasive issue of access within the arts. Although many pieces, including my own, express a desire to invite diverse participation, Shah points out:

Emphasis is largely placed on the moment of access, the point of access, and the actions generated once access has been successfully achieved—on access as a verb, which finds its fruition in the bridging of the last mile, the connectivity to the underserved, and the production of the connected subject. The primacy of access as action makes the infrastructure, which is the condition of access, invisible (2017, 117).

The 'participant' in participatory art is, to a degree, already selected by the condition necessary to engage with the piece. Therefore, it is crucial that artists recognise that all participatory pieces have exclusion built into them. As a social exercise, they are ephemeral experiences of embodied collectivity that cannot actualise the collectives they imagine in society-at-large.

Nevertheless, participatory art acts as a catalyst for social change by changing how participants see themselves and each other. *We called it Earth*, for example, offers the collective experience of multiple subjects occupying and controlling a single body. This could easily feed into a larger conversation about conflict resolution, teamwork, or social movements. Pieces like this also teach how to use participation as a mode of public discourse.

Participatory performance is usually too short-lived to observe the kind of collective emergence evidenced in multiplayer virtual worlds. Additionally, the subjectivity brought into focus by the artist is likely not based on the participant's customised choice as is common in video games. This makes it less likely that a participant would choose to re-inhabit this *played-subject* beyond the life of the performance. However, precisely because of its temporary nature, the subjective embodiment in participatory art is an invaluable pedagogical tool.

Through its focus on selective subjective experiences, it helps participants gain new insights about their social reality, and their shared experience can be a touchpoint in subsequent conversations. This kind of dialogue could potentially raise the visibility of the collective problems of our time by engaging individuals who, for a brief time, accept the invitation to step outside of their busy lives to co-author an alternative way of being.

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¹ For in-depth information about the mechanics and rules of the game, please see Chapter 4 of my thesis (Renfro, 2021).

transcendence – trance ‘n dance (performance)

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***transcendence – trance ‘n dance* is a poetic-political performance which explores the power of dance as a tool of bodily reappropriation and of trance as a state of heightened awareness. It is a critique to the body and gender oppression we are subject to within this colonialist, patriarchal and capitalist society. The piece depicts a sonic battle between a set of loudspeakers and a drum circle. I am the mediator of this clash, controlling and generating the actions through a vaginal muscle reader. In this text, I describe the dramaturgy behind the performance and delve into the narrative elements that form it, finding their ground within feminist theory.**

Dance. Trance. Poetry. (Cyber)feminism. Body. Gender. Oppression. Technology. Identity. Latin America.

*The Church says: The body is a sin.
Science says: The body is a machine.
Advertisement says: The body is a business.
The body says: I am a party.*

–Eduardo Galeano



Figure 1: *transcendence – trance ‘n dance* performance.
Picture by Robinou.

1. INTRODUCTION: ARTIVIST STATEMENT

I am a tEckhnO¹ feminist activist, dancer, performer, researcher, writer, raver, technician and latinx who creates interactive works that address the oppression of the body-mind-spirit. Using an interdisciplinary and intermedia approach, diverse elements converge in my creation: from the body to its relation with physical/virtual/spiritual spaces, materials and entities, to poetic forms of movement,

language, sexuality and mysticism—all enhanced by the chameleonic capabilities of technology, which is both medium and subject of criticism.

The goal of this text is to support my artistic practice within the contemporary, feminist context of creation. It serves as an explanatory device for my performative work *transcendence – trance ‘n dance*², which explores the power of dance as a tool of bodily reappropriation and of trance as a state of heightened awareness. The piece focuses on the liberation journey of the Self from the physical and psychological confinement imposed by the politics of a colonialist, patriarchal and capitalist society.

transcendence – trance ‘n dance is part of the trilogy *ānim@* by the collective sWitches, an interdisciplinary, cyberfeminist, activist constellation formed by Ines DeRu, Ella Hebandanz and myself. Taking the witch as a symbol for the wise and rebellious feminist, we make our way into the patriarchal technological field to express a more diverse(ifying) view on technology. In our exploration of sensorial experiences, interventions and manifestations, we fuse circuits of electricity to extend and enhance human connection and solidarity. Making use of our diverse origins and creative approaches, we link back to our own roots, while creating a new circuitry.

My performance is an interactive, technologically aided piece where I fight against the spirits of oppression and along the spirits of liberation. I draw inspiration from my background as a dancer, as well as from protests and trance-inductive practices. I use the format of street dance, where

dancers encounter and challenge each other, to create an *energicospatiotemporal* setting where the boundaries pushed are not against another human but against the machine.³

During the performance, a narrational electronic-poetic piece plays in space. I listen; I respond—through dance. Since I am remotely connected to a set of automated drums via a vaginal muscle reader, which reacts to the movement of my hips, the outcome is a sonic clash between the drums (primal, ancestral) and the *electropoetry* (digital, intellectual). I am the activator and mediator of a chain system of feedback interactions that guides the narrative.

Technology translates the intentions while expressing its dualistic nature by showing its abusive face as representation of domination, as well as its supportive face by helping me reclaim my power through corporeal and ancestral memory. The audience observes this interaction by being immersed in space, witnessing my movements converted into sensorial stimuli for them.

The semiotics of the piece bring forward a narrative revolving the body, where sound, movement, anatomy, aesthetics, technology, and voices of the living and the dead create a subversive action where *herstory* will be told. Through mythological devices, I address a set of “opposite” forces, which in my position of mediator, I try to bring together. From chaos to harmony, sky to ground, fire to water, air to earth, yang to yin... I embody the eagle and the snake in me and battle to balance them, reclaiming my body as subject to stop it from being object, transcending from oppression to liberation.

This work is the commencement of a lifework, a journey of discovery of how a very damaged past attempts to create a very pleasurable future. We all embody time; we are continuously part of the regenerative cycle of matter and *nonmatter* that connects us to one another. Glancing at a destiny that seems grim—from climate change to pandemics to white supremacy—it is hard to envision hope. But I believe feminism has the capacity to forge that path. I delve into the complexity of this movement and some of its sub-movements, finding my position and action within its propositions. I analyze the two cultures that shape me: Latin American and European. From politics to poetics, from activism to art, I venture and **adventure** into the healing capabilities of different forms of rhythm, of inspiring movements and the creator creatures behind them. My own expression nourishes itself from the fighters of this world—the change generators—to then create a multiverse of its own.

2. DEVELOPMENT: NARRATIVE

2.1. sWitches

transcendence – trance 'n dance exists within *ānim@* by sWitches, a sensorial, communal universe where our unique spells generate a ritualistic act of resistance. This poetic, political, performative ritual simulates an ecosystem where harmony and chaos co-exist. In our realm of tEckhnO magick and wwwwitchkraft, we explore sound as an agent of healing (*son tra mi ona* by Ines DeRu), dance as a tool for bodily reappropriation (*transcendence – trance 'n dance* by pamela varela) and sonic optics that question the constructed boundaries of the body (*Compositions of Unbroken Flows* by Ella Hebenanz).

2.2. Setting

My performance starts with me laying down. An agonizing sound comes from the loudspeakers, which are hanging above me: the sky. From them, a red half-eagle mask falls, as well as copal, a Native Mexican incense, which represents fire, and feathers, which represent air. As I listen to the screeching sound, my body, decorated by a green snake, twitches painfully. I am surrounded by a drum circle. The drums stand on the ground, representing earth. A collection of stones and crystals—earth—and seashells and oysters—water—accompany them.

The chronology of the performance is a transformation process from chaos to harmony, the final message being that these opposite forces can coexist in balance. Taking inspiration from the Greek creation myth, the piece starts with the loudspeakers and the drums playing chaotically. When I insert the vaginal probe, Gaia, the earth, appears—the drums become rhythmic. When I put on the mask, Uranus, the sky, is born: the *electropoetry* becomes rhythmic.

2.3. Electropoetry

The plot of the piece revolves around a sonic battle between the *electropoetry* (played in the loudspeakers) and the automated drums. The *electropoetry*, an electronic-poetic composition of the duration of the performance, is the main narrative device. It is the digital and intellectual entity, formed by electronically composed sounds and a poem written by me. This element is always present; it is not generative, hence indicating invasive qualities. As a representation of the ancestors' spirits, the piece also contains excerpts from female-identifying poets of the American continent: *Patriarchal Poetry* by Gertrude Stein (Stein 1980), *Still I rise* by Maya Angelou (Angelou 1978), *Natsiká/Viaje* by Celerina Patricia Sánchez Santiago (Sánchez Santiago 2018) and *Mujer* by

María Sabina (Sabina 2018). I chose to work with poetry because of its power in (re)adapting and (re)signifying language.

Poetry, electronic beats and drumming are commonly rhythmic. Rhythm is the gateway of trance, which is a state of heightened awareness used in esoteric practices to take the body beyond its physical and mental limitations. I choose to reference this state and work with it because of its dissociative and healing capabilities; it is about going beyond human. The whole dance/performance is led by this state of consciousness.

Repetition has the capacity to numb the conscious mind. My aim is to use it as a portal of transcendence, but the danger of falling into a state of stasis is the risk I take when getting involved in this sonic battle. Marco Donnarumma, alongside with the collective Fronte Vacuo, also works with performative, technologically backed rituals. In *Humane Methods*, rhythm is portrayed through an artificial intelligence deity, a “computational ‘brute force’ hammering the senses”: the machinic of the *digitocapital*, algorithmic societies. (Donnarumma 2019)

Electronic beats make their appearance as symbols for liberation within the rave, a place of community building and radical self-expression, as artist and dancer Michele Rizzo points out (Stedelijk Museum 2018). He refers to the ideas of Julia Kristeva, a feminist semiotician who studies dance’s close ties to religion and questions its usage when “God is dead [...] an event that happened in Europe—and nowhere else—which cut ties with religious tradition” (Kristeva 2012). Dance has been seen in diverse cultures as a way of achieving transcendence, a fact Michele Rizzo compares to the contemporary rave culture, where individuals go to the club to be with their community (Stedelijk Museum 2018). Likewise, Bogomir Doringer is an artist, researcher, curator and raver who is engaged in an ongoing exploration of the rave as ritualistic and on the power of collective dance. *Dance of Urgency*, curated by him, focuses on this urge to dance and its socio-political meaning (Het Hem 2020).

2.4. Attire

The attire I wear in the performance is a red eagle mask on the right side of the head (mind) and a green snake on the left side of the torso (body), embodying the symbolic dualism in me and linking to my Mexican roots. The snake is a woven piece of fabric made by a Mexican craftswoman⁴, while the mask was made imitating a Mexican beading technique.

In some Mexican cultures, the mask is commonly used in traditional dances, where in some styles, women are not allowed to participate. If there is the

need to have a female character, a male will wear a mask with the face of a woman. The belief that it was not proper for women to dance was brought from Europe (Lechuga & Sayer 1995). The use of the mask is linked to identity; some Indigenous groups, like the Cora, from which my great-grandmother had roots, destroy the masks after using them in dance as an act of purification. Mask making is also often a tradition of patriarchal lineage, where the *oficio*⁵ is passed from father to son (Lechuga & Sayer 1995). I reappropriate the mask and use its identity-moldable capabilities, getting inspiration from its role in performance, ritual and (feminist) protests.

The Mexican emblem is an eagle eating a snake. The myth says that this symbol was pointed out to the Aztec people by their god Huitzilopochtli, who indicated that where they saw that image is where they had to establish their civilization. In her book *Borderlands/La Frontera: The New Mestiza*, Gloria Anzaldúa, who was a Chicana, a lesbian, an activist and a writer, points out that the fact that the eagle (fire, air, the sky, yang energy) is eating the snake (earth, water, the earth, yin energy) is an indication that the pre-Hispanic culture(s) were already patriarchal by the time the Spanish got there. The snake was an attribute of the female deities, which she argues were desexed by both the Nahuas and the Spanish (Anzaldúa 1987).

2.5. Drums

The drum, the oldest musical instrument, represents the primitive entity in my piece, in opposition to the *electropoetry*, the technological. Nine traditional drums from diverse origins form the drum circle. All of them were given or lent to me by friends, which for me is a representation of cultural diversity. They are all different, aesthetically and sonically. I chose metal as a material to hold them in place, partly because of its recycling possibilities and partly because of its unexpected and imperfect nature, allowing me to shape it freely. I emulated organic beings—some sort of animal-looking creatures.

2.6. Technology

I use a vaginal muscle reader, which is a medical device used for pelvic-floor health, to remotely activate the drums. I started using this technology while working on a project on the reinvention of the crinoline (hoop skirt) and inspired by Dani Ploeger, an artist who uses an anal electrode in his work. Originally, I was interested in making a technofeminist statement by creating a wearable electronic piece which referenced the oppressive garment, while turning it into an expressive apparatus, which was activated by the contractions of the vagina. Accidentally, I found out how well the sensor worked when I moved my hips, and from the point of departure that I am a dancer and a new media artist, I started to formulate the idea of

creating a dance performance where this sensor would be the activator of the piece. I was captivated by the idea of tracking movement from within.



Figure 2: Vaginal probe. Illustration by Ines DeRu.

Being a maker-woman and often using complex computation and heavy machinery to create my works, fascinated by the creative possibilities this gives to me, I also often find myself in the middle of an inherently patriarchal field. For instance, machines are not made for my body. They are often too heavy, hard and big. “[M]achinery is literally designed by men with men in mind—the masculinity of the technology becomes embedded in the technology itself.” (Wajcman 2004)

Cyber-, techno- and xeno- feminisms are all movements navigating technoscience and englobed within the term “cyberfeminism”. Cyber- is a prefix associated with computing, the Internet and technology. Technofeminism is a term coined by Judy Wajcman and fuses cyberfeminism with a materialist analysis. Xenofeminism was created by the collective Laboria Cuboniks, who call themselves “Haraway’s Disobedient Daughters” (Hester 2018). The movement is described as an anti-naturalist, techno-materialist and gender-abolitionist movement, where *xeno-* stands for alien, foreign (Hester 2018).

These movements converge in the inherent gender inequality of technoscience, while simultaneously envisioning its emancipatory capacities. If science and technology have been developed at the expense of women’s—let alone other dissident groups’—participation, the question is what point of departure these feminisms can take. To try to be an activist within a cause that was born from inequality is an ongoing task of reconfiguration. But it is necessary; we have to reappropriate these practices, too. The idea offered by these movements is for feminism to steer a path between technophobia and technophilia, to neither reject existing technologies, nor to uncritically embrace technological change (Wajcman 2004).

Eventually, cyberfeminisms understood that science and technology were male-dominated fields, in comparison to second-wave feminism, where technoscience was seen as gender neutral and the problem was considered to rely on the lack of

women’s presence in the space (Wajcman 2004). Nowadays, technoscience is often conceived to go in conjunction with the exploitation of nature for capitalist ends, and movements like ecofeminism relate this to the exploitation of women.

Ecofeminism (or at least its initial trends) is considered to be a gender binarist and essentialist movement, where woman is associated with creation and nature, and man is associated with war and destruction, “a project that not only feminizes creation but also masculinizes destruction” (Hester 2018). For these reasons, it has been discredited by many. One of the things that can be recovered from this framework is its concern with centering the role of ecology and climate change as major global issues.

Cyberfeminism and ecofeminism are often regarded as diametrical movements, where the role of women within nature and technoscience is debated. Yvonne Volkart coined the term techno-eco-feminism as an attempt to show there can be an intersection. She talks about creators that connect with other beings through techno-scientific means, like Špela Petrič, who mothered plant embryos with the hormones extracted from her urine. It is about the “queering” of powerful dichotomies (Volkart 2020).

To be a tEckhnO feminist activist, one must be aware that the anti-racist, the environmentalist and the LGBTQ+ fights are intertwined with the feminist fight and share a stake in the struggle for collective liberation. None of us are free until we all are, and one’s main fight should not disregard others. As an artist, the origin and afterlife of materials used should be as important as the concepts behind the work. As an activist, one must not fall into hypocrisy and draw arbitrary lines between emancipatory movements. Techno, eco, feminism, art and activism should all work together. In *transcendence - trance 'n dance*, I am using a technology⁶ that refers to the components as “master” and “slave” and to the cable ends as “male” and “female”. How can such a thing as technofeminism even exist, in a context where these words are still widely used? This is where we must generate change.

When exhibiting the first prototype of *transcendence - trance 'n dance*, a U.S. friend remarked how “Latin” this was, regarding the hip movement and the ass. It is allegorical when conceiving the region as *el culo del mundo* (the ass of the world), “in the ambiguous sense of the place of pleasure and contempt at the same time” (Galindo 2020). At some point during the decision-making part, I was listening to an episode of the podcast *La hora trans*, where Jovan Israel, a Mexican non-binary artist and DJ, talks with the host Luisa Almaguer, a Mexican trans woman, about how the anus is such an important **degenitalization** organ because it “unites us all”. It is a point of pleasure that we all share. Whether you

have a vagina/vulva/clitoris, penis or intersex genitals, you will always have an anus (Almaguer 2019). For a while, I considered involving my anus in this project or changing the original idea of using my vagina, precisely to make this statement, but then that would mean we would have already arrived in paradise.

The vaginal probe I use is an intrusive object; it is made of hard material, and I feel it all the time, especially when I move. This is a reminder of the oppression that my genitals, our genitals—the starting point of gender oppression—are subject to, and which in my performance will liberate, express and expand themselves through technological means. I feel the need to work from my own experience, where it is about my body and my reality as a cis woman. This does not mean I disregard the fight of women who do not have a vagina, who are especially exposed to extreme danger, or even the fight of men within feminism. The great thing about the technology I am using is that it can be worn both in the vagina and the anus, and it works similarly, so it is for anyone and everyone. It is all about the **hara**, an energetic point close to the genitals, which my dance coach Fazle Shairmahomed says is the spot of connection with our ancestors.

2.7. Dance

As Fazle always remarks: our bodies have also been colonized, just like territories. As a Dutch Surinamese-Hindustani Muslim queer person, **he/she/they** often refers to problems concerned with the politicization of **his** body. **Her** way of reappropriating these territories is through the liberation of the body, through dance. In the form of decolonizing rituals, **they** work with trance states to connect with **his** ancestors. Fazle and I collaborated to create choreographic elements for the dance component of *transcendence – trance 'n dance*. I chose to work with **her** because in the dance sessions **they** organize, we dive into a journey to heal the trauma and pain our ancestors have experienced during colonialism, as well as the impact of capitalism on our bodies.

“Capitalism was born from the separation of people from the land, and its first task was to make work independent of the seasons and to lengthen the workday beyond the limits of our endurance.” Silvia Federici, a feminist activist and scholar with extensive research on the medieval witch-hunts in Europe, places the body at the center of political activism: the body as a ground of confrontation and resistance. She encourages us to reappropriate the body, to understand its transformative capacities, to resist, to dance, to celebrate (Federici 2020).

During my performance, I dance to free my body, navigating a series of movements that correspond to the timeline of the narrative. The piece is

improvised, but there are choreographic elements that activate the vaginal muscle sensor in different ways. This is how I control the actions and mediate the battle. From starting in pain and ending up in pleasure, I navigate different movements alluding to the eagle, the snake, and the rave. As an activist, dancer and technician, I feel the responsibility to use the arts to reclaim the body and transform our suffering, and that of our allies and ancestors, to bring change to the future, by learning from the past and through revolting in the present.

3. CONCLUSION: CELEBRATION

The body is a party, a delicious celebration of senses and sensations. Let us enjoy it. After years of existing in this *cuerpa*, I fully engage in the journey to heal my body and mind in regards to that which for my spirit was always inherent: pleasure and joy. Carrying painful stories in my vessel, I understand that the effort is immense.

Within the research for this performance, I delved into diverse subjects which, for me, all embody poetic means with political ends, movements that I personally engage with. The personal is political. I am loosening the soil and planting the seeds for a future constellation to occur, a bright destiny where I commune, collaborate and cooperate with the change generators. We are not free until we all are, and we need to unite to destroy **cis-temic** violence: capitalism, colonialism and patriarchy.

I call myself a tEckhnO feminist activist, creating the term “tEckhnO” as an attempt to demonstrate how powerful dichotomies/binaries can coexist, stressing that the way to break these codes is through poetic-political *artivism*. Being immersed in a field that is closely influenced by technology and realizing that this is a quality inherent to humans, I critically question to what extent technophobia and technophilia can coincide and whether technology can be emancipatory or the exact opposite. Given that bodily characteristics are some of the main motivators of discrimination and marginalization, I concentrate in corporeality and how genital differences generate gender and body constraints.

I connect to my Latin American origins, to a culture that has been shaped and harmed by Europe, while at the same time existing and creating within a European context. My current circumstances and privileges allow me to create a transgressive type of work, so I must remain critical and aware of my positionality. I recognize how much both cultures shape my creation and wonder how *transcendence – trance 'n dance* would be received in my home country, hoping to be able to introduce it eventually.

I make kin with my collective sWitches in an interdisciplinary manner, remaining true to collectivism, diversity and plurality. Reclaiming the

witch and her rebellious, noninstitutionalized ways, with a body that dances pleasurably to the beats of the obscure, I tell you a story, my story, *herstory*.

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5. APPENDIX: POEM

phrases, pledges

my great-grandmother was a land
and just like the Mexican grounds
taken she was
by a European man

trinchera de guerra
a body is a land
continuously regenerating
a body embodying time

transgenerational experiences
rooted in ancestral stories
collective trauma
transmitted into our spirits
presente in our bodies
carrying painful stories in our vessel
the grandchildren of generations of rape

capitalism-colonialism-patriarchy
hammering our Selves
is hope on the horizon?
hope should be no diamond

patriarchy at the forefront of pain,

of restraint, of constraint
cisgender men exerting domain
–don't let them tell you that is the natural way–

and capitalism committed
to racism and sexism
a system that does not value
the looks of a body
that is just not the Vitruvian man

binary constructions rejecting “the other”
a history that does not
tell herstory, theirstory

so if imprisoned by language
then poets to break the code
myths myths myths
myths can be retold

se la robaron, she was stolen
a woman taken by a man
oh, dear great-grandmother
I light a candle on your name
Cande
your story is the fuel of my fire
and thanks to all the rebels

who changed my path
so that I won't be
taken by a man

so here we are, protesting
the new mestizas, a breed of antagonist cultures
daughters of an encounter of ravaging essence
gaining control of the dangerous streets
so that the eleven Mexican women
who die everyday
at the hands of men
will march then

heartbeat rising when walking the night
do you think it's fine
to walk with your keys between your hands?
the night, the obscure, the shadows
taken away from us
unaccompanied?
to depend or to endanger

and is home any better?
to perform the unremunerated job
of raising kids and feeding husbands
choose one: whore, mom, nun
I choose none

gender binarism professed
biological differences stressed
those with uterus oppressed
so let us protest

united in the struggle
to destroy cis-temic violence
intersectionality striving diversity, plurality
to construct new realities and virtualities
inclusive bodies, including bodies
from politics to poetics

from activism to art
of movements that heal
and its creator creatures
the change generators:
the rebels
the dancers
the poets
the witches
the serpents

dance as a form of protest
“for the joy of a body that enjoys
and dances on the ruins of order and progress”⁷
movement connecting us
physically, spiritually, sexually
to our joy and our struggles
the rave as subversive
and the power of collective dance
breaking away from the framework of norms:
“political disobedience, sexual rebellion”⁸

loosening the soils, planting the seeds
for a future constellation to exist
a bright destiny where we
commune, collaborate, cooperate
for change, to change

reclaiming the witch and her rebellious ways
with a body that dances to the beats of the obscure
I let the quietened voices
living in and around me
guide my way
mi cuerpa, my body
enjoys, joys, joins
to rebel, to dance
I rebel, I dance

¹ tECKhnO references techno, without diminishing eco.
The (mis)spelling introduces the idea of political activism,
non-conformism, DISORDER.

² Concept, Development, and Performance:

pamela varela

Electropoetry: Montserrat Balmori,
Victoria Martínez, Anna Arov

Technology: Marlot Meyer, Maarten Keus,
Adriaan Wormgoor

Costume: Mexican artisan, Ines DeRu, Jill Wilkinson

Thesis: Sofía Irene, Taide Martínez, Anna Arov

Percussion: Bob Verhoeven, Lucien Nicou

Installation: Ella Hebdanz, Ines DeRu

Dance: Fazole Shairmahomed

Metalwork: Dennis Sloopweg

Mask: Davide Amato

Format: interactive dance performance

for one performer

Duration: 12 minutes

Media: dance/performance, automated drums, metal
frames, sonic composition, poetry, mask, costume,
wearable electronics (muscle sensor, vaginal electrode)

Software: Arduino, Ableton Live, Max/MSP

³ Inspired more specifically by Chicago Footwork, a
street dance style where the dancing is extremely fast
and the music can go up to 170 bpm, so the dancer often
challenges the speaker. Who can go faster?

⁴ I use the term “woman” to include cis, trans, and
femmes, recognizing that there is an ongoing debate as
to whether terms like “womxn” are trans-exclusive. To
the extent that my analysis applies specifically to cis
women, I will highlight this in the text.

⁵ Profession, job.

⁶ ESP32 modules are wireless microcontrollers which
“give orders” to each other to communicate, instead of
using cables to do so.

⁷ Maldita Geni Thalia

⁸ Materia Hache

DIGGING EARTH

Digging Earth: The Politics of the Extractive Industries on Indigenous Lands

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This paper functions as an introduction to the panel *Digging Earth: The Politics of The Extractive Industries on Indigenous lands*. It addresses the historical and colonial background linked to the takeover of indigenous lands in North America, settler colonialism, the role of the Treaties and indigenous resistance. The coal and uranium mining on Diné and Hopi nations, and the resistance from Diné and Hopi grassroots organization to the exploitation of their ancestral lands are highlighted.

Extractive industries. Colonization. Indigenous resistance. Indigenous lands. Treaties. Mining. Sustainability.

1. INTRODUCTION

Extractivism is a mode of accumulation that started to be established on a massive scale five hundred years ago. The world economy –the capitalist system– began to be structured with the conquest and colonization of the Americas, Africa and Asia. (Acosta, 2013, p. 62)

From the myth of the El Dorado and the start of the colonial exploitation of earth resources on indigenous lands on the American continent, to the present 21st century worldwide demands for rare minerals that sustain new technologies, the extraction of earth resources has been strategized to meet the demands of industrialized countries. Deep sea mining is the next frontier for the extraction of rare earth elements, while a lucrative space industry is developing plans for asteroid mining.

On indigenous lands and communities, forms of predatory extractivism have contributed to the plundering of natural resources, land and water. The extraction of minerals and other resources are allowed by governmental and local policies and fostered by international treaties and regulations that profit from their exploitation. Mostly destined for outside exportation, these resources rarely profit local economies. The mining, extraction, storage and disposal of minerals are issues that lie at the heart of the concept of sovereignty in indigenous nations world-wide. This concept was violently attacked during colonization and reclaimed by indigenous nations throughout a history of resistance to colonialism and visible recently through the activism of grassroots movements.

Nick Estes:

Prophecy told of Zuzeca Sap, the Black Snake, extended itself across the land and imperiling all life, beginning with the water. From its heads, or many heads, it would spew death and destruction. Zuzeca Sapa is DAPL –and all oil pipelines trespassing through Indigenous territory. But while the Black Snake prophecy foreshadows doom, it also foreshadows historic resistance and resurgent Indigenous histories not seen for generations, if ever. (2019, p. 13)

The specific history of Native American resistance in the United States illuminates the ties of the history of extraction with the first colonial expeditions, a process that culminated with the establishments of reservations and the containment of indigenous populations in spite of the resistance from indigenous people throughout northern America in what are called the Indian wars.

2. THE TAKEOVER OF INDIGENOUS LANDS IN THE UNITED STATES: A VERY BRIEF HISTORY

2.1. Early settlers and land occupation – The first American revolution

In 1540, after traveling through what is now the state of Arizona, Francisco Vazquez de Coronado's expedition arrived in what is now New Mexico. The expedition was based on the rumoured existence of the seven cities of Cibola, a legend connected to that of El Dorado, the fabled land sought after by Spanish armies during the 16th century throughout the northern part of South America, today Colombia, Venezuela and the Amazonia. In spite of

high hopes to find cities made of gold, what Coronado came upon were the adobe towns of the ancient Puebloans. Among those, were the villages of the Zuni and Hopi people who, despite fighting against the advance of the Spaniards, couldn't stop them. In lieu of gold, Coronado discovered rich turquoise and copper reserves, and soon after the Spaniards and their missionaries occupied the land of the Puebloans, attempting their subjugation and conversion.

It was the first attempt at mapping the route for the further expansion of the Spanish conquest of indigenous territories in the southwestern region of North America.¹ Several waves of conquistadores followed Coronado. In 1595, Juan de Onate came from Mexico with 500 settlers and thousands heads of livestock in another attempt to gain control of the region. In 1599, the Acoma people led by Zutacapan fought against the conversion to Catholicism, religious persecution and the rule of *encomiendas*. *Encomiendas*, conferred by the Spanish crown to the colons and enforced by Onate, gave the right to impose forced labor on indigenous people. The battle ended with the victory of the Spaniards who massacred Acoma people.

Soon after, Spain established a governorate in Santa Fe led by Pedro de Peralta who, in 1610, built the Palace of the Governor still standing today. By the 1630's a few hundreds of Spanish settlers, including missionaries, had established about twenty-five missions in Nuevo Mexico. The entire region proved however to have only few minerals resources and the colons turned to the rule of *encomiendas* to grow their economy and enforce their presence.

In 1680, the Puebloan people, unified around the leadership of Po'pay of Ohkay Owingeh (San Juan pueblo) rose against the Spaniards' occupation. Puebloans and their Navajo and Apache allies captured Santa Fe, overthrew the Spanish rule and established indigenous sovereignty for twelve years. The Franciscan missions were burnt and the colons fled south to Mexico. The historians of the Puebloan remember the insurrection as: "the first American revolution". Soon however, the systematic conquest organized by the British colons in the East would follow.

2.2. Manifest Destiny and Treaties

The 1784 original boundaries of the first thirteen colonies expanded rapidly from the Eastern Seaboard towards the Pacific. Following the purchase of Louisiana by President Jefferson in 1803, settlers annexed close to 2 billion acres of indigenous territories, most of them west of the Missouri River.

This systemic takeover was legalized by a 1823 Supreme Court decision that defined the rights of

the United States to the Indigenous lands. Indigenous people were given only "occupancy rights" to their lands. They were thus considered as politically non-existent, with no title to the land. In addition, armed with the "Doctrine of Discovery", an early colonial framework sanctioned by the Christian church.² The annexation process became known as the "Manifest Destiny", a phrase coined in 1845, describing the God-given right to settlers and their government to expand their domination throughout North America.³

One of the primary means that helped consolidate the western expansion was the system of the treaties. After the first treaty was signed between the Lenape people and the US government in 1778, the pace accelerated and by the end of the treaty-making period in 1871, 370 of them were ratified. While the language of the treaties is diverse, some common features included a definition of land boundaries, the preservation of hunting and fishing rights and a guarantee of peace. In some treaties, the federal government agreed to provide education, healthcare and other services to indigenous tribes and to manage and protect indigenous resources such as land and timber. Most importantly, treaties also recognized the autonomy of indigenous governments on their land. In 1830, however, the Indian Removal Act required all indigenous tribes to relocate west of the Mississippi River and spearheaded the disregard of the obligations set by the treaties. The duty of protection was quickly transformed into a coercive system under which the US government could remove indigenous populations from their lands and manage indigenous assets in a trust. (Taylor, 2019)

By the last quarter of the 19th century, the notion of autonomous tribal governments was deemed incompatible with the politics of expansion, the idea of a unified new nation emerging from the civil war and nationalist ideals. Politicians, land-hungry settlers, ranchers, mining and railroad companies found tribal sovereignty an obstacle to the development of an economy based on profit. In 1871, the Congress passed the Indian Appropriations Act, under which indigenous autonomy was denied.

At the end of the 19th century, white America hunger for new lands continued to grow and led to wars with the indigenous people of the Great Plains and eventually to the "second great removal" of indigenous people from their lands.⁴ In 1887 the federal government implemented an allotment system –the Dawes Severalty Act–⁵ breaking up the reservations into parcels of land allotted to indigenous families on the model of white farming and property, in effect destroying the indigenous traditional agrarian system. Boarding school education became mandatory, implementing a cultural genocide that has been only recently

acknowledged, along with the systematic mistreatment, torture and murder of Indigenous people. The recent discovery of unmarked graves of thousand children near boarding schools in Canada in the provinces of British Columbia and Saskatchewan testifies anew to the spread of this systemic destruction.

The growing consensus about the illegitimacy of independent tribal nations in modern America not only fueled the abolition of treaty-making, but promoted the break-up of tribal land ownership through allotment, legitimized federal government forced cultural assimilation policies and presaged the U.S. Supreme Court's 1903 ruling in *Lone Wolf v. Hitchcock*, which recognized Congress's power to abrogate existing treaties with Indian tribes. (Hirsch, 2014)

The full takeover of indigenous lands in the US was thus achieved by the early 20th century through treaties, laws, forced conversion and education, wars and genocide. It led, among other colonial practices, to the lucrative development of mining industries that continues today.

3. DIGGING AND MINING THE SOUTHWESTERN US

The preservation of land and water is fundamental to most indigenous cultures, along with the use of sustainable practices. Land and water resources are often linked to sacred and culturally significant sites. The people of the Four Corner region --where New Mexico, Utah, Colorado and New Mexico meet-- entertain rich and complex relations with their environment as they consider themselves stewards of the land. The traditional use of sustainable practices has been seriously compromised as these lands have been particularly impacted by industrial-scale mining exploitations. In addition, many sites considered sacred by the local communities of Ute, Diné, Hopi and Zuni people have been destroyed.

The General Mining Act of 1872, signed by then president Ulysses Grant, acted as an incentive to promote settlement in the frontier lands and opened federal public land to private ownership. This law still allows today's private companies to negotiate the extraction of minerals from Indian reservations that are considered federal lands. Their presence in the southwestern US is highly visible in the open pits and the excavated flank of mountains that punctuate the landscapes.

3.1. The exploitation of Black Mesa – Sustainable responses

Black Mesa figure prominently in the founding narratives of both Diné (Navajo) and Hopi nations. For the Diné, Black Mesa is a sacred female

mountain named: Female Pollen Range, where the ceremonies and esoteric rituals of the Blessing Way are regularly performed. The Hopi conduct pilgrimages to springs and sacred sites on Black Mesa, where they gather plants, minerals and ponderosa wood for ceremonies. Many ancient Diné and Hopi graves are located on Black Mesa. It is also an important geological site where the main aquifer and natural springs that supply Hopi villages and Diné populations are located.

For years, Black Mesa was at the centre of a large controversy between Diné, Hopi and the directors of the Peabody Coal Company. In 1966, the Hopi and Diné tribal councils sold the exploitation rights of the minerals and the underground water to the company for a meagre price. The contract was negotiated by lawyers working for an electricity consortium grouping about twenty companies that serviced the energy needs of the urban zones in the Southwest. For more than thirty years, billions of gallons of water were pumped from the aquifer to cool the mining equipment and wash the mineral.⁶

The depletion of drinkable water renewed ancestral conflicts between the two people who had to share what had become an insufficient resource. During the 1990s, the springs on the Hopi territory, sole source of drinking water became almost completely dry. The exploitation of the mine also included the 1977 displacement of thousands of Diné to allow the expansion of the mining activities of the Peabody corporation.

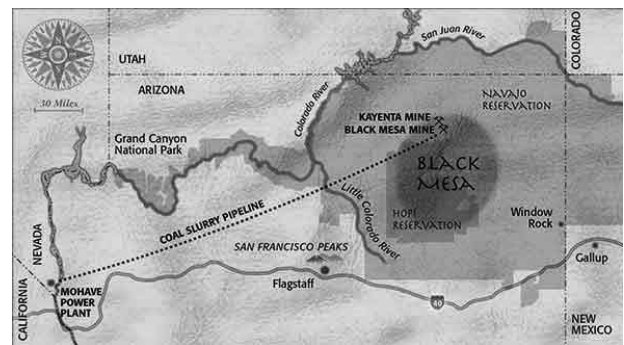


Figure 1: Black Mesa mine map. Source: <https://intercontinentalcry.org/navajo-and-hopi-under-threat-from-more-coal-mining-on-black-mesa/>

During the decades of the exploitation of the coal mines, the mineral was used to supply electric power in several parts of the Southwest, including Las Vegas and Phoenix, the largest cities in the region. Located in the desert, they consume extraordinary amount of energy to sustain the casinos and gambling industry in Las Vegas and feed power to the suburbs of Phoenix. In this context, it is important to point out that near 40% of the Diné people do not have access to running water on their territory and must walk several hours to get to water points. Close to 30% of Diné

households do not have electricity and use gas lamps. This is also true for many houses on the Hopi territory.⁷

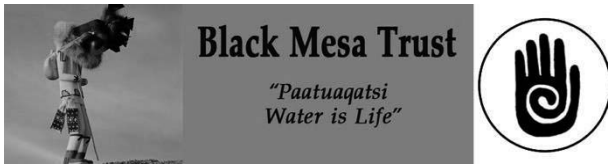


Figure 2: Black Mesa Trust logo. Source: <https://www.blackmesatrust.org/>

Hopi and Diné communities have engaged in several forms of resistance to the practices of the Peabody corporation. Black Mesa Trust, founded in 1998 by Vernon Masayesva, a Hopi leader of the Coyote clan, organized actions and protests against the exploitation of Black Mesa. Eventually, under the pressure of the Black Mesa Trust and other community organizations, the mine closed in 2005 although cleaning and rehabilitation have not yet been completed. For years the mine provided some revenues to both populations and for this reason, its closure was opposed by some. It was however completely shut down in 2019.

Grassroots groups such as Black Mesa Trust, the Black mesa Water Coalition, an organization composed of both young Diné and Hopi activists and To Nizhoni Ani "Sacred Water Speaks" created by a group of Diné are working together to rehabilitate the sites and develop sustainable economic projects of renewable energy to replace the mining jobs.



Figure 3: To Nizhoni Ani logo. Source: <https://tonizhoni.org/>

The first initiatives to bring renewable energy to the reservations were led by the Hopi Solar Electric

Enterprise in 1987 and another called Native SUN. the Navajo Tribal Utility Authority (NTUA) has created an affordable rental system to provide solar power to Diné households since 1999. Together these efforts have opened new economic and sustainable opportunities in the region.

3.2. Uranium mining and storing

During the 1940s, uranium was discovered on several indigenous territories, including the Diné nation. From 1948 to 1986, four million tons of uranium were extracted from Diné lands. More than 1000 mines and four uranium mills were built during this period.

The work of Diné artists Will Wilson and Steven Yazzie testifies to the issues surrounding the rogue uranium exploitation on the Diné nation that have created grave health hazards and disregard the complex and rich history, artistic legacy, and cultural significance of Diné land and culture. Both artists address the specific relations of landscapes with history and the sacred while pointing to the effects of uranium mining on the Diné communities.



Figure 4: Navajo Miners near Cove, AZ, Courtesy of the Navajo Nation Museum, Window Rock, Arizona.

The criminal failure by the US government and the mining companies to disclose the risks of uranium mining also omitted to present health reviews to the mine workers. Most of the thousands of tunnels and pits, now abandoned, have been left unsealed and radioactive waste piles remain on the Diné territory as families live near the sites. Much of the water is contaminated. The grave ecological problems caused by the poisoning of the water in the region have tragic consequences on the health of Diné and Hopi people.⁸

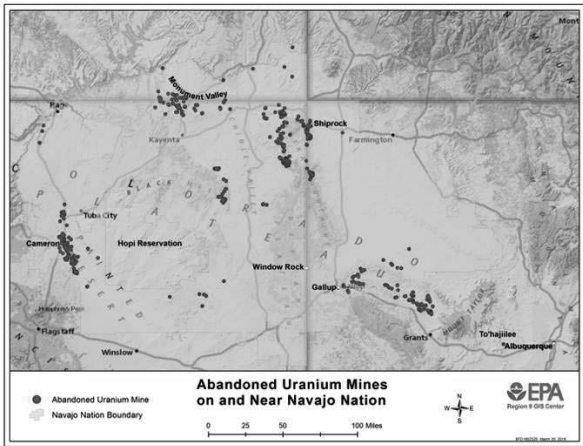


Figure 5: Abandoned Uranium sites, Navajo nation.
Source: <https://www.epa.gov/navajo-nation-uranium-cleanup>

The example of Mount Taylor is most telling.⁹ One of the four sacred mountains of the Diné people, it is also a significant pilgrimage site for several others: Hopi, Zuni, Acoma and Laguna people. Mount Taylor was first dug for uranium from the 1960s to the 1980s. As the price for uranium decreased sharply in the early 80s, its exploitation was stopped. Since 2010, renewed efforts have been led by the Texas-based Rio Grande Resource Corp. In 2007, a coalition of several pueblo people along with the Diné, represented by several native organizations such as the Navajo Preservation Fund and the Laguna-Acoma Coalition for a Safe Environment, succeeded in obtaining the closure of the mine and the denomination of Mount Taylor as a Traditional Cultural Property. Mount Taylor is protected from further attempts at exploitation, at least for now; several groups affiliated with large companies have since applied for new permits of exploitation.



Figure 6: Clean up the Mines!
Source: <https://cleanuptheminesthats.com/>

In addition to uranium mining on indigenous lands waste management systems to store nuclear waste have been implemented in New Mexico and Nevada on or near reservations. The Waste

Isolation Pilot Plan (WIPP) in Southeastern New Mexico receives nuclear waste from all over the US. It is part of what is called the “New Mexico nuclear corridor” because of the proximity of nuclear sites such as the Sandia National laboratory, and the Los Alamos laboratory. The WIPP is the only storage for nuclear waste in the continental US, a deep geologic long-lived radioactive waste pit that receives the detritus of national nuclear weapons production. It is buried half mile underground in deep salt deposits.¹⁰



Figure 7: WIPP signage, New Mexico. Source: <http://www.clui.org/ludb/site/waste-isolation-pilot-plant-wipp>

The Mescalero Apache and Yakima people, who live near the WIPP site, have long protested attempts to build additional nuclear waste storage facilities near their lands. In 1992, members of both nations went to Washington to protest what they called the latest form of exploitation of Indigenous people by the US government. Among them was Juanita Makil, grand-daughter of the Apache leader Geronimo.



Figure 9: Yucca Mountain repository seal.
Source: US Department of Energy.

<https://www.atlasobscura.com/places/yucca-mountain-repository>

Yucca Mountain is a 7-mile-long volcanic ridge located on the Western Shoshone nation and is considered a sacred site for both the Western Shoshone and Paiute people. The Western

Shoshone call it Snake Mountain. It is a place where prayers are said to rise from the mountain. For the Paiute, Snake Mountain is a source of spiritual and cultural knowledge. Ancient burial sites are also located on the mountain. Funding for the construction of the facility was stopped under the Obama administration, following protests from the Shoshone and Paiute and their non-native allies. It is only temporarily closed, and pressure from the nuclear industries to restart the Yucca Mountain project is still on the table.

4. CONCLUSION

The histories of mining on Diné and Hopi lands are only two illustrations of the many predatory activities of the rogue extractive industries on indigenous lands globally. Examples abound. They attest to the tacit agreement among the large capitalist economies that the world is entirely commodifiable for their benefit. Entangled with neo-colonialist practices, large mining industries are responsible for a large share of the damages caused on the ecological systems on these lands. The over exploitation of the land and the water point to their disregard and enact de facto the takeover of the commons –our commons –.

In these ecocidal times, opposition to the merciless disregard of the extracting industries for ecological balance and the disempowerment of local communities has been mounting. In northern America, it is relayed by a number of grassroots and activist groups such as the Indigenous Environmental network, American Lands Alliance, Idle No More, Zero Hour, Grassroots International, the Pachamama Alliance and many others.¹¹

As local indigenous populations and their allies organize protests, they compel their respective governments to acknowledge their presence and demands. Author Nick Estes, a member of the Lower Brule Sioux nation, sends a prophetic message in *Our History is the Future*. He traces the traditions of indigenous resistance in the US against the history of settler colonialism, while pointing to the efforts by native people to protect sustainable modes of relating to the environment and to uphold their historic values for clean land and water for all. If these efforts may seem futile to some in the face of the enormous powers deployed by corporations and governments, the question is: what would happen if activists were not engaged in countering the noxious and destructive operations of the mining industries? If the political and geopolitical issues stemming from the current situation continue to be ignored, the unsustainable pillaging of Pachamama will continue, destroying the lands and resources of millions and hastening the road to the ecocide we are foretold.

Digging Earth gathers contributors that discuss the work of individual artists, are artists themselves, activists or cultural practitioners whose work look critically at the systemic exploitation of natural resources and their consequences on indigenous lands and who highlight sustainable and alternative strategies to counter the mindless plundering of the earth.

Jamie Allen's *Infrastructural Unrest* scrutinizes a growing nexus of knowledge, awareness and activist practices that questions the contemporary problematic of infrastructure and global logistics. The 2020 Canadian pipeline and railway protests, the Wet'suwet'en blockades, a series of blockades across Canada in solidarity with indigenous land defenders, are examples of 'infrastructural unrest'.

Erich Berger's practice explores the materiality of information, information and technology as artistic material. *Deep Time, Deep Futures and the Politics of Scales* examines how Berger's interest in issues of deep time and hybrid ecology led him to work with geological processes, radiogenic phenomena and their socio-political implications in the here and now.

The artist collective DesertArtLab is an interdisciplinary environmental arts collaborative established in 2010. Their work promotes Indigenous/Chicanx perspectives on ecological practices, food sovereignty, self-determination, and climate change. DesertArtLAB's projects activate public space through participatory artworks and support the restoration of desert environments and their foodways through zero irrigation regrowth projects.

Andre Mintz and his collaborators focus on artistic engagements with mining landscape as sites where memory and identity intersect with the sociotechnical. *Can We Still Remember Those Mountains? Breaking the World Into Pieces: Art and Mining Landscapes in Minas Gerais* reflects also on how the Anthropocene is inscribed on these landscapes. With *Ruins Across the Atlantic: Speculations on the Colonial and Mythological Genealogies*, Juan Pablo Pacheco Berajano discusses the route followed by the Atlantis-2 undersea fibre optic cable, the entanglement of the internet with colonial history and submarine ruins and connect the Atlantis-2 cable with the mythological city of Atlantis. Diné artist Will Wilson's project: *Connecting the Dots for a Just Transition* addresses remediation following uranium extraction that has poisoned Dinétah and impoverished its people. It shapes a platform for voices of resilience, wisdom and a vision advocating the transition to restorative systems of economy and memory making.

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¹ Conquests in South and Central America territories were already well underway in Peru, Ecuador, Colombia, Mexico.

² In 1455, Pope Nicholas V established the policy that authorized the conquest of all non-Christian territories, known as the Doctrine of Discovery. The newly established US government justified the takeover of any newly "discovered" territories. The annexation process became known as the "Manifest Destiny", a phrase coined in 1845, describing the God-given right to settlers and their government to expand their domination throughout the North American continent.

³ "Manifest Destiny" was first used by journalist John O'Sullivan in the *New York Democratic Review* in 1845. O'Sullivan wrote in favour of the U.S. annexing Texas, a region that the U.S. recognized as independent of any other nation.

⁴ Indigenous populations in the Western states were settled and forced to move to reservations: Western people were moved to South Dakota. Southern people were moved to Oklahoma.

⁵ The General Allotment Act, also called Dawes Severalty Act, (February 8, 1887), is a U.S. law providing for the distribution of Indian reservation land among individual Native Americans. The result of the allotment act was to break tribal social structures. In addition, a provision of the act allowed any "surplus" of land to be made available for public sale to ranchers or settlers.

⁶ The slurry obtained by the treatment of the coal has contributed to the ecological damage on and around Black Mesa.

⁷ It is also true that the decision of not using electricity in some parts of the Hopi land is voluntary, prompted by the traditional respect for the values of the ancient Hopi way of life.

⁸ See Moore-Nall, A. (2015) and Morales (2016).

⁹ See Lippard (2014), p. 56.

¹⁰ In 2014, one of the burial chambers in the WIPP released americium and plutonium particles. The nuclear accident raised the awareness among the non-native population of the serious danger posed by the proximity of the WIPP to Carlsbad and received attention from the federal government. A town of 30,000 people on the edge of the Chihuahuan desert and close to the Caverns National Park, it attracts thousands of visitors each year.

¹¹ For a list of indigenous grass roots organizations, see: <https://sacredland.org/indigenous-environmental-network/>

Infrastructural Unrest

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'Infrastructural Unrest' characterizes a growing nexus of knowledge, awareness, participative and activist practices that indicate how people are waking up from the contemporary logistical nightmare of infrastructure and global logistics. It is a wake-up that newly resonates with theories of infrastructure by provoking a systems-level, decentralised field of awareness and action, revealing the interconnections of ecologies of "invisible" systems, ways of life, work and people. The wilful, unwitting and projected invisibility of infrastructures, which modes of technological progressivism (e.g. "ambient computing") attempt to disappear, prove available to rifts and interruptions in the smooth operations of infrastructural globalism. The specific ways in which infrastructures are (made) invisible, to whom and for what purposes, remains an ever more important consideration in the Technosphere, during the Anthropocene, and under conditions of planetarity. The 2020 Canadian pipeline and railway protests, the Wet'suwet'en blockades, a series of blockades across Canada in solidarity with indigenous land defenders, are an example of 'infrastructural unrest'. Actions like this are hopeful examples of a growing, situated awareness of how scaled infrastructures are (made) *un*-invisible and impactable, as sites where the localized effects and defects of colonial logics of extractive capital can be traced, diagnosed, subverted and halted.

Infrastructure. Environmentalism. Invisibility. Pipeline. Ecology. Technology. Systems. Planetary. Activism.

1. INTRODUCTION

As Gayatri Chakravorty Spivak has written, our current condition is one of "planetarity": a sense of alterity, of an always-on-the move, contradictory sense of distant attachment to one another and the Earth (Spivak, 2015). Interconnections between beings abound yet they are experienced as heavily mediated and in isolation. Overlapping crises and rifts to ecological systems, temporal ecologies, and human knowledge from one perspective appear simultaneously as smoothly operative and pervasive infrastructural systems, operating at planetary magnitudes. Planetarity "smoothly 'translates' into the interest of globalization in the mode of the abstract as such" (Spivak, 2015) while "logistical nightmares" (Rossiter, 2016) and "broken worlds" (Jackson, 2014) intertwine with a continued sense that information and goods flow, relentlessly. More and more human interactions are experienced through, and more deeply integrated into, the kinds of "robust, reliable, widely accessible systems and services that are beginning to look in form and centrality like... the canonical infrastructures of telephony, electricity, and the rail network" (Edwards *et al.*, 2009). A problem with the proliferation of scalar technological systems, of touchpoints and designed interfaces that obscure the in/visible work that takes place for, against and

through infrastructures is that these give rise to specific kinds of alone-togetherness (Turkle, 2017). They are un-convivial systems that provoke a lack of mutual understanding and context, obstruct solidarity, moderate action, squelch motivation and forestall alternatives.

Pronouncements and projections of pervasive infrastructures as "invisible" are problematic and the stakes of such pronouncements are high (e.g. Anand 2017, Greenberg 1998). Such pronouncements stem from both wilful and programmed blindness to the effects and agencies people have toward the reconstitution, reconstruction or deconstruction of infrastructures. As with concepts like the 'Technosphere' (Haff *et al.*, 2019), which can naturalize infrastructures and distract from conceptualizations of alternate pathways for development, 'invisibility' is a projection of incapacitation, limiting human agency and creativity in the face of technological 'spheres' (Zalasiewicz *et al.*, 2017). There are direct links between the avid and frequent pronouncements of politicians and policy pundits that infrastructures are merely 'unsexy' and 'boring' to their creation and elaboration as a "means to transfer public money into private hands" (Larkin, 2018 citing Mbembe & Roitman, 1995).ⁱ

In the book “How to Blow Up a Pipeline,” Andreas Malm writes of the necessity to reinvigorate our sense of localised possibility against infrastructural globalism (Malm, 2021). It is possible to ‘speak to’ and interrupt globalized infrastructural systems through direct, concentrated actions. These systems of planetary sensing and logistics, driven by the abstractions of market finance, are in reality themselves neither abstract nor invisible, and continuously impinge on the lives of human and nonhuman beings. A role of infrastructural unrest as civil disobedience is to equalize this impingement by turning qualities like omnipresence and ubiquity back on themselves.

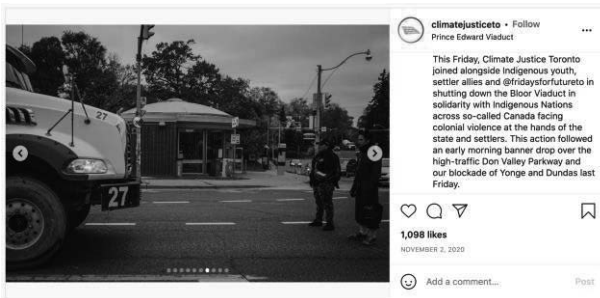


Figure 1: An Instagram post by @climatejusticeto, affiliated with @fridaysforfutureto, staging a blockade of the Bloor Viaduct, a heavily trafficked bridge system in Toronto, Ontario, Canada.

2. SOME IRONIES OF INFRASTRUCTURE STUDIES

In 2009, adding to and precipitating a blossoming of scholarship, media and creative work that would become known as the “infrastructural turn,” (e.g. Shafiee, 2019) four white male academics penned the introduction to a special issue of the *Journal of the Association for Information Systems*. The title of this article was “An Agenda for Infrastructure Studies” (Edwards *et al.*, 2009). Along with introducing the themes and topics in the special issue, the “central lines (and wicked problems) of the necessary field of infrastructure studies,” were sketched out. The authors contended that such a study would need to bridge “three kinds of scales — global/local, large/small, and long-term/short-term” as central challenges for the theory and practice of infrastructure and its study. Further, Infrastructure Studies would help counter the “lingering functionalism that continues to mark efforts to build, but also too often to understand, infrastructure.”

Much of this agenda continues to be elaborated through the work of various academic disciplines, media, arts, design and civic technology, activist and advocate communities. Science and Technology Studies scholars, anthropologists,

artists, media makers, citizen scientists, and information activists compose what could now be called the quasi field of Infrastructure Studies. Sensitively inaugurated and given its methodological underpinnings by people like Susan Leigh Star (Star, 2002) and Geoffrey Bowker (Star & Bowker, 2006), the areas and styles of investigation have been further elaborated conceptually, in different directions, by people like Brian Larkin (Larkin, 2013) and Lauren Berlant (Berlin, 2016), pointing toward the poetic, affective and intimate resonances of infrastructure (Wilson, 2016). These ideas are also empirically studied through a host of fieldwork, field trip and arts-based investigations, including the “Logistical Worlds” project by Ned Rossiter and Brett Neilson (Neilson & Rossiter, 2018) and the *Haus der Kulturen der Welt* in Berlin’s research procession “Mississippi, An Anthropocene River” (HKW, 2019). Since the early 2000s, the interests of these studies and activities have elaborated similar claims of tensions between how large-scale technical systems support, enable and connect while also separating, alienating, constraining, dividing, conquering and killing. They include technical, material, human, informational, political and mythic aspects — somewhat explaining the breadth of interest in their analysis. There are broader, philosophical fora for and specific, situated discussions of “The promise of infrastructure” (Gupta & Appel, 2018) and “Chemical infrastructures” (Murphy, 2015). Shannon Mattern, Lisa Parks and Nicole Starosielski have created brilliantly elaborated sensory and visual perspectives to an inspiring litany of infrastructural reveals and reveries (Parks, 2007; Starosielski, 2012; Mattern, 2018).

Initiatives like Critical Infrastructure Studies (<https://cistudies.org/>) revive and revise the Infrastructure Studies mandate, taking up how infrastructures “reinforce and reshape the stresses between dwelling and work, centre and margin, high and low, and local and global” (Critical Infrastructure, 2020). These are stresses that re-emerge continually as central problems of modern, racial, colonial, globalized capitalism. Maan Barua (Barua, 2021) and Sandra Jasper (Jasper, 2020) call out the importance of abandoned, disused infrastructures and their relationships to human and nonhuman existences and exigencies. Nelson and Bigger question the casting of nature and ecosystems as infrastructures as an ontological trick of and problem in development conservation and green capitalism (Nelson & Bigger, 2021). The white-supremacist, racist and colonial making of urban modernity and metabolizing of nature are part of the “The Coloniality of Infrastructure” initiatives of Nick Axel, Kenny Cupers, Nikolaus Hirsch (Hirsch, 2021) and others, along with Davies’ work on the coloniality of engineering (Davies, 2021).

It is no coincidence that Infrastructure Studies flourished in the post-millennium technocentric milieu of the early 2000s, in which the world's most extensive and complex infrastructure, the Internet, was feverishly being built and proselytized. The call to better understand the function, affordances, limitations and mythologies of these large-scale interconnected systems is, in some senses, ironic. These systems that "we" have built around "us" are, of course, made by "us." Perhaps "we" could or should be able to just go to a local library, a civic or public office or an infrastructural engineering or technology planning bureau (which also should, but often does not, exist) and look up how, or if, these public-facing and socially-structuring systems function. Who we presume this "us" and "we" to be in such a scenario, who it includes and excludes, is of central importance, as is the way that these problems or tensions, are expressed in oculo-centric terms: the binary of visibility and invisibility, words and metaphors that stand in for the kinds of awarenesses, understandings, and accesses that the becoming-infrastructural of technologies have long forestalled.

The phenomenon of "placebo buttons" (Luo, 2004), used for crosswalks and elevators, is an example of a paradoxical gap between knowledge, context and affordances in and with infrastructures. These interface elements have no technical function in these infrastructural assemblages. Still, they are put in place to give people a sense of control, communication and interface with centrally controlled systems that control their action and agency; that have power over them. Although infrastructural modernity begins with the romance of an equalizing, civic utility 'for all,' these power disparity evoke how infrastructures have also inevitably created inequality of knowledge and access, throughout history.

Placebo buttons are infrastructures that 'work' as technological systems "to the extent that [their] models or representations are imposed successfully back upon the social systems they describe" (Monahan, 2016). Placebo buttons bring into relief the disempowering "dual functions of infrastructural management and infrastructural neglect, both depriving the body and controlling its basic functions and mobilities" (Sherman, 2021). These simple cases of urban crosswalk and elevator placebo buttons reminds us of the everyday systems to which we entrust our personal safety or even life-and-death decision making in public spheres. Numerous scholarly works and creative approaches characterize such "apocryphal technologies" (Allen, 2016; Bernico, 2018) and the relationships between expectation, trust, deception, surveillance and control resident in complex technological systems (Monahan, 2016). There are just as many, if not more, popular articles asking the more straightforward question, "Do 'WALK'

Buttons Actually Do Anything?" (Gan, 2015; Winkless, 2017). That this question gets asked, and that it is somewhat challenging to answer—requiring external, empirical studies and reverse engineering—indicates the unequalizing power to obscure and alienate that is resident in even the most seemingly banal of infrastructural systems.

The slight irony of Infrastructure Studies is that we have built technologies that build a world, or worlds, in which the lines between invisibility-visibility, understanding-obfuscation and power-incapacity become darkened and controlled. Modern infrastructural globalism comprises and impose rituals toward "the maintenance of society in time" and "the representation of shared beliefs" (Carey, 1992), which continuously require and desire new mythologies and imaginaries through which to model them (see, for example, the rise and prevalence of conspiracy theories; Gray *et al.*, 2020).

Infrastructure Studies that seek to understand these somewhat ironic mechanisms bring significance and urgency to how technological exclusionism begets other forms of separatist and eliminative politics. Recognition of this exclusionism tempers projections of universalism or naturalness in technology discourses and practices (e.g. "natural" user interfaces; Norman, 2010) and provides evidence for how infrastructures cut across and erase racial, gender and class differences. (Watkins, 2021).

Infrastructure Studies and its motivations can at times feel as if they come too late, and from positions of privilege—initiated as they often are by those who suddenly realize the externalities of and damage done in "the interest of globalization in the mode of the abstract as such" (Spivak, 2015). People in advantageous positions of security can expect and safely demand (whether successfully or not) that systems be open, convivial, explainable and emancipatory (Allen, 2019). There are far more instances, places and peoples who experience and understand infrastructures as firstly, necessarily and forcibly un-ironic, as delusions of technological invisibility are impossible when geographic, psychic and social spaces are being directly displaced, dominated or destroyed by these technologies. The division of publics and the dismantling of ways of life through ambient incursion, omnipresent exclusion and continuous confrontation, are aspects that make infrastructural colonialism insidiously brutal. Those who have not been listened to or who have less power to act, have perhaps always and better understood how infrastructures are "deeply implicated in not only the making and unmaking of individual lives, but also in the experience of community, solidarity and struggle for recognition." (Amin, 2014).

The condition that infrastructures should be 'invisible' or 'mute' is a condition chosen by some and enforced upon others. Infrastructure theory-become-lore holds that pervasive technologies are mute and invisible, only present to human awareness as they break down, decay or pose a risk. The activities of activists, artists and other critical, creative practitioners have, in contrast, have been in the direction of point out and opening out these sealed systems, of cajoling them to speak, in hopes of being able to talk back to them (Allen 2014). Much of the past years' scholarly work, particularly in Anthropology, has likewise tended to re-assert the "mundane visibility" (e.g. Barry 2020) of seemingly omnipresent technical systems.

3. A VERY SHORT HISTORY OF INFRASTRUCTURAL UNREST

The American elder statesman of nature writing and natural living, Henry David Thoreau, was an early proponent and practitioner of Infrastructure Studies. In his often-cited journal entries about early installations of telegraph wires, he writes, "How much the ancients would have made of it! To have a harp on such a great scale, girdling the very earth and played on by the winds of every latitude and longitude" (Thoreau, 1851). We might speculate that his poetry of scalar systems also gave to the individualist, liberal Thoreau ideas for disobedience against such systems. In his characteristically romantic way, Thoreau espoused the prowess and advancement of human infrastructures while holding fast to the autonomy and responsibility one could address to these systems. This contradiction is what, for Thoreau, gave to these systems their awe-striking beauty, ferocity and potential. Thoreau's famed essay from 1849, "Civil Disobedience" (originally published as "Resistance to Civil Government"; Thoreau, 1993) called for a direct protest of the U.S. government through the withholding of taxes by citizens, most specifically to curtail aggressions and spending in its war against Mexico. These writings would come to influence Mahatma Gandhi and Martin Luther King (Scherhauer *et al.*, 2021). Civil disobedience is a primary form of protest and practice which often attempts to address scalar systems and technologies of infrastructure through direct action. Civil disobedience methods include blocking roads to production facilities, the occupation of private and industrial lands, "abseiling from cooling towers of nuclear power plants, chaining oneself to railroad tracks to stop transports with nuclear waste, tree-sitting to avoid deforestation for (coal) mining" (Scherhauer *et al.*, 2021). The risks and stakes of enacting civil disobedience in these ways are much different for people of different classes, colours and backgrounds. As has become a topic related to the

Extinction Rebellion movement and its tactics, for example, black and brown bodies are much more likely to suffer much harsher consequences for engaging in what are ostensibly illegal activities (Bell & Bevan, 2021).

4. THE 2020 WET'SUWET'EN BLOCKADES

Wet'suwet'en territories exist in the northern part of British Columbia, in the Western part of Canada. These territories are part of the Wet'suwet'en nation, a part of north-western North America that is 'unceded' land. Wet'suwet'en lands have never been part of Canada, as its people have never signed any treaties or otherwise acknowledged the dominion presumed by colonists. A series of blockade camps, erected at the initiation of Wet'suwet'en hereditary leaders, has since 2009 been installed to create checkpoints within these lands, controlling who comes in and out and for what reasons. The main concern of those blockading has been to monitor the activity of a 670 km pipeline link, a pipeline designed to move natural gas from the north-eastern part of the province to shipping ports and transport boats on the Pacific coast, bound for Asia. It is called the "Coastal GasLink pipeline".

After more than ten years of build-up of contestations and injunctions, in February 2020, the Royal Canadian Mounted Police moved to physically enforce a court order to remove Wet'suwet'en blockades from the pathway of pipeline construction. The RCMP scaled the central blockade, intimidated protesters, threatened violence and arrested tribal leaders to ensure progress on "the largest private sector investment project in Canada".

Disacknowledgements of indigenous claims were emboldened by declarations that "Canadian energy security" was under threat and that "critical infrastructures" were in danger of a kind of pre-emptive sabotage or even domestic terrorism (Van Rythoven 2021). Immediately following these actions, solidarity protests started to spring up across Canada, like other tribal territories, as well as concerned settler citizens in urban and rural regions alike, creating public spectacles and interruptions that drew international attention to this remote locale halfway up the western coast.

These distributed, swift and responsive national actions took place nationwide as localized and targeted port, rail and policy office blockades. They included one obstruction near Tyendinaga Mohawk Territory, which halted traffic along major Canadian National Railway lines between Toronto and Montreal, five provinces and over 4500 kilometres away from contests in the Wet'suwet'en region. These actions, in turn, led to a shutdown of passenger rail service and rail freight operations in

much of Canada, employment layoffs and contentious general economic shutdown about which there is still much ambivalence and debate amongst the majority population of white, settler Canadians. There was even a Wet'suwet'en action in my hometown of Windsor, Ontario. Windsor is a city that borders Detroit, Michigan and which has its own unfortunate catalogue of social and economic challenges and indigenous rights violations. It was nonetheless a heartening sign of an arising infrastructural awareness that links a struggling automotive manufacturing town to the actions of an oil and gas pipeline company on the other side of a continent.



Figure 3: A schematic map of the Canadian National Railway system. Tyendinaga Mohawk Territory blockades, near Toronto, right of centre on the map, caused a temporary shutdown of most rail systems to the east.

Although their significance, resonance and import are much in excess of their framing as such, the actions, strategies, protests and interruptions which arose in media and against transport and energy infrastructures spurred by the Wet'suwet'en blockade in Canada in 2020, are an example of something we could call 'infrastructural unrest'. Through the attempt to run a 200 km pipeline called the Coastal GasLink Pipeline (CGL) through unceded Wet'suwet'en First Nation territory in Western Canada, the national and supra-national connections that such projects require were revealed to many: From the steel pipeline cylinders that need to be shipped from sites of manufacturing and fabrication, to other support, supply and engineering industries in Canada and the world over that are set to action to the finance and capital flows that become mobilized.

As a reaction to this mobilisation of infrastructural expansions, the Canadian protest blockades evince awareness of and action on human and nonhuman infrastructures. Blockades forcibly strip these systems of the muteness and invisibility projected upon them by abstracting 20th Century Western, colonial, privileged and racialized epistemologies. Outstandingly, the Wet'suwet'en pipeline solidarity blockades took place nationwide, all across Canada, through semi-autonomously organized, localized, distributed industry cities like Hamilton, Ontario (a steel manufacturing town 4374 km from

the proposed pipeline site) and Halifax, Nova Scotia (a fishing, petroleum and trade port almost 6000 km away from Wet'suwet'en territory). The campaigns, which did not resemble the traditional actions of localised activist groups, developed awareness of one another through social media hashtag use. They were grassroots, decentralised and seemingly quite spontaneous, developed by trusted local and regional networks to provoke blockades in solidarity with Wet'suwet'en territory-based supporters and hereditary chiefs.



Figure 2: The Instagram account @therealtown charting a history of the solidarity protests that emerged in Kingston, Ontario, a petrochemical manufacturing town on the shores of Lake Ontario, 4000 km east of the initiating site of The Wet'suwet'en blockades.

The phenomenon of the 2020 Wet'suwet'en blockades in Canada is in line with other modes of contemporary, distributed, networked civil disobedience against the technological somnambulism (Winner, 2014) that renders technological systems invisible to those privileged enough *not to have to* encounter them directly. Modern civil disobedience of this kind adopts appropriately complex, intersectional approaches and procedures that create counter-infrastructures. The *Ende Gelände* (a German phrase meaning "here and no further") protests in Europe similarly employ contradictorily simple-seeming yet sophisticated organizational strategies, combined with a systems-understanding of energy infrastructure. Such movements understand infrastructural systems as at once accessible and abstract, secured yet vulnerable, pervasive yet still localizable, as Star and her colleagues also wrote. Infrastructural sites, activism and blockades, like issues of class, race and gender, "cannot be understood comprehensively or properly assessed as independent entities" (Morris, 1992).

5. AS CANADIAN AS INFRASTRUCTURE (A BIOGRAPHICAL NOTE)

It is a tradition amongst many native peoples in North America for a person to introduce themselves, before a discussion, along the lines of

who they are, where they come from, who their people are. It is a gesture that helps determine a person's 'stake' in said discussion. And so: I am a white, male media researcher and artist, whose current work is attempting to construct and engage with softer infrastructures of metabolism and sustenance — food, cooking and baking, for example. I think of these projects, as ever, as Infrastructure Studies by other means. By 'study' here, I mean not just an analytic or critical regard, but also the development of creative and resistive forces that would otherwise seek to homogenize technological and other kinds of landscapes. How can we approach infrastructures not only as oppressive and unapproachable examples of technological lock-in, but also, as Shannon Mattern writes, as "generative structure", as "framework for generating systems and environments and objects and cultivating individuals and communities, that embody the values we want to define our society." (Mattern, 2016) This turn from repeated reveals of the material consequences and bases of globalism to their direct (de)construction seems to me to signal a kind of small victory, or at least progress, for those of us whose battle cry has for some time been 'we need to understand infrastructural systems better'. In some sense, the ensuing year of infrastructural critique looks like it may have, in certain ways, achieved some of its goals. In no way do I claim that Infrastructure Studies is directly responsible for or often even aware of the openings and changes actions like the 2020 Wet'suwet'en blockades advance, but it may be that these these crucial, necessary and urgent reorganizations and conceptualisations are in resonance with one another.

I was spurred to write this contribution and reflection after my interests in Infrastructure Studies changed focus and style, during a few years spent back in the place I was born, a place white settler colonialists at some point started to call "Canada". While stationed in the fairly remote, maritime port city of Halifax, Nova Scotia (the Mi'kmaq name for Halifax is *K'jipuktuk*, pronounced "che-book-took"), it became apparent to me, again, through involvement in labour organizing and student activist campaigns, how vastly distributed and infrastructured, yet regionally divided Canada is. There is a specific, regional form of Canadian alone-togetherness that Canadian economic theorists Mary Quayle Innis (Innis, 1935) and Harold Innis (Innis, 1999) have well elaborated. Its regional politics are organized primarily around the geopolitics and political ecology of the specific resources that each region supplies. These resources result from colonial appetites and the provision of staple goods, themselves "integral to the infrastructure and logistics" (Young, 2020) of North America. It has become increasingly clarifying and helpful for me to read the history and

present of colonial governance of the "Canadian" portion of Turtle Island (an indigenous name for Earth or North America) as having created a nation that is, through and through, *infrastructural*.

Canada-as-infrastructure is a perspective that has more lenses than we would have apt space to address here. Darin Barney similarly argues how infrastructural systems, like pipelines, materialize nationalism despite being owned by and for the profit of private interests. There are, according to Barney, "pipeline nations" and Canada is most definitely one of them (Barney, 2017). The vast and ample natural resources that attracted Canadian settlers to Canada over past centuries, and the brutal and rapacious way that the people who already lived there were moved around and killed to take advantage of these resources, is part of the modern expansionism and desire for interconnectivity at-all-costs that underlie technologies of infrastructure (Davies, 2021). As a reckoning with the nation of my own birth and my upbringing in the highly industrial, economically faltering landscape of the Windsor-Detroit area in the late-1980s and early 90s, this framing has shifted my sense of home and how I can act on and against the brutalities of infrastructural colonialism. This is part of 'the work' that I believe to be the responsibility of the white settler colonial and European cultures and individuals who benefit from this extractive technological expansion, regardless of where they live. As Brian Holmes writes, "As the global shift advances, with its train of threatening and disruptive effects, individuals will increasingly be called upon by conscience to participate in complex projects to repurpose or dismantle industrial energy systems that resist even the slightest transformations" (Holmes, 2017).

Recent incursions into the lands of the Wet'suwet'en have provoked an emergent awareness of the 'infrastructural unrest' both created by and now needed to address the modes of complex, slow violence that indigenous, displaced and disappeared peoples have experienced and understood for centuries. Of course, these dynamics of dispossession and colonial supremacism can be seen today in Canada, but they are also manifesting themselves, in importantly different and similar ways, in many other places.

6. WELCOME TO BLOCKADIA

Our thinking about and encounters with infrastructures manifests a continuous unease in our inability to access their endpoints or account for entire systems and their externalities. The political stakes of this kind of space-time compression — that squeezes some things through and some things out — are part of David Harvey's Marxist critique of

the effects of capitalism as an infrastructure (Harvey, 1989). Within this compression is the bringing into proximity of principles of the commons, of public goods and rights of use, with issues of 'critical infrastructure' and proclamations of 'domestic terrorism' posing risks to national security. The socio-spatial arrangements and dynamics that contemporary energy and communications infrastructures afford also provoke illegal attacks and sabotage, as well as legislation and protections at the very limit and intersection of civic duty, activism, civil disobedience, public good, government and private interests.

Energy and transport infrastructures are increasingly sites where the pressures and anxieties of climate and energy politics play out, showing how far from agreement about 'public works' for the 'common good' local and global communities have become. The building of pipelines, roads and communications networks is still often unquestioningly considered a normative public 'good' in business, governance and development communities (Sheng, 2020), as these align with notions of progress and modernization that privilege speed, access, exchange and commerce.

As Anne Spice elaborates in her excellent writings on "Fighting Invasive Infrastructures" (Spice, 2018), pipeline technologies are not simply "sites" that "support the flow of goods, people and ideas over space". They are protracted events that are a strategy of colonialism, enabling the "material transit of empire" (Spice, 2018). Now, as when they first arrived on the scene, telecommunications and transport networks, pipelines and railways, are hailed as inevitable and necessary pathways to progress, a charitable bringing of the periphery closer to the centre, whether it likes it, wants it, or not. And none of these issues can be solved merely through analyzing 'drivers of conflict' or by continually re-designing 'better' planning processes or providing offset-concessions for infrastructure projects' social or ecological impact (e.g. Boudet, 2011).

The 2020 protests against the Coastal GasLink pipeline, in what could be called an 'intuitive' way, provoked people to target Canadian national and industrial infrastructure sites. Seemingly unrelated and not directly connected to the pipeline itself or even the oil and gas industry, these uprisings are promising evidence of infrastructural awareness, understanding and unrest. They are undoubtedly an instance of what Naomi Klein has called and called for with the term "Blockadia" (Klein & Wright, 2019).

7. INFRASTRUCTURAL UNREST

The blockade actions have been successful in many senses. They have raised awareness of the

existence of the Wet'suwet'en people, nation and rights. They have precipitated the dropping of charges against arrested protesters. They have driven evaluation of government and police action toward the UN Declaration on the Rights of Indigenous Peoples, highlighting pipeline politics and practices as a violation of indigenous persons' right to free, prior and informed consent. Canada, a place that we white, settler, colonialists had been taught to think of *simply* as a 'country', has been revealed again also as an extractive, colonial, white supremacist infrastructure, exposing unequal distributions of knowledge, accesses, benefits and detriments. These inequalities aligns with the messaging of Wet'suwet'en solidarity movements and activism, whose powerfully incisive online mantra, ambition and hashtag is: #shutdowncanada. Protests against the Coastal GasLink pipeline in the winter of 2020 physically shut down Canada's nation-as-infrastructure. For many white settler Canadians, this would be the first time this logistical, resource extractive and racial-capitalist operational layer of the country would halt for long enough for it to be seen for all its illusory 'invisibility' and actual violence.

The Wet'suwet'en Blockades are both products of and a response to an increased understanding and feeling—intimacy even—developing for and against the interconnected networks, strata and industries of infrastructures. As a moment in histories of civil disobedience and against presumptions of 'utility' and 'progress' that often underlie indigenous rights violations, the 2020 Canadian pipeline and railway protests and the #shutdowncanada movement have amplified distributed, ongoing processes and counter-infrastructures. Like the *Ende Gelände* and "Idle No More" movements, they enact an intersectional compression of problems, space and time as multi-sited, spontaneous, temporally, geographically and socially transversal actions that strengthen networks. The Wet'suwet'en blockades signal a deep infrastructural unrest that is welcome, difficult, vital and hopeful.

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¹ The American television show ‘Last Week Tonight with John Oliver’ devoted an entire 2015 episode to the topic of infrastructure, humorously highlighting the repeating of the “infrastructure is not sexy” mantra by a number of powerful, rather unsexy, white male figureheads across the U.S. political spectrum.
<https://www.youtube.com/watch?v=Wpzvaqypav8>

Can We Still Remember Those Mountains? Breaking the World into Pieces: Art and Mining Landscapes in Minas Gerais, Brazil

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Mining has been, for centuries, the main economic activity in the state of Minas Gerais, in Brazil. This paper focuses on artistic engagements with mining landscapes as situated manifestations of the Anthropocene and as sites where memory and identity intersect with sociotechnical inscriptions. A double approach is pursued. First previous artistic experiences are presented and discussed with regards to landscape's relations with memory and identity. Second, initial considerations regarding mining's sociotechnical transformations of the landscape are discussed, followed by a brief presentation of ongoing experiments by the authors.

Landscape. Anthropocene. Mining. Art and technology.

1. INTRODUCTION

Memória das coisas que ainda existem (“Memory of the things that still exist”) was the title of the first exhibition, in 1974, of Brazilian artist Manfredo de SouzaNetto (SouzaNetto & Ribeiro, 2006). Among the works presented at the show was a project materialized in a sticker designed for car windows that, at the time, became widely spread in the city of Belo Horizonte, where the exhibition was held. Among those of us that lived here from the mid-1970's until the early-1990's, it is still memorable today. A thin dark-green stroke, forming the outline of a mountain, crossed the whole width of the otherwise mostly transparent sticker. Overlaid to it, in large capital letters, was read: “OLHE BEM AS MONTANHAS...” (“Take a good look at the mountains...”). While subtle, this work expressed a critique of mining that no one in Belo Horizonte (either then or now) could possibly miss. For this city – whose name (somewhat ironically) translates as “Beautiful Horizon” – sits in the middle of one of the world's largest iron ore deposits and, thus, is neighbored by extensive mining complexes. For its inhabitants, therefore, mountains and horizons have been, quite literally, moving and disappearing. In this paper, we take this artwork as the starting

point for approaching artistic responses, both actual and possible, to the complicated relationship between mining and landscapes.

In addressing this topic, we relate to the wider discussion about the Anthropocene, its associated terms (see Haraway, 2016), and art's engagement and possible contributions to this debate (see Haraway, 2017; Latour and Weibel, 2020). Yet, we write, of course, from a situated position, as does anyone (Haraway, 1988). Geographically, we write from the greater metropolitan area of Belo Horizonte, capital of the Brazilian state of Minas Gerais, and we thus have our existences, from smaller to greater degrees, affected by mining activity. The concept of landscape helps us to mediate between that larger debate and its situated manifestation. As suggested by Anna Tsing and her collaborators (Tsing et al., 2017, G5), landscapes can show us the way “[b]ig stories take their form from seemingly minor contingencies, asymmetrical encounters, and moments of indeterminacy”. Thus, the landscape is taken here as a nexus of various scales. Beyond that, as SouzaNetto's work suggests, it might also be a nexus of temporalities. Tsing et al. suggest that Anthropocene landscapes would be haunted by the ghosts of past ways of life (2017, G2). SouzaNetto

seems to imply that they would also be haunted by the ghosts of their own future. We thus seek in art possible ways of imagining and acting upon these circumstances.

This paper thus proposes to engage with the issue of mining landscapes through a double approach. On the one hand, we seek to briefly review and recollect some of the previous artworks that have addressed this topic of landscapes and mining activity. The intertwining of landscape, memory and identity is the main conceptual underpinning of this effort. On the other hand, we will also present some of our own initial explorations of this topic through art practices inspired by notions and methods of Science and Technology Studies (STS). This particular approach leads us to aesthetically inquire into the contemporary rendering of landscapes through sociotechnical inscriptions.

2. TAKE A GOOD LOOK AT THE MOUNTAINS: LANDSCAPE AND MEMORY

The concept of the landscape takes on varied meanings in the work of different authors and theories. French philosopher Jean-Marc Besse (2014) proposes to map some of these approaches by describing five “doors” to the landscape concept: as a cultural representation; as an inhabited and historically fabricated territory; as a systemic complex that articulates nature and culture; as a phenomenological experience; or as a functionally designed space. Each of these perspectives share the idea that the landscape is relational, in the sense that it only exists once it has been experienced, produced, constructed or lived in. A landscape is therefore constituted by several interrelated layers that should not be reduced to their most visible aspects. It is not something to be simply contemplated as a “natural” or “untouched” scenery, since a location would only become a landscape as long as it is part of a culture – including when it is framed as an economic resource.

However, while all landscapes are fabricated and constructed, the forces that steer those processes are often violently imposed over those who actually live there. Thus, it might make sense to discuss an antagonistic relationship between mining and landscapes if we acknowledge, as we should, processes of alienation by which landscapes are taken away from their inhabitants. As discussed by Horacio Machado Araújo (2020), mining could not be understood apart from this, especially given that the interrelation of mining and colonial violence is fundamental in the history of Latin America. While the actors involved and the forms of the process may have changed, this still holds largely true to this day. Local elites and multinational conglomerates may have taken the role of the colonial states but, as Kate Crawford (2021) has

noted, while associating artificial intelligence and extractive industries, mining is still only viable as long as profits are detached and unaffected by the actual costs and consequences burdened upon affected communities.

This has been strongly felt in Minas Gerais, across history. The intricate relationship between landscape, mining, colonialism and identity is really impossible to disentangle in the region. At the very basic, the state’s name literally means “general mines”. Also, those of use who are born here are denoted as “mineiros”, which translates as “miners”. The exploitation of gold and diamonds was pivotal in the region’s colonization by the Portuguese and, more recently, the extraction of iron and other mineral commodities are among the state’s most significant economic activities. While environmental and social damages are part and parcel of mining, in recent years, two tailing dam collapses have become particularly emblematic of those consequences. In 2015, in the town of Mariana, the collapse buried a small town, murdering 19 people, and it also irreversibly contaminated the Doce River, all the way to the Atlantic Ocean. It is symbolic that Vale, the company that owned the mine (shared with BHP Billiton) was originally named after Doce River Valley, where it started its operation, in the 1940’s. In 2019, in the town of Brumadinho, another tailing dam owned by Vale collapsed, killing nearly three hundred people and severely polluting the Paraopeba basin. Despite mounting evidence of Vale’s responsibility for both crimes, victims have not been properly compensated, executives have not been held accountable, and the company remains operating and profitable for its shareholders, as one of the largest mining companies in the world. With the surge in iron prices, pushed by United Statesian and Chinese infrastructure development plans, there is current expectation of an increase of mining activity in the region – less so for serving local interests, than for attending foreign demand.

Thus, it seems important that an approach to the landscape as this relational concept, as pointed out by Besse, connecting people to their surroundings, should also account for the ways in which landscapes are expropriated. One way of approaching this is by understanding how colonization and globalization complicate the very notion of territory. Bruno Latour takes from Kenneth Pomeranz the notion of “ghost acreage” (Latour and Weibel, 2020, 15) for referring to territories that have been added to a central economy through the efforts and violence of colonization, while remaining somewhat remote and virtual (from the perspective of the colonizers, of course). Sitting on this massive iron ore deposit and watching mountains fade away into an ever distancing horizon, perhaps this ghostly quality could only be asserted to the fading memories of a landscape and of forms of living (Tsing et al., 2017) that no longer exist.

The writer and indigenous leader Ailton Krenak, whose nation sits at the Doce River Valley, indicates how, beyond forms of material expropriation, colonization also stresses the differences between the very conception of what landscapes mean to different cultures and cosmologies. He writes that, for the modern colonial mindset: “[t]his great continent of ours is [seen as] an anonymous platform awaiting occupation” (Krenak, 2015, 337). And it is only because this territory is conceived as this “anonymous platform”, or as “ghost acreage”, that the forms of extractive exploitation that we have seen and continue to see in these lands can be made possible. This emptying of the landscapes, made into mere mineral deposits, as Krenak stresses, has also pushed the extermination of peoples and cultures living here – a process that is both ancient and current. As part of the communities affected by the 2015 tailing dam collapse, Krenak has been a vocal critic of mining, framing it as another form of “recolonization”, through which, he describes, locals are pressed to earn their living in the present by selling away their future (see Krenak, 2019, 2020).

Thus, in this circumstance, landscapes are far from sites of willing construction and interaction between environment and culture. Rather, they are sites of conflict and, frequently, of alienation through forceful imposition. By acknowledging this, we can better understand the particular ways the landscape is conceived in Souzanetto’s work. The gaze it asks us to direct to the mountains reveals not what can be seen, but what could be foreseen in them. As David Lowenthal (2008) proposes, the landscape is a place of memory; a palimpsest that has been constructed upon previous and current experiences of its history. In Souzanetto’s work, that past and present is also a ground upon which to imagine the future, and this may also help us to understand how this only apparently simple act of looking could also be a form of resistance and insurrection.

In fact, as the artist discussed in an interview (Souzanetto and Ribeiro, 2006), his show *Memória das coisas que ainda existem* was threatened with censorship by a staff member of the exhibition venue, who also served at the political police of the dictatorship that ruled Brazil at the time. The event was being held at Instituto Cultural Brasil Estados Unidos (ICBEU), a cultural branch of the US diplomatic presence at the time. While censorship to the exhibition could be avoided, the artist recalls other difficulties faced in realizing his project. An intended part of his idea could not be accomplished, for instance, because local newspapers rejected selling him ad space for publishing the line: “Take a good look at the mountains...”. Besides producing the car sticker, which enabled him to spread his work, Souzanetto

also resorted to projections of the sentence onto city buildings at night. Interestingly, this tactic of art activism has also been currently employed in Brazil, as the ghosts of past autocratic regimes seem to rise, once again, from their shallow graves.

Importantly, this perspective on the complicated constitution of landscapes under the pressure of mining had also had a fundamental antecedent in Brazilian poetry. Carlos Drummond de Andrade, one of the most celebrated Brazilian poets of the 20th century, is also a central reference both to Souzanetto and Krenak. He was born in the Doce River Valley, in Minas Gerais and, more specifically, in Itabira, the town where Vale established its first iron mine, in the 1940’s. Vale’s activities in that town have completely destroyed Cauê, a hill that was a distinguished landscape feature in the region. This destructive act was a central theme in Andrade’s work, including in newspaper op eds. Literature scholar José Miguel Wisnik (2018) recently proposed a broader review of Drummond de Andrade’s body of work under the light of this engagement with the issue. His analyses show how the subject matter of his poems frequently revolved around the material qualities of the stone (“pedra”) and the image of the “mundo” (Portuguese for “world”). For Wisnik, these are keys for understanding not only the relationship between his poetic work and mining but, also, his particular standing in Brazilian modernism. He argues that the stone and the world are, at once, each other’s contraries and equivalents: “[f]or, if the mundo is the inexpressible and unreachable threshold one cannot take hold of, certain objects appear as the very cipher of that impossibility” (Wisnik, 2018: 183). It is through this engagement with the particular that the unreachable image of a totality enters his poetry, in a condition of impossibility. As both Wisnik (2018) and Krenak (2015) highlight, Drummond de Andrade’s poetic work enmeshes the mineral landscapes of his hometown into the identity of its inhabitants, and also his own. In some of his most famous verses, this becomes clear as they also express a shift in the condition of the post-mining landscape, from a lived environment to a nostalgic image of a long lost past. In his poem “Confidências do Itabirano” (“Confidences of the Itabiran”, in free translation), published in 1940, he wrote: “I have had gold, caddle, farms. / Today I am a public servant. / Itabira is just a photo on the wall. / But it hurts!” (Andrade, 2012, freely translated).

It is not by accident that this nostalgia for the landscape resonates so clearly with Souzanetto’s work, since one of the pieces in the artist’s 1974 show was a slide projection accompanied by an audio track with the reading of a 1967 poem by Drummond de Andrade (“O pico do Itabirito”). The verses in that poem lament the grinding and exporting of a hill while mentioning, by name,

several of the international mining companies and government departments involved in that process. In articulation with the poem, Souzanetto then builds his work in anticipation of future destruction and alienation from the landscape – a feeling that we, as fellow inhabitants of the Anthropocene, can certainly relate to. Souzanetto's *Memória das coisas que ainda existem* thus appears as being able to capture and express a latent collective mourning, that we too share, today, for something that still is, but which, as we now acknowledge, is not going to remain so. In this resides much of the conflict and lament pertaining to mining landscapes and the Anthropocene.

3. BREAKING THE WORLD INTO PIECES: SOCIOTECHNICAL INSCRIPTIONS ON THE LANDSCAPE

Also in dialog with Drummond de Andrade's work, the artist Laura Vinci, from São Paulo, presents another form of poetic engagement with the themes of landscape and mining in the installation *Máquina do mundo* ("Machine of the World", 2006). The work references a poem by Drummond de Andrade, from 1961, that bears the same title. In the installation, a conveyor belt reaches between two piles of marble powder, continuously moving small amounts of the material from one pile to the other. This configuration produces a moving landscape, in continuous construction, destruction and reconstruction. A landscape in flux. Whereas the marble powder takes us back to the traditional materiality of sculptures, the conveyor belt elicits sites of mining activity while producing a combined process of erosion, transportation, and accumulation. With this piece, we would like to introduce another element in our understanding of mining landscapes: its machinic quality.

In the title of the piece, we find once again the word "mundo" which, as we have discussed, based on Wisnik (2018), is a key sign in Andrade's poetic work. But, whereas "mundo" suggests the image of an unreachable threshold, "máquina" introduces another kind of imponderability. For Wisnik (2018, 199), in Drummond de Andrade's poem, the word máquina should not be read by its modern meaning but, rather, as a reference to the ancient use of the word. In that sense, the machine of the world would be the presentation of a cosmic engine in the form of an object. Specifically, in this case, the object would offer a glimpse of the world and its inner-workings, in its totality. Yet, bringing this notion to our own time, and placing it together with Laura Vinci's installation, perhaps other images of this world-machine stand out. Andreas Broeckmann (2016), based on Félix Guattari (1995), relates the notion of the machinic with a form of autopoiesis that is also a source of estrangement and uncanny. A machine, abstractly speaking, is a complex

ensemble of forces that often produce an irrepressible motion. When combined with the understanding of landscapes as sites of conflict, as we have proposed, this idea helps to comprehend the sociotechnical reality of mining. Its seeming irrepressibility, therefore, is not due to a technical machine but, rather, to the heterogeneous complex that is also formed by international markets and geopolitics. Although affecting our location, as many others, it also has a source that, like "mundo", is out of sight and out of reach.

If we are to then take this machine as an entity of mining landscapes, an important aspect to consider would be how to identify and characterize the traces of its intervention. For, in its activity, mines mark landscapes with particular forms of inscriptions. French sociologist Madeleine Akrich (1992) has proposed to study the political agency of technical objects by taking into account their inscriptions. In her approach, sociotechnical inscriptions serve as entry-points for understanding the intertwining of forms of knowledge and forms of political operation of a technical system. In order to operate, a system needs to describe the world and establish points of translation between such a world and its own operation. In Akrich's terms, any technical object or sociotechnical system articulates forms of knowledge in their operation, by which: "the designer not only fixes the distribution of actors, [but] he or she also provides a 'key' that can be used to interpret all subsequent events" (Akrich, 1992, 216). When investigating mining landscapes, therefore, perhaps we are not simply engaging with landscapes affected by mining but, also, the landscapes of mining. That is: how mining, as a sociotechnical system, defines and interprets what constitutes a landscape.

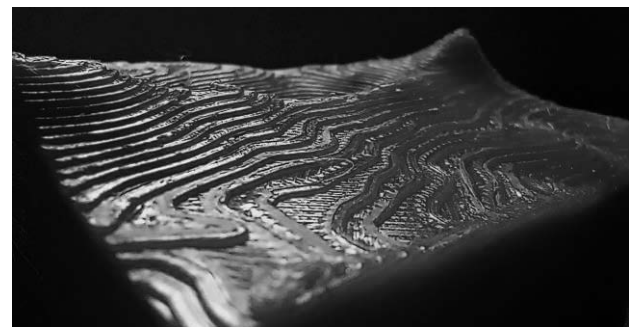
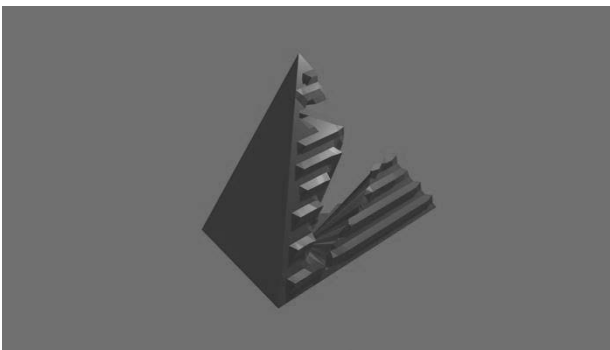


Figure 1: Detail of a PLA printed model depicting the outline of Serra do Curral, in Belo Horizonte, from SRTM topographical data. It is part of an experiment by André Mintz, but which is here mainly for showing how contour lines are also constitutive of additive manufacturing layers, resembling the discrete staggered landscapes of mining.

If we move our gaze from the mountains that still stand to the cavities left by the mines, a difference immediately stands out. The mountain's morphology has been sculpted in deep geological

time and, in Minas Gerais, it displays smooth rippling forms produced by different types of erosion throughout millennia. Mining, in contrast, leaves something like a discrete, staggered form in the landscape. While digging, what is left of the mountains is turned into a shape that, perhaps not coincidentally, resembles the contour lines by which that long-gone mountain was originally drawn onto a map. In a sense, it is as if mining's long lasting inscription on the landscape would turn it into its own cartographic caricature. Of course, there are structural factors leading to this: the staggered shape helps in avoiding the collapse of the remaining mountain. Yet, in the chain of mediations that compose mining as a system (or, as a machine), it should not be dismissed that this is the form of sociotechnical inscriptions that enable



the knowledge, operation, and mobility of the mountain as an “immutable mobile” (Latour, 1986). Modern science and technology, as we know, operate best on measurable and discrete quantities that enable their tasks of projecting and calculating.

Figure 2: *Rendering of an ongoing experiment by Lohuama Lisboa, who built this 3D model derived from a chemistry ternary diagram representing physical states of a compost of iron and silica. The experiment initiated from an interest on triangles as elementary sociotechnical inscriptions in computer graphics while also being a symbol of the flag of Minas Gerais. This later prompted the aesthetic exploration of further conceptual, symbolic and fortuitous associations of triangles with the investigated topic.*

This thread has been leading our way in in-progress artistic experiments with this topic, while working in a diverse research group, composed of faculty and undergraduate students. Inspired in the method of critical making (Ratto and Hertz, 2019), we have sought to engage with the constituting elements of mining landscapes through modeling and printing 3D objects based upon heterogeneous mining data – including topographical data, but not exclusively. Such an approach has been requiring our involvement with several other forms of sociotechnical inscriptions originating from sources as diverse as remote sensing (Figures 1 and 3), public environmental databases, and even chemistry diagrams (Figure 2). We have been conceiving of these experiments as efforts to draw

the dispersed sociotechnical constitution of mining landscapes. For the sake of concision, brief descriptions of some of these experiments are presented in the caption of their respective figures.

In line with the proposal of critical making, our experiments are hands-on explorations of the research topic, through which several aspects of the form and constitution of mining landscapes were perceived and understood by us in the very process of modeling and printing. Among several insights provided by this process, we would highlight: the perception of the ubiquity of contour lines as sociotechnical inscriptions linking mining landscapes and our printed models (Figure 1); the various scales of mining that can be perceived through data sculpture experiments (Figure 2); the varying affordances of representation techniques in the translation of a familiar landscape to a digital 3D environment (Figure 3).

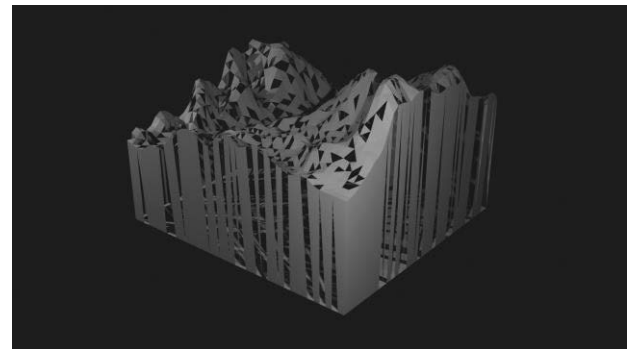


Figure 3: *Rendering of an ongoing experiment by Gabriel Aragão, built from SRTM topographical data of a mine in the outskirts of João Monlevade, in Minas Gerais. The experiment focuses on aspects of computer graphics materiality as a form of abstraction from the actual represented landscape.*

4. CLOSING REMARKS

As initial takeaways from these experiments and discussions, we have found that the sociotechnical rendering of landscapes by mining has also important consequences for the intricate relationship we have been discussing – among landscapes, memory, and identity. For the morphological discretization of the landscape is also the fragmentation of the relationships that compose it. It is as if mining activity produced a temporality that is faster than the communal times of the landscapes inhabitants and even faster than Earth itself, eliminating the delay that is so fundamental for producing memory. This flattening and discretization of the landscape we have identified are, perhaps, the concrete operations producing that which Ailton Krenak described as an “anonymous platform awaiting occupation” (Krenak, 2015, 337). Working hands-on with the sociotechnical inscriptions describing such formations enable a more direct grasp into this aspect.

In many ways, the destruction of mountains and hills also moves the horizon away, which is not a trivial feature of landscapes. As Jean-Marc Besse (2014, 50) notes, the horizon relates “to the invisible part residing in any visibility, to this ceaseless folding of the world”, which constitutes the “overflowing potential” of the landscape. Discretized and monetized into finite calculable units, the mining landscape would thus be – or, at least, that seems to be the intent – devoid of such invisibility and, in a way, devoid of a proper future. To take a good look at the mountains, therefore, is to acknowledge and reflect upon this still existing mystery. Our hope is that by critically engaging with these sociotechnical mining landscapes we could also inject some sense of instability into such a totalizing frame.

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² Gabriel Aragão has received a scientific initiation scholarship from the Pro-Rectorate of Research of Universidade Federal de Minas Gerais.

³ Lohuama Lisboa took part through the volunteer scientific initiation program of the Pro-Rectorate of Research of Universidade Federal de Minas Gerais.

Ruins across the Atlantic: speculations on the colonial and mythological genealogies of the internet's submarine infrastructure

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This paper centres around an interdisciplinary research on the Atlantis-2 undersea fibre optic cable, seeking to plot the deep entanglements between the internet's material infrastructure, colonial history, and submarine ruins. Through connecting and interpreting a set of historical, archival, and narrative elements around Atlantis-2, this paper speculates on the deep genealogies of undersea telecommunication cables. Starting with a discussion on the route followed by Atlantis-2, the first section plots a connection between colonial and digital networks that cross the South Atlantic. Then, the second section weaves a story that brings together the Atlantis-2 cable and the mythological city of Atlantis, speculating on the possible future of the internet as a submarine ruin. The historical and mythological speculations presented in this paper bring to the forefront the concealed colonial and material genealogies embedded in submarine cables, seeking to propose a new way of relating to the internet's material infrastructure as a fragile ecosystem to care for.

Infrastructure. Internet. Networks. Colonial History. Ruins. Mythology.

1. INTRODUCTION

Installed in the year 2000, Atlantis-2 was the first submarine fibre optic cable to create a direct internet connection between Europe and South America. One of its seven landing sites is located in an underground bunker on the Atlantic coast of southern Spain, which was built in 1970 to protect one of the nodes of the TAT-5/MAT-1 telephone cable that connected the Mediterranean to the United States during the Cold War. Next to the main entrance to the bunker there is a bronze plaque featuring a relief of the Italian, Portuguese, Spanish, and United States flags connected by a meandering cable, commemorating the laying of TAT-5/MAT-1. In the background, there is yet another relief that depicts three ships with crosses on their sails navigating through the ocean, most likely referring to the three caravels used by Christopher Columbus when he first sailed to America: La Pinta, La Niña, and La Santa María (see fig. 1).¹ The image inserts transatlantic submarine cables into a genealogy that originates from the European colonization of America, establishing a historical relation between colonial and digital transatlantic infrastructures.²



Figure 1. TAT-5/ MAT-1 cable commemorative bronze plaque. Source: Burns, B. *History of the Atlantic Cable & Undersea Communications* (<https://www.atlantic-cable.com>).

Taking this image as a starting point, this paper weaves and interprets a network of historical, material and narrative connections that emerge

from the Atlantis-2 undersea cable, seeking to shed light on the entanglements between coloniality, the internet's maritime infrastructure, and the ocean floor. First, the paper discusses Atlantis-2 in relation to the history of intercontinental connectivity across the South Atlantic, with the purpose of plotting the deep geopolitical entanglement between undersea cables and trading routes across the Atlantic. Then, I speculate on the relations between Atlantis-2, the mythological city of Atlantis, and submarine ruins, aiming to destabilize the monolithic narrative of the internet as an intangible and frictionless infrastructure. The discussion presented in this paper is a revised version of two chapters of my Master Thesis for the Media Arts Cultures program.³

This paper aims to enrich recent discussions on the study of infrastructure, which seek to bridge the gap between social, material and technical considerations when studying technological systems (Sandvig, 2013). On the one hand, some researchers characterize infrastructures as historical processes of situated social and technical relations (Star and Bowker, 2006). And on the other hand, other researchers highlight a materialist perspective focused on artefacts and their relation to the natural and social surroundings where they are located (Parks and Starosielski, 2015). Far from being mutually exclusive, both outlooks emphasize the importance of combining different methodologies to study the material and symbolic correspondences between social relations, material environments and infrastructures. Drawing from this interdisciplinary perspective, this paper proposes that speculative interpretation is also a key methodological strategy to enrich the study of technosocial infrastructures such as the internet.

Even though speculation can refer to many different things that range from foretelling the future to economic investments or active contemplation, I refer to speculation as the creative act of making conjectures based on the interpretative connection between seemingly disparate elements. The imaginative quality of speculative interpretation is also deeply tied to the creative act of storytelling (Latour, 2005; Haraway, 2016), which opens new vantage points to trace patterns that differ from those that have been already established. This act of speculative and interpretive storytelling is also profoundly implicated with non-linear thinking, an approach towards research that seeks to shed light on the correspondences between occurrences across time and space (Ferreira da Silva, 2016). The relations between technology and reality are always layered and multiple, a network that goes back in time and tends to be obscured by distance. In order to elucidate these complexities, I argue that non-linear speculative interpretation is better equipped to plot the material and semiotic relations embedded in the internet's infrastructure.

2. BETWEEN SHIPS AND CABLES

The underground bunker where the Atlantis-2 cable lands in the south of Spain is located in the province of Cádiz, which stretches from the Gibraltar Strait through the Atlantic coast of the Iberian Peninsula. Before Columbus' first transatlantic voyage, the Atlantic coast of Cádiz had symbolized the westernmost frontier of Europe for millennia. According to Ancient Greek and Roman mythology the two mountains that frame the Strait were known as the Pillars of Heracles, and it was believed that the demigod inscribed the motto *non plus ultra* in the two rocks, which in Latin implies that there is nothing beyond.⁴ The Pillars of Heracles guarded the encounter between two bodies of water as well as it protected the edges of the Mediterranean world, a passageway and a frontier at the same time. However, during the early years of the Spanish colonization of America, Cádiz became one of the most important seaports for the Spanish empire. During the sixteenth century, Spanish king and Holy Roman Emperor Charles V, who commissioned Ferdinand Magellan's voyage around the world, transformed the ancient motto *non plus ultra* into *plus ultra*, which in Latin implies that there is more beyond. This reformulation of the Atlantic Ocean as a medium for connectivity is inscribed in the Spanish coat of arms, which depicts the emblem *plus ultra* on the two Pillars of Heracles floating above the ocean's waves (see fig. 2). If the sea was the frontier of the pre-modern western world, early modernity transformed the Atlantic into the connecting axis of empire building.⁵



Figure 2. Spain's coat of arms. Source: *Heralder*, CC BY-SA 3.0, Source: *Wikipedia*.

Most of the seven landing sites of Atlantis-2 either overlap with or are very close to some of the most important seaports of the Spanish and Portuguese triangular commerce, a transatlantic trading system designed to secure the extraction of enslaved human labour from the African west coast and of raw materials from America (see fig. 3). Many of these seaports were also crucial for Ferdinand

Magellan's voyage in 1519, which, sponsored by the Spanish crown, set out to circumnavigate the world for the first time crossing the South Atlantic from Spain to the Canary Islands and Cape Verde, and then sailing to Brazil and Argentina before finding the strait that connects the Atlantic and Pacific Oceans. These voyages that characterized what is referred to as the "age of discovery" created the colonial trading routes that, since then and until today, sustain the global capitalist market (Wallerstein, 1980). New infrastructure is typically built on top of an already established base (Star and Bowker, 2016), and in the case of submarine cables, their routes bear a deep historical relationship with colonial transoceanic networks. The historical and geographical symmetry between Magellan's voyage and Atlantis-2 reveals that the internet's interconnectivity is rooted in the colonial networks that established contemporary global markets, a system of sanctioned movements of profitable commodities and information.

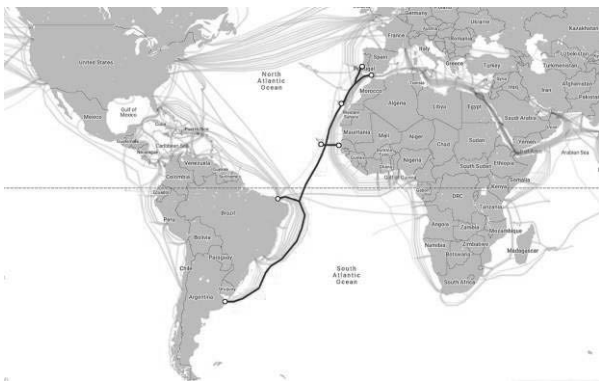


Figure 3. Atlantis-2 cable map. Source: TeleGeography (<https://www.telegeography.com>)

The consolidation of European markets depended on the interconnection of the world through maritime infrastructures that mobilized both commercial goods and ideological paradigms of civilization and development, while also providing the possibility of extraterritorial control (Mignolo, 2011). The transatlantic routes charted during the European colonization of the world define to a large extent the routes followed by container ships today, which move 90% of the world's material economy (George, 2013). Considering that data is one of the most valuable assets for contemporary information capitalism (Fuchs, 2008; Zuboff, 2019), the parallel between the movements of material goods and of digital data highlights the deep relation between the internet's infrastructure and the expansion of empire and capital. The flow of commodities and of data that sustains contemporary capitalism converge at the infrastructures that cross the world's Oceans, as ships and cables enable governments and multinationals to sanction the

movement of material goods and information.

Even though the South Atlantic was a very active region of the world during the early colonial routes of Spanish and Portuguese commerce, the shift towards British and Dutch dominance over transoceanic commerce in the seventeenth century solidified much stronger routes in the North Atlantic. Considering that submarine cables were built during the height of British colonial dominance in the mid-nineteenth century, the South Atlantic saw very few developments in the early construction of undersea networks. By the time the British empire was securing its interests with the support of a global telegraphic network known as the British All-Red line (Starosielski, 2015), most South American nations had gained independence from Spain and were negotiating directly with the English-speaking world, mainly with the United States. The US Central and South American Telegraphy Company completed the construction of a series of cables between 1881 and 1882, which duplicated the communication between the United States, England, Brazil, Uruguay, Buenos Aires, Chile, Peru, and Ecuador, none of which crossed the South Atlantic.⁶ In 1898, when the British empire was laying the Anglo-Irish telephone cable,⁷ Spain lost Cuba and the Philippines—its last colonial enclaves in America and Asia—to local independence movements supported by the United States. The historical connections that had linked Spain to its colonies in South America were severed by the independence movements of the nineteenth century, and this disconnection was reinforced by the newfound cabled connectivity between South America and the capitalist order dominated by Britain and the United States. Thus, the vast majority of undersea cable infrastructure between South America and Europe first pass through the United States. Only between 2017 and 2018, three new cables began operating between Brazil and Miami, reflecting this long history of already established trading routes.⁸

The absence of cables in the South Atlantic has been noted by companies with interests in South America. In 2010 Telcordia presented a report to the Institute of Electrical and Electronics Engineers in the United States about the role of Brazil's undersea cable infrastructure in the upcoming 2014 World Cup and Rio 2016 Olympic Games.⁹ One of their conclusions was that there was a lack of major routes connecting South America with the rest of the world, since it is a region outside of the dense connectivity corridor in the northern hemisphere. Even today, the South Atlantic is not a very active region for undersea infrastructure. As I write this paper, only four of the nearly 450 submarine fibre optic cables in the world cross the South Atlantic: Atlantis-2 (2000), SACS (2018), SAIL (2018) and EllaLink (2021). Atlantis-2 was built in 2000 by a multinational consortium, seeking to provide

alternatives to the geopolitical configuration of submarine cables and to strengthen relations between Europe and South America. The cable costed between 230 and 370 million USD,¹⁰ and was mostly financed by Embratel (Brazil), Deutsche Telekom (Germany), Telecom Italia Sparkle (Italy), Telecom Argentina, and Telefónica (Spain).¹¹ With 8,500km of undersea cable, two pairs of fibre, and an initial capacity of 40 Gbps, Atlantis-2 was the first fibre optic cable to create a direct connection between Europe and South America, connecting Portugal and Spain to Brazil and Argentina via the Canary Islands, Cape Verde, and Senegal. In this way, two former colonial empires were linked to their former colonies through updated technological hardware, strengthening the social, political, and economic ties between the different regions of the Spanish and Portuguese-speaking world. The dynamic in the South Atlantic is currently changing as Spain is quickly emerging as a telecommunications hotspot for the entire Atlantic world. Towards the beginning of 2021, three telecommunications companies commissioned TeleGeography to develop a study on the Iberian Peninsula as a strategic interconnection region, as it provides a convergence site for data traffic between Europe, Africa, America, and Asia.¹² Atlantis-2 revived the transatlantic connection between South America and Europe inaugurated during the Spanish colonial era, bringing back the South Atlantic as an active geopolitical space in the digital era.

3. MYTH AND TECHNOLOGY AT THE SEABED

After having plotted some of the historical connections between colonial and digital infrastructures across the South Atlantic, the following non-linear speculative fabulation around the Atlantis-2 cable seeks to further expand on the historical, material and narrative entanglements embedded in the internet's material infrastructure. The purpose of this story is to highlight what Star and Bowker (2016) have already pointed out when they refer to "the importance of the metaphors that we use to think through technology" (p. 233). Infrastructural metaphors bring certain aspects of technology to light while simultaneously hiding others from view, and upon close examination they reveal aspects of technology that we might take for granted. This story starts with a discussion on the names of submarine cables as metaphors that produce particular meanings around the internet's material infrastructure.

Some undersea cables are named after historical figures as a reminder of the origins of modern telecommunications. For example, the Alonso de Ojeda (Aruba-Curaçao) and the Columbus-III (United States-Portugal-Spain-Italy), both bear the

names of Spanish colonizers, a symbolic gesture that creates a direct relationship between colonial connectivity and modern telecommunications. Some other cables are named after Ancient Greek mythology, one of the common origin stories between European science, technology, and languages. Cables such as Hermes-1 (United Kingdom-Belgium), Minerva (Cyprus-Italy), Aphrodite-1 (Greece-Cyprus), and Ulysses-1 (United Kingdom-France) refer to Greek mythology in order to emphasize both the shared past of European nations as well as the traits of each God and Hero. Hermes reinforces communication, Minerva refers to wisdom and the arts, Aphrodite invokes beauty, and Ulysses crossed the Ocean for the first time before returning home. Bearing these six names in mind, one could characterize the internet as a beautiful and wise journey to connect Europe with faraway lands. In other words, a euphemism for colonialism.

Atlantis-2 is named after the mythological city of Atlantis, which was first mentioned by Plato in the *Timaeus* and *Critias* dialogues as a technologically advanced island that stretched from just outside of the Pillars of Heracles to the mainland on the other side of the Atlantic Ocean. Even if Atlantis was just an allegory, the impossible dream of transoceanic connectivity that it epitomized has been interpreted by many. For example, in 1678 Athanasius Kircher drew a map depicting Atlantis as a huge island in the middle of the Atlantic Ocean, creating a more accessible connection between Europe and America (see fig. 4). Bearing this depiction in mind, I argue that the Atlantis-2 cable is the only known remnant of the mythological city of Atlantis, inheriting the might of the Atlantean civilization as an intercontinental link. Is it possible that Atlantis-2 meanders through the underwater ruins of this ancient mythological civilization, as it crosses the undulations of the Atlantic Ocean floor?

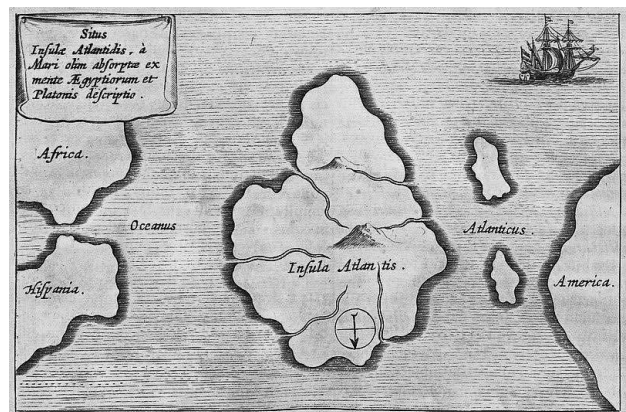


Figure 4. Map of Atlantis, Athanasius Kircher (1678), *Mundus Subterraneus*, Vol. 1, Amsterdam. Source: <https://doi.org/10.3931/e-rara-52686>

Despite its wealth and technological advances, the city of Atlantis was susceptible to the powerful forces of its material surroundings. Atlantis was shaken by earthquakes and floods in the course of a single day, until the entire island “sank beneath the sea and vanished” (*Timaeus*, 25d). The fragility of Atlantis is reminiscent of the fragility of the internet’s undersea infrastructure, composed of cables of approximately 60mm in diameter that are subject to geological forces as well as to anchors and fishing boats.¹³ On average, there are around 100 reported failures on submarine cables per year, discounting the other hundreds of small damages that need constant repair and revision.¹⁴ Atlantis-2 suffered several damages due to the infrastructural work conducted for the Olympic Games in Brazil, which were detected by the Networking Operations Centre of Telefónica located in the south of Spain.¹⁵ The internet’s infrastructure is as susceptible to its material surroundings as the city of Atlantis was thousands of years ago.

Submarine cables do not last forever; they have an approximate life expectancy of 20 to 25 years. When cables cannot be fixed or reused anymore, they are typically just turned off and left at the seabed since dismantling the entire infrastructure is very expensive.¹⁶ However, sometimes cables are either repurposed to create other connections or become a recycled infrastructure for other species to dwell in. Nicole Starosielski (2015) mentions that at the end of the 1990s, several submarine cables retrieved by AT&T were deposited in the Ocean close to Maryland to create a Cable Wire Reef. Besides cables, other submarine digital infrastructures have also become the home for marine life. When Microsoft brought its submersible datacentre out of the Ocean off Scotland’s Orkney Islands in 2020 after two years, it was covered in algae, barnacles, and sea anemones.¹⁷ In other words, when technological infrastructure becomes a submarine ruin, it also become the home for other forms of life. If the city of Atlantis is indeed sunk somewhere in the Atlantic Ocean as Plato narrated, it has probably been undetected by modern machines because of how quickly life spreads at the Ocean floor.

The seafloor is filled with anthropogenic debris such as the ruins of ancient civilizations, sunk colonial galleons and telecommunications infrastructure. With time, the maritime ruins of human colonial and modern infrastructures become part of the seabed’s geological layers. Jussi Parikka (2015) has proposed to think about media from the standpoint of geological time, raising questions about the deep spatial and temporal roots of contemporary media as well as its possible futures. Drawing from this invitation, I want to highlight the complex multi-layered relationship between cables and the Ocean floor. Guided by the awareness of the rich layers of bio-geological deposits at the seabed, governments

and multinationals have set their eyes on the seabed for the extraction of oil, gas, and other minerals.¹⁸ Fibre optic cables could rely on this extraction in the future, as they are composed of polymers, metals, and glass. After completing their functional life, cables eventually become part of the same seabed from where their constitutive parts were extracted from. Atlantis-2 will soon become part of this submarine ecosystem since it will probably be put out of service during 2021.¹⁹ Recognizing the cycle of media as a material phenomenon challenges the nature/culture divide that characterizes modernity, and increases our awareness of the ecological impacts of technology.

The lost city of Atlantis was gifted with an advanced set of metallurgic technologies by its godly founder, Poseidon, the God of the Ocean (*Critias*, 114e). In a similar way to our digital era, Atlantis depended on the extraction of minerals in order to power their technology, harnessing the energy contained in underground matter. However, incapable of bearing their own prosperity and technological prowess, Atlantis collapsed because of the greed and corruption of its rulers (*Critias*, 121b). The tragic story of Atlantis inspired Francis Bacon to write *New Atlantis* in 1627, a utopic narrative that imagined a future society where scientific knowledge was organized in order to produce increased wealth and welfare, reflecting the trust that early modern thinking deposited in rationalism and technoscience. Susan Bruce (1999) identifies that “underlying the construction of the early modern utopia was the sense of discovery and possibility afforded by the Renaissance voyages of exploration” (p. x). At a point of the narrative Bacon mentions that Atlantis is just another name for America, and points towards the ancient might of amerindian civilizations. The convergence of myth and reality during the European colonization of America shows that the story of Atlantis was revived in order to make sense of a new world order, marked by western globalization and the destruction of indigenous civilizations. If Atlantis was the antithesis of Athens, America became the antithesis of Europe. Moreover, if Atlantis was a cautionary tale during Plato’s time inviting Athenians to revise their relationship to technology and prosperity, during the age of European colonial empires Atlantis became a site for speculative imagination about the possibility of a technicist global utopia. Bearing in mind the collapse of Atlantis narrated by Plato, I am tempted to think that the seed for failure is always contained in utopian narratives about the future. In this sense, the seed for the internet’s failure is probably contained in the very same utopian narratives about frictionless digital interconnectivity.

As the world faces an impending social and environmental catastrophe, Atlantis-2 becomes a cautionary tale for us. If the lost city of Atlantis was

doomed to flood because of its misuse of the resources it possessed, will our digital society face the same future because of the destabilization of the biosphere ushered in by our extractive technologies? When the climate crisis brings upon us the inevitable flooding of coastal areas, will the internet's cable stations and datacentres be sunk underneath the sea just like Atlantis once was? The ruins of Atlantis have been used as inspiration for the creation of utopian histories, as much as the technological utopia inaugurated by the internet seems to be slowly turning into a submarine ruin itself. What will happen when more of the internet's undersea infrastructure turns into a ruin? Atlantis-2, the first internet cable that connected Europe and South America, will be remembered as the lost echelon in the mythology of the lost city of Atlantis. Whether its ruins will become coral reefs or nesting grounds for humans as an endangered species remains to be seen.

4. CONCLUSION

In their website TeleGeography claims that "undersea cables are built between locations that have something "important to communicate"", referring to how cables are part of the complex geopolitical relations that define the world.²⁰ One of the key elements of China's political and economic plan for the next few years is based on what they refer to as the Digital Silk Road, a vast network of undersea cables that seeks to position China as a leading competitor in emerging digital economies.²¹ The very name of the project bears a striking historical relation to the largest pre-modern web of commercial trade between Europe and China, the Silk Road. This network was expanded and consolidated during the journeys of Venetian merchant Marco Polo during the thirteenth century, sparking the chimera of the Indies that drove Europeans to colonize America in search for the wealth in the merchant's tales. When Columbus sailed for the first time in 1492, he was searching for a route to East and Southeast Asia in order to secure the commercial dominance of the Spanish crown. What kind of chimeras and deliriums emerge from undersea digital silk roads, as data becomes the most valuable asset of today's economy?

According to TeleGeography,²² even though international bandwidth used by global networks had already more than doubled between 2018 and 2020, digital data networks are expected to continue growing at an ever-expanding rate due to the pandemic (Brodsky, 2021). This impending growth calls for more critical and interdisciplinary research on the historical, material and narrative relations embedded in undersea cables. Plotting the deep connections between coloniality, mythology and submarine cables, highlights the

internet's materiality as a fragile system that is prone to decay and infrastructural repurposing by human and non-human agents. Considering the entangled layers in which the Atlantis-2 fibre optic cable is embedded, I wonder how we can imagine new ways of surfing the internet's waves that bear in mind the social, material and historical relations that they are part of. Hopefully this paper, as well as future non-linear speculative interpretations around submarine cables, open up new ways of relating to the internet as a fragile ecosystem to care for.

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¹ I visited the underground bunker during my three month research into the internet's infrastructure in the Atlantic coast of the south of Spain in 2021.

² When I refer to America in this paper I mean the entire continent, not the United States.

³ Pacheco Bejarano, J. P. (2021) *Cables, frontiers, bunkers, and ruins: relating anew to the internet's material infrastructure through non-linear speculative assemblies*. Aalborg University.

⁴ Curatorial text at the archeological museum of the Roman theater of Cádiz, visited on 1 May 2021.

⁵ I have discussed the relations between frontiers and the internet's infrastructure in detail in Pacheco Bejarano, J. P. (2021) *Cables, frontiers, bunkers, and ruins: relating anew to the internet's material infrastructure through non-linear speculative assemblies*. Aalborg University.

⁶ Burns, B. *History of the Atlantic Cable & Undersea Communications: from the first submarine cable of 1850 to the worldwide fiber optic network*. Available at: <https://atlantic-cable.com> (Accessed: 21 May 2021).

⁷ *Ibid.*

⁸ Interview with Anahí Rebatta, senior analyst at TeleGeography, 21 April 2021.

⁹ Telcordia (2010) 'Potential Role of Brazil's Undersea Cable Infrastructure for the FIFA 2014 World Cup & the Rio 2016 Olympic Games: Background, Observations, and Considerations', 9 June. Available at: https://cqr2010.ieee-cqr.org/Day%202/Session%207/3_Spilios_Makris%20OFIFAMAKRIS%20-%202014_2016_Olympics_presentation_version.pdf.

¹⁰ TeleGeography reports that the cable costed 230 million USD, while the Submarine Fiber Optic Communications Systems (SFOCS) Newsletter state that Atlantis-2 costed 370 million USD. See: TeleGeography (2020) *Global Bandwidth Research Service: Atlantis-2*. PriMetrica, Inc.; and, Information Gatekeepers Inc. (2000) 'Embratel Launches International High-Capacity Fiber Optic Network', *SFOCS*, 8(5).

¹¹ See:

¹² Mingas, M. (2021) *DE-CIX, EllaLink, Interxion and TeleGeography put connectivity on the map*.

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²⁰ See: <https://www2.telegeography.com/submarine-cable-faqs-frequently-asked-questions>

²¹ Devonshire-Ellis, C. (2021) 'China's Submarine Digital Fiber Optic Belt and Road', Silk Road Briefing, 17 March. Available at: <https://www.silkroadbriefing.com/news/2021/03/17/chinas-submarine-digital-fiber-optic-belt-and-road/> (Accessed: 21 May 2021).

²² TeleGeography is a telecommunications market research and consulting firm based in the United States. They are widely recognized beyond the telecommunications industry due to their Submarine Cable Map, an open and free tool that maps all the active fiber optic cables around the world and their respective landing stations.

**SPACES – ENCOUNTERS,
SUBJECTIVITIES +
ENVIRONMENTS**

Skin and Scales: Two Thoughts in Ecological Times

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The concept 'being-in' indicates how beings cannot be rigorously understood without taking their environments into account—the terrain 'in', and from which, they exist. Being-in is in this way a thinking of the primacy of relation. This essay develops this idea with the themes of 'skin' and 'scales'. Most immediately, skin is a border which is a property of individual beings that distinguishes one proper zone from others. However, skin is also porous and must be understood also as passage. If the theme of 'skin' reveals beings' fundamental, constitutive relationality, then the theme of 'scale' highlights the problem of perspective that arises when delimiting constitutive relations. Scale critique asks of the scale from which relations are understood, that is, the ontological basis of an understanding of beings, values, and practical action. The challenge is to at once affirm a scale for the possibility of ethical and political action and at the same time, remain receptive to other scales and skins which re-introduce the question of being-in.

Being-in. Relation. Skin. Scale critique. Environment. Eco-destruction.

1. INTRODUCTION: BEING-IN AS ORDINARY RELATION

"Being-in": in itself, this hyphenated word, these two words bound as one, sounds strange, incomplete, in need of further elaboration. Being-in: what is here being discussed? Where? Who? How to begin to understand it? (And perhaps already by speaking of being-in as a word, an 'it', a discrete entity, we are set off course, past being-in's enigmatic quality before the start.) It seems evident that this word needs assistance, it seems to call for others to come to its aid, others that would provide a stable foundation for it to be more clearly understood—perhaps.

Or at least, my initial reaction is to perceive this word, being-in, as calling for others out of a crisis of instability, a crisis that presumably must be overcome, as if it would be righteous to bring it to stand alone, erect, independent of others. This reaction, my reaction, reveals an implicit teleology of bringing to completion, bringing to an end, which demands for being-in to be fused with other words, creating, for example: 'being-in a house', 'being-in a relationship', 'being-in love', 'being-in debt', 'being-in a country', 'being-in denial'. These determinations do not only gather being-in within horizons from which it is to be understood, but each introduces a 'who', a subject who is in space, somebody or some bodies that are in a house, relationship, love, debt, country or denial. Accordingly, this reaction to being-in ultimately

determines it as a link between a 'who' and a 'what', a de-scription of a subject's relationship with an object. Although this is a legitimate way to understand this term, perhaps another approach would not side-step the inherent tension that it presents, but instead step into its strangeness.

One such approach to being-in is found in Martin Heidegger's *Being and Time*, which seeks in part to provide an ontologically rigorous account of human existence understood as *Dasein*. (Heidegger–1962) Being-in [*In-sein*] arises as an important concept for Heidegger to describe how human existence is essentially relational, an understanding that sharply differed from the dominant understandings of human being as presented in Descartes' *Meditations* and Husserlian phenomenology as most essentially a pure monad unaffected by its relations. Heidegger distances himself from this tradition by understanding human existence as "being-in-the-world" [*in-der-Welt-sein*], where being-in signifies a process of being constituted which precedes the formation of any subjectivity or ego.

Here being-in means something fundamentally different than the normal way in which things are described as 'being in' the space of other things, such as when one describes water as being in a glass. As Heidegger describes:

Being-in is not a 'property' which *Dasein* sometimes has and sometimes does not have,

and **without** which it could **be** just as well as it could with it. It is not the case that man 'is' and then has, by way of an extra, a relationship-of-Being towards the 'world'—a world with which he provides himself occasionally. Dasein is never 'proximally' a being which is, so to speak, free from Being-in, but which sometimes has the inclination to take up a 'relationship' towards the world. Taking up relationships towards the world is possible only **because** Dasein, as Being-in-the-world, is as it is. (Heidegger 1962, 57)

In other words, Heidegger argues that human being **is**, only insofar as it is firstly **in** the world, meaning only insofar as it is given its existence by the constitutive relationships in which it finds itself. "Being-in-the-world" indicates how human beings exist as products of an original belonging to others *qua* world, which draws attention to a radical passivity and dependence on constitutive relations that give human existence as a possibility.

From this basis, we can understand being-in as a fundamental characteristic of human, and perhaps non-human beings, a characteristic that must alter how we apprehend their truth. In order to understand a being 'as such' we paradoxically must turn outward, towards the webs of relations in which they are caught. Thus, beyond the scope of Heidegger's project in *Being and Time*, the concept of being-in can be appropriated for an ecological form of thinking that acknowledges the importance of 'environment' for a dynamic understanding of beings, which acknowledges their existence as fundamentally passive, plastic and dependent on others. This relational thinking of being-in can help diagnose past failures to account for the processual inter-play between humans and non-humans, and begin to present human well-being in ways that do not relegate non-human life and non-anthropogenic forces to the status of an inert background.

In this paper, I develop the concept of being-in with two themes that complicate the thinking of relation and indicate some aporetic limits for such environmental thinking, I first discuss 'skin' as a way of thinking being-in, a figure that is not only a metaphor, which indicates the constitutive separation and relation of beings. I then complicate this thinking by introducing the question of 'scale'. Scale critique asks of the ontological basis from which a discourse departs, serving as a reminder that there is always an *a priori* selection that brings forth certain beings and concerns over others, which enables one to speak, think and practically engage in the world. This pre-decision of scale is a necessary, originary violence that must remind us that ethical, political work can never be satisfied, but must always re-pose the question of its basis and the ontological foundations from which it departs.

2. SKIN

[Skin] is not really a matter of metaphor or even metonym; the skin is from where a presence to the world and to oneself begins and ends: not just one's life but one's sensibility, one's activity and passivity, one's expressivity and signification. (Nancy 2021, 13)

2.1 SKIN AS BORDER

Skin is the outermost layer of a body, the largest organ that stretches, retracts, excretes, shrinks and delimits a body's edges and contours. The skin runs alongside the body, holding it in place, making it (a) whole. Insofar as a body **is**, meaning insofar as a body is encounterable as a being, it **is** skin. For it is only through and as skin that the body can, and can come, to presence; being as it is entirely dependent on this outermost layer. Skin creates the difference between an inside and an outside, interior and exterior, preserving one as one, other as other. In this sense, skin separates an interior from others and makes this separation perceptible, as a difference, creating a proper sphere that, from the point of view of the body in question, is the region of the same, 'mine'. We are reminded of each body's irreducible singularity in the skin itself—its shades, bumps, hairs, inscriptions, openings, ages, sizes and scars differ from one body to the next, from one moment to the next, even on the same body, on what was its self, marking each as irrevocably different from others. No skin is the same—and yet, it is skin, and skin alone, that preserves the same.

Here, skin is a border that preserves the property of a proper sphere by keeping it pure of its others. In skin, I am, myself, ego, soul, mind, spirit, reason, unscathed—each traditional determination of the proper self depends on skin as a border, without which any 'inside', as well as any sense of an 'inside', would be dispersed into a manifold of differences. Skin gathers a being into a unity, giving it the presence necessary to be experienced as a self, to be seen, touched and held, as such. Skin gives this property of the 'as such' to beings, and insofar as there are beings, skin is at work as their border, preserving their distance and difference from others.

And yet, if skin preserves the purity of an inside, it must also be turned outward, in a relation with an outside. The skin must caress the body **and** be in contact, and touch, the other. And this is quite clear since skin is what is there to be experienced—skin is what is seen. Skin shows. Skin presents the body as a possibility, as a phenomenon. This presentation of the body is even what first opens the questions of touch, scent, sight, sound, taste, grip and understanding. These experiences, experience as such, would not be possible if it were not for the skin's gathering of bodies into

perceptible things, without which the organ-less bodies would remain sites of differential force, dissemination and entropy. As Nancy writes,

The skin is itself an organ—for the physiologist—but this organ exceeds organicity. Playing with Artaud's famous phrase, one could say that it is the organ of a body without organs, the organ or indeed the place where a body presents itself as itself. (Nancy 2021, 13)

Skin is the organ par excellence because it gathers the body into presence and temporally resists forces of transformation, allowing for the univocality of a self, an Other, beings and thus the question of Being, and accordingly the possibility for ethics and politics.

Skin in this first sense is a border that defends a being's proper sphere and presents the body as a phenomenon. It offers a two-fold sense of presence, first as self-same containment, 'whatness', and second, as event, as a coming into relation with others, what can be called passage. Skin is both border and passage.

2.2 SKIN AS PASSAGE

The skin is not the site of a calculation nor a measurement: it is a site of passage, transit and transport, traffic and transaction. (Nancy 2021, 14)

This second side of skin is well represented by another, as yet overlooked feature: the pore. Peeling the skin from the body, it not only has depth, layers, a variety of colours, hairs and stains, but it is also littered with holes of various sizes. These pores cannot be grasped as discrete beings for analysis, for they are nothing more than spacing. Ontologically speaking, they are nothing. And yet even if they cannot be understood in the same manner as the skin's other features, pores nevertheless make up an integral dimension of the being of skin.

Skin is a border, but this border is porous, with doors, cracks, secret entrances, and passages which allow for the exchange of fluids, pieces, vapours, sounds, and waves. There is continuous passage along this border, and such exchange is not inherently antagonistic to the proper sphere of a being, but in fact is essential for its very possibility. Paradoxically, it is only through the intrusion of others, of the 'not-me', that a being can exist in a way that allows it to say 'me', to be a self. This hetero-affective quality of life is not only physiologically evident, but metaphysically and psychologically, it is only through the work of the other, the not me, that a self can exist. To take the privileged example of language, which is not simply one example amongst others, one can only speak, think, and be a self, that is, one can only say 'I',

think and be as an 'I', because of and through a language of others, a language that is firstly **given** by others, from and as a history which precedes oneself, that one inherits and dwells in.

Skin is thus porousness. It is the site that opens the possibility for touch, understood as a constitutive sharing that precedes and gives the possibility of the fixed identities of different beings. Indeed, in this sense, skin is not a present matter, but an in-between that blends and conjoins bodies, and gives place for their relation. This constitutive play between inside and outside, between others, is nevertheless fragile, for the intensity of this relation, the wideness or narrowness of a skin's pores, must vary from time to time, body to body—for too much or too little openness would betray the inside, overwhelming or suffocating it. Skin is thus not simply a limit, but through this constant exposure to others, the very source of the life of a self.

2.3 SKIN AS BEING-IN

Skin is being-in. It demonstrates how the proper sphere of a being is always contaminated by traces of others and that the proper sphere itself is a product of this differential play. This dynamic qualifies any claim of pure identity or interiority as only approximate, practical and finite, since the border that preserves identity also is a passageway for differences.

Although the thought of being-in draws attention to the historically overlooked relatedness of beings, it does not for this reason simply erase the differences between them. Even as each being is always undergoing transformation, it is crucial to nevertheless maintain an awareness of their irreducible singularity, for the encounter with the concrete presence of an other is precisely where ethics begins. Whether it is a problem to be responded to, a being in need, a process to be addressed, an insufficient structure to be recreated, ethics departs from such an encounter with a thing that stands out as a present matter, phenomena or being. Without this initial presentation, there is no ethical or political question, and no possibility for action.

The thought of being-in demands for the singularity of beings to be respected, while raising an awareness of each being's essential relatedness with others. It is this duplicitous thinking that will be crucial for addressing climatic problems, for it draws attention to the constitutive play of human and non-human beings without losing sight of the importance of each being's absolute singularity. Environmentally attuned ethics is tasked to delimit and cultivate such constitutive relations, understanding that without them, human and non-human beings will increasingly suffer. That each and every being is always a singular, finite difference understood from out of a larger play of

forces, demonstrates that the truth of a being is always also an environmental concern.

3. SCALE

Being-in, understood through this analysis of skin, describes the relationality that composes humans, non-humans, organic and inorganic matter, which has radical implications on ontology and epistemology. However, how is this insight to affect ethical and political practice? Two difficulties seem to immediately arise:

- (i) If beings are to be understood as relational, when does one know a being's relations enough to commence positive theoretical and political work? When have its others been taken sufficiently into consideration? And if the answer is never, is there an ethical way to make this decision, or is there a fundamental need for exclusion at the origin of ethical action?
- (ii) Theory and activity depend upon an initial encounter with a discrete entity. Thus, regardless of the approximate nature of any entity's self-sameness, this phantasmic, practical stability of presence is the necessary starting point for ethics and politics.

There is thus a need for some kind of original decision—a first incision—that extracts a present matter from a differential manifold of relations. Such would be a necessarily arbitrary and violent interruption of being-in—a selection of skin—how is this selection made?

As has become evident, skin can refer to literal human skin as well as the outermost layer of any phenomenon. Every **thing** that stands out in presence, material or not, has skin in the double sense of border and passage, a play of inside and outside that deconstructs the purity of any interior. Yet we must now go further and see how skins, and thus proper spheres, **overlap**. This brings us to the question of 'scale' which addresses why certain beings stand out over others from the same overlapping relations. This problem is best presented by way of an example.

Imagine somebody standing in an ashy clearing, the aftermath of a forest fire that had stopped burning a few months prior to their visit. The clearing abruptly ends at the edge of the remaining forest, which is lush, and teeming with various types of trees, ivies, fungi, mosses, birds, rodents and insects. The earth is dark and moving, and in a strange sense it is loud, even if this is not technically so. The sun is hot and bright and it is humid, and the person is tired even though it is still early in the afternoon. They take in the scene, an

assemblage of different beings and forces, intermingling and unfolding at different temporalities and levels of perceptibility.

The question is, what in truth is there? What beings are present? What shows itself? The answers to these ostensibly banal questions are not as obvious as it may seem, for depending on the person, the assemblage in question may take radically different forms. None of the observations made above necessarily will arise for another person, not even the determination of the assemblage as a forest. They may have an altogether different encounter that is no less accurate. Perhaps they would be seized by a specific tree that would be a lucrative asset in the present furniture market. This person would have a fundamentally different series of presuppositions, that is, a different **scale** according to which beings come into presence for their experience. Another person may be fixated on the canopy, their gaze turned upwards, the canopy standing out not as a manifold of different beings, but as one, itself in relation with the heat of the sun and the support of the trees. Another will look in the same direction, but instead of encountering the canopy, they will focus on a snake that coils within the tree line. The snake stands forth as a discrete being, against a backdrop of other beings and relations that give it life, as it exchanges its gaze.

The question of scale concerns the bases from which one perceives, thinks and acts. What are these ontological predeterminations that order experience and how are they formed? As this example demonstrates, scale is not the result of a conscious decision, but is always at least in part, if not entirely, given prior to any act of consciousness. One does not entirely choose the scale that they inhabit because scale forms the very ground from which beings, that is, skins, can come to matter, and it is only from this first presentation of beings that one subsequently can make decisions. This question of scale must be understood with the measuring instrument in mind, which weighs, values, compares, and balances, as ultimately an instrument of selection. At the same time, these scales in their multiplicity ought to be heard in the sense of the other type of skin, as if these value scales littered the surface of an endlessly stretching snake which exhausts all horizons, surrounding and overseeing any scale, thus preventing the possibility of an outside of its play. This serpentine god is precisely one of the foes of Nietzsche's *Zarathustra*: the Great Dragon who sparkles "like gold, an animal covered with scales; and on every scale shines a golden 'thou shalt'. Values, thousands of years old, shine on these scales." (Nietzsche 1954, 27) As Nietzsche suggests, we must not listen to its demands to simply surrender to the authority of given scales, and thereby relinquish the possibility of critique and

creation. That one always already has and departs from a scale does not prevent the possibility of putting one's scale, after the fact, or at least a part of it, into question, but this necessary embeddedness does demonstrate the impossibility of escaping scalar horizons altogether.

It is indeed concerning that the critical thematisation of scale does not in any way circumvent the difficulties that it poses. For even when the theoretical possibility of changing scales arises, there remains no 'correct' scale which would offer a trustworthy foundation for ethical conduct and would not also enact blind violence against others that would be perceptible from other scales. How are we to then decide the basis from which to organise our conception of beings and ethics at a given time? From where? Human well-being? Which humans? The global north? Non-human beings? Eco-systems? The scale of a city's well-being? A nation? Continent? Forest? World? And then according to what timescale? The immediate present? The course of a month, 15, 100 or 10,000 years?

Each of these decisions would have, and do have, drastic effects on ethical political action as well as thought, and it is each scale that has always already responded to these questions, which can be reduced to one: 'Which skins matter?' where 'matter' must be heard in three ways:

- (i) Matter as being-forceful—which skins are affective? Which beings-relations are at work in a given assemblage? Where is there evidence of significant force?
- (ii) Matter in the sense of coming into material presence—which skins stand out as a possibility for experience? Which are present to be reckoned with at all?
- (iii) Matter as having value—which beings that do come forth are valued? For it is evident that certain presentations of exteriority are considered to be valueless, as are the relations, environments and institutions with which they are bound.

Which skins matter? Scale is the presupposed reply to this question at the basis of any encounter with beings. Knowledge acquired or action conducted necessarily remains in the horizon of such scalar determinations, forming a regional ontology bound to a particular scale.

Scale critique is the task of pointing out the function of scales while analysing the presuppositions and valuations that are at work in each. Timothy Clark has argued that deconstruction can be understood as a form of scale critique, since it too draws attention to the overlooked decisions and presuppositions that guide thought in ways unbeknownst to it. (Clark 2018) We must also take account of an important second movement of

deconstruction that follows from this first paralysing reminder of scalar difference. If one is necessarily always within scales, without hope of getting outside of their serpentine play, each scale separating and blending with those around it, thousands sliding into one and vice versa, deconstruction cannot be content with focusing on scalar instability alone, but must also affirm the necessity of scalar **decisions** for the possibility of ethics and politics. This necessity stands even as such affirmations mark the end of (relational) thinking and slip one into forms of dogmatic positivism, for this exclusionary violence against others: other people, relations, beings and scales; allows for ethical political action as such. This necessity should spoil any good conscience that would allow one to believe that they have done enough, as it is structurally impossible to consider and be considerate for every overlapping relation from which beings stand. Ethical politics thus betrays beings and their relations, and must do so, insofar as each and every decision violates an other, which, even when in part perceived, takes place beyond any scalar horizon. There is no way past this aporia which has striking effects on the meaning of 'world' and 'being-in' with which I conclude.

World: if 'world' describes the multitude of relations that one is always already in, then this world must be constantly transforming beyond any semblance of identity due to the continuous loss and transfiguration of others and relations that constantly take place—and thus with it, we too must undergo such transmutation. The phrase, "being-in-the-world" becomes all the stranger when the world is no longer understood as a unified entity, nor as a series of identifiable relations, but as a continuous violent transformation beyond the scope of reason or any scale. This thought is what increasingly drew Derrida to the following passage from Paul Celan's *Der Meridian*: "*Die Welt ist fort, ich muss dich tragen.*" [The world is gone, I must bear you.] Derrida read this line (at times) as a suggestion that regardless of the world's lack of presence, or precisely because of it, one is obliged to act **as if** there were a single, unified world, obligated to enact a scalar decision and erect a phantasmic world for the possibility of ethical politics. As he said during the final session of his last seminar:

That where there is no world, where the world is not here or there, but *fort*, infinitely distant over there, that what I must do, with you and carrying you, is make it that there be precisely a world, just a world, if not a just world, or to do things so as to make **as if** there were just a world, and to make the world come to the world, to make as if—for you, to give it to you, to bear it toward you, destined for you, to address it to you—I made the world come into the world poetically, as though there ought to be a world where

presently there is none, to make the gift or present of this **as if** come up poetically[.] (Derrida 2011, 268)

Being-in: if, as being-in, we are essentially bound with others, then each loss of an other, or every transmutation that radically changes or bursts an other's identity, inflicts a mirrored force against our own interiority. Properly speaking, this would not even be a force that one could personally undergo, for there would be no identical self that would remain through such transformation. The more intimate the relation was, the more extreme this parallel violence is. Such is what Blanchot describes as the little death, the transmutation of one's world that ruptures one's identity to the point of being no longer self-same, leaving only some trace, some remainder, the survival **of** a ravishing and dispossession. (1989) A great event, a love lost, can be a little or not so little death, up to inciting the complete collapse of one's skin, when a threshold is crossed and the skin can no longer recuperate a facade of the same, letting the body slip free as the skin sags and loses form. Whether through major events, or too many little deaths, the facade eventually falls, bringing death in the biological sense, generating another wrinkle in other skins, and in turn presenting new relations and horizons for others. In this sense, life is the undergoing of continuous little death, while dying is no longer being able to undergo the death of others.

4. CONCLUSION: ECOLOGY AND THOUGHT

The thought of being-in presents a fundamentally ecological sense of existence in which beings are thought from the basis of their dependence on others. The idea of skin demonstrates that this originary relatedness is not just a great unity, but a differential play of overlapping borders that preserves proper spheres while exposing them to others. This ecological form of thinking demands for the scales, or ontological bases from which experiences depart, to be understood as being bound to presuppositions and valuations. Thus there is no purely 'ethical scale' at which to arrive, but each must be understood to necessarily obfuscate other possibilities that are opened by other scales.

In order to think existence as being-in, particularly as concerns ecology, we must remember: 1) the distancing inherent in any relation that prevents the thought of being-in from collapsing into homogeneity; and 2) the scale at which any 'skin' or perceived relatedness is grasped. We must ask, should **this** scale be affirmed at this moment? Why or why not?

Skin and scale; two thoughts for being-in ecological times.

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Art-Science Research in Botany: Reinvestigating scientific representations of trees

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Collaborations in art and science work with explorative and uncertain research methods to find new ways of knowing about nonhuman actors such as trees. Methodologies and concepts common to modern science are questioned ontologically, in part through artistic practices. The epistemological process itself, its contextual meaning and philosophical level are investigated. In this paper, I analyse two case studies on trees that gathered and measured data on their sounds and smells and question the scientific representations of plants as inert objects.

Scientific research has highly influenced our perception of nonhuman actors, mainly from an anthropocentric narrative. This knowledge is created with scientific methods and narratives. In the sociology of science, this situatedness of knowledge in human experience and expertise is analysed in how it shapes the presentation of scientific knowledge (Latour 1987, Collins 2001). For trees, which have an essential impact on our environments as a habitat for many species, in their use by human beings and their influence on climate. Yet, trees as a taxonomy cannot be completely defined in botany or in common language. It is an anthropocentric conception that has created too narrow narratives for a “woody plant with secondary growth.”

Art, science and technology. Scientific constructivism. Art installation. Botany. Art history.

1. ALL THE THINGS WE NEVER KNEW ABOUT TREES

One goal of interdisciplinary projects is to ontologically question existing forms of disciplinary knowledge and research (Barry *et al.*, 2008). Particularly art and science collaborations can critically reflect upon concepts and representations in science through an artistic lens. Disciplinary methods can be reinvestigated within an artistic context, and vice versa, artistic methods used in a scientific experiment to challenge the boundaries of common practices. In this paper, I analyse two art-science projects in their relation to scientific representations of trees. Both projects reinvestigate traditional methods and their underlying representations of plants as inert objects. Sound artist Markus Maeder co-developed new research approaches on tree sounds that consider them as potential communication (*trees*, 2012-15). In *One tree ID*, Agnes Meyer-Brandis reflected upon methodologies on tree scents. The artists explored trees as agents in the complex ecosystem of a forest.

Until today, a universally recognized definition for ‘tree’ has never been phrased. In botany and in common language, trees can be standardized by their usage, as research objects in labs, or in their co-existence in forests. Descriptions include the production of lumber or characteristics like upwards growth, woody stem, or growth rings. Any of these many attributes can also exclude one another and this diversity of trees challenges a singular definition.

Research in botany since the 2000s (Mancuso *et al.*, 2002; Marder, 2016; Coccia, 2019) revealed new attributes that questioned our traditional understandings of ‘tree’ anew. Trees have five senses and can f. ex. hear a bee flying over their flowers (Mancuso, 2015). They also create sounds intentionally and unintentionally. As part of photosynthesis and other biochemical processes, scents are produced that communicate information from one plant to another. The sensory perception creates an awareness of their surroundings, particularly of other trees. During a drought, trees can share nutrition with smaller ones surrounding

them (Wohlleben, 2016). Sounds and scents in a forest are a system of communication where trees act as historical agents. Although much data has been gathered in botany, tree as a historical agent and living entity is only partially palpable through scientific inquiry (and, hence, otherwise).

Many phenomena in botany have often been regarded as passive by-products. Botanists knew about these phenomena but did not consider them research objects (Mishra, 2016, p. 4484).

Auditory and olfactory data has not been standardized and added to any plant taxonomy. They are not measured by common methods in plant morphology, physiology, or other fields. Sounds are often described as noise rather than phenomena of their own. Tree scents are produced by biogenic volatile organic compounds (BVOC) and analysed in their chemical composition and impact on the atmosphere, but they are not much understood in their significance for trees themselves. Botanic observation is often conducted with a one directional gaze. Consequentially, scent and sound fell through the grid of botanic research as signs of tree co-agency.

From the outer surface to the cellular level, plants are commonly understood in a cyclical life process (Kallhoff, 2002). In a paradigmatic concept of a daily cycle, any communication with other plants or insects has been neglected. Modes of action in a plant are explained in their causal chain of reactions such as the transportation of water from the roots to the leaves. Plants are examined as purely causal processes, leaving not much room for non-purposive explanations. This analytic approach has an evaluative aspect, too (Kallhoff, 2018). Guidelines for the health, vitality, or ill conditions of a plant are determined in the scientific analyses of good and bad conditions. Such evaluations are at least in part constructed through a causal narrative.

Roman Zweifel as ecophysiologicalist in the art-science project *trees* questioned whether alternative approaches to analysing auditory tree data existed (Zweifel *et al.*, 2008). Agnes Meyer-Brandis, too, questions our (scientific) representations of trees through viewer-tree interaction in her artwork. Explorative approaches in art-science research can potentially help to open up scientific representations to previously neglected aspects.

2. TREE AS SCIENTIFIC REPRESENTATION

In the projects, measuring scent and sound data as investigation of tree agency is a critical reflection of standard methods in botany. The collaborators ontologically questioned how trees are constructed as inert objects. The scientific representation of trees becomes palpable. Gaining knowledge is not

discovering or unveiling truth but constructing it within the scientific referential and narrative system it was created in.

The difference between a plant in its natural environment and its representation as research object derives from a transformative process where plants are dissected, dehydrated, preserved, or otherwise transformed to make them analysable and comparable. Bruno Latour analysed this as “epistemological question of scientific reference”, describing that “the sciences do not speak of the world, but, rather, construct representations that seem always to push it away, but also to bring it closer” (*ibid.*, p. 30).

Research in arts and humanities reconstructed representations and scientific narratives towards co-agency and ideas of trees as historical agents in a forest while questioning anthropocentric views (Tsing, 2015; Marder, 2016). This capacitated a re-evaluation of tree characteristics as interaction and communication. Today, we know that trees can hear, smell and taste and they actively influence the ecosystem in a forest. An explorative investigation of tree data helped to make these discoveries. In the relation between arts, humanities, and science, any questions about plant ethics and plant intelligence are intrinsically connected to scientific research and vice versa.

The interdisciplinary connections also challenge conceptions of scientific practices as fundamentally different to artistic or humanist ones. Innovative research can be compared to creativity in art since it preresquires a breaking out of learned techniques and a questioning of confirmative structures. Especially during initial research stages, experience and observation are embedded into a predefined methodology. Scientific observation is a learned and skilled technique that is based on collective practice (Daston, 2008, p. 102) and necessitates a system of standardized knowledge. No researcher can perceive her research object with impartial or undefined perception but includes a background of knowledge and a skilful observation.

Lorraine Daston has compared this perception to the aesthetic pleasure of seeing a painting (2008, p. 107). Both practices require previous knowledge and teaching. However, the study of how intuition in science is initiated is still a neglected idea. Regarding tree data and how it may be considered as communication, this may answer why tree sounds were neglected as research objects for a few centuries. A deeper investigation required a novel and creative approach. Michael Marder boldly declared the discovery of tree senses as a Kuhnian paradigm shift in botany, although the actual innovation of this research is still in the margins and only time can tell its potential influence (2016, p. 75).

3. ART-SCIENCE PROJECTS: HEARING AND SMELLING DATA

3.1. *trees*, 2012-2015

Tree sounds were discovered during an analysis of conduction and cavitation in sap (Milburn *et al.*, 1966). Botanists recreated the cavitation process to understand the water tension in plant cells. During the night and during droughts, cavitation may occur in cells that can cause them to burst. This process causes a crackling noise in ultrahigh frequency that is not audible for human ears.

The art-science project *trees* (2012-2015) was one of the first research-driven attempts to investigate tree sounds in their potential meaning for a daily life cycle as well as for communication. Eco physiologist Roman Zweifel and sound artist Markus Maeder gathered data from Scots pine trees in the Swiss Alps. A data sonification was used to explore the meanings of these sounds. The research results were used in a sound art installation. The interdisciplinary research project was a collaboration between the Swiss Federal Institute for Forest, Snow and Landscape Research and the Zurich University of the Arts.

As a sound artist and engineer, Maeder recorded, transmitted, and made the ultra-frequency sound data audible. The recordings included not only the cells bursting but other noises such as insects landing on leaves, bugs crawling on the stem, and leaves rustling from the wind. The artist and the botanist collected the data together but kept to their individual expertise in the data analysis/art installation. The challenge for a scientific use of this data was to analyse and differentiate their origins.

Following Zweifel's general research, one of his main approaches is to investigate the meaning of climate change for forest trees. Since drought is a possible symptom of climate change, the investigation of conduction sap could lead to new research results. Due to the sonification, he could hear tree sounds that are not from sap but seem to be from trees growing at night. An idea that in the paradigmatic concept of a daily life cycle had not been considered (Zweifel *et al.*, 2021). Collaborating with a sound artist offered him the possibility for data sonification. Maeder's recordings were much more precise in differentiating between several sound types (Huber, 2014). In this sense, the artist collaboration was about sonification, mainly, rather than an exchange of work practices or knowledge. Although Maeder acquired the expertise of sound recordings for his artistic practice, his part in the collaboration centred around technical knowledge more than an artistic one.

As an art and science project, another goal was to make research in eco physiology more relatable to

a wider audience. The public outreach was extensive with several newspaper articles and radio and TV documentaries. The data sonification also resulted in an art installation that was exhibited at Ars Electronica and other festivals (Maeder *et al.*, 2013) and during the climate conference in Paris 2015. Visitors saw a video from the Scots pines and an auditory display while listening to the sonification. Maeder portrayed the many sounds as a network rather than dissecting the different origins. It showed the connections between co-agents in a forest through the sound narrative.



Figure 1: Markus Maeder/Roman Zweifel, *tree lab*, 2017, installation at Ars Electronica. © Florian Voggeneder

The initial idea in the project proposal was to re-examine tree sounds as more than a by-product of conduction sap and to question whether this could be a form of communication as much as whether they can tell us something about how trees respond to drought. The questions were formulated broadly, and the results were different from the initial outset. The execution of the project was highly experimental since a data sonification is not a standard method in botany and results could not be accepted as new research outcome. It is difficult to think of *trees* outside of an art-science framework. The project methodology does not fit into a scientific narrative, and the results cannot be made into a “proper” scientific construct. The results show the importance of art-science for innovative research in general.

The approach of a network of interaction resulted from interdisciplinary thinking by embracing an understanding of tree co-agency. The sound recordings showed the many interactions between plant and insect life in a forest. Although the scientific and artistic practices are mainly separated, their combined method challenges the botanic representation of trees. However, although this change of perspective may have influenced his research approach, Zweifel as eco physiologist follows traditional representations. Whereas *trees* was initiated from a scientific observation, the second case is situated in arts-based research.

3.2. One tree ID, 2019

The project *One tree ID-How to be a tree for another tree* reflects on trees as scientific representations, invisible data, and tree scents. Agnes Meyer-Brandis' art-science project examined BVOCs as tree communication. In the art installation, visitors see a Himalaya cedar encapsulated by a table. Three glass bottles stand on it, each containing a tree perfume. In the installation, ideally, visitors will walk to the glass bottle, choose a perfume, and walk over to the tree. They can turn on a microphone and record a message as exchange. The cedar is placed in a hole in the table and around its stem is an analytic tool that measures BVOC data live shown on a computer screen next to it.

The perfumes were created during the artist's interdisciplinary research. At the Institute for Bio Science (University of Rostock), Meyer-Brandis together with biochemists Birgit Piechulla and Uta Effmert conducted biochemical analyses of BVOCs from the roots, stem, and needles of the cedar to create three perfumes identical to the tree scents. Perfumer Marc vom Ende from the company "Symrise" compared the original scents from the tree to the synthetic versions to make them as identical as possible. Since BVOCs are fragile due to their chemical compound, the artist and the scientists could not be sure that they could recreate the scents solely as reconstruction and relied on the perfumer to detect differences.



Figure 2: Agnes Meyer-Brandis, *One tree ID*, 2019 art installation. © A. Meyer-Brandis, CC BY-NC-ND 2.0

Meyer-Brandis created a new artistic narrative and performative installation for her research. The elements of her artistic-scientific practice—biochemistry, environmental science, posthumanism, performance—are all intricately connected. Although she applied a standardized analysis to create the perfumes, she changed the paradigmatic concept from a passive chemical process to a communication method. The art installation portrays how much scientific innovation depends on its underlying concepts. By creating an

artistic narrative and an installation, the biochemist results can be recontextualised towards an alternative approach to their research object.

Recontextualising standardized practices creates tensions between 'normal' science, artistic narrative and trees as research object which become visible in the performative aspects of the installation. The interaction between human and tree is not a real communication and any attempt is bound to fail. We smell the perfume, aware that this is how trees send information to each other, and we then communicate with them in our own language. We can interpret this as a critical reflection of how a "true" understanding of what a tree is, cannot be reached with scientific methods and through scientific representations of trees. The failed communication can also be a contemplation of all the things we may never know about trees. Like any good artwork, the artwork is subjective, contemplative, and open for interpretation.

The installation view is reminiscent of the traditional botanical perspective of dissecting and standardizing trees rather than trees as co-actors. It shows the histories of a scientific discipline and challenges us through the performative aspects to consider alternative approaches on how to regard trees.

4. CONCLUSION: QUESTIONING AND REAFFIRMING SCIENTIFIC REPRESENTATIONS

One tree ID reapplied a traditional scientific method to question its epistemological assumptions. Meyer-Brandis' installation is in many aspects an artistic expression of scientific knowledge. *Trees* produced two types of outcomes: an artwork and a data analysis. The approach nevertheless relies on a questioning of the scientific representation of plants in their ontological status. It is exploratory and can become functional as basic knowledge. This highly explorative approach is difficult to imagine outside of an art-science framework.

Markus Maeder's installation disseminated the subject of drought through climate change to a wider audience and is based upon an idea of true knowledge in science. The aesthetic in the installation depends on the reality of tree sounds. Viewers would perceive it radically different had it not been a data sonification but an artistic creation. Maeder also did not create an artistic narrative like Meyer-Brandis, or otherwise re-worked the data artistically. The aesthetic is focused on the idea that we can hear genuine tree sounds. By relying on a concept of scientific truth, any possibility of an artistic exploration was neglected. In comparison to his other sound installations, there are not as many artistic components in the installation.

Agnes Meyer-Brandis was less concerned with truth values for her installation. *One tree ID* investigates scientific understanding itself in how the viewer's experience critically reflects upon the botanical concept of trees as research objects. The installation questions the transformative process into a scientific construct. The tree is not the research object on display, but something hidden from us because we cannot (yet) understand its language and signs.

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Andscapes: As the Bug Crawls

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Borrowing landscape architect Martin Prominski's term 'andscape', this essay attempts to forge a link between two definitions of andscape: on the one hand, as a non-dualistic approach to environment that productively problematises distinctions of subject-object, nature-culture; and, on the other hand, as emerging from an artistic practice in landscape that is rooted in epistemological questions concerning empirical measurement. My point of departure for thinking about andscapes here is a critical look at the default perspective of distance across landscapes: distance as the crow flies. A literal top-down cartographic perspective – the global point of view of satellites, planes, drones – flattens a landscape's surface irregularities and renders the distance between two points smooth and two-dimensional. But what might be learned about a landscape if we measure its distance from a more surficial, earthbound perspective – for instance, from a bug's point of view? If we adopt the practice of measuring as the bug crawls, what temporalities and qualities of the Earth's surface might surface through this action? And while this practice troubles notions of scalability, what gains can be made in valuing specificity? Moreover, could an artistic read of the physical resistance of roughness evoke a political resistance to smoothness?

Andscape. Andmeter. Assemblage. Cartography. Scalability. Situatedness. Temporality.

1. INTRODUCTION

I first came across the word 'andscape' in landscape architect Vilja Larjosto's doctoral dissertation (2019), which examined the seasonal dynamics and resilience of urban islands within the frame of research-through-design in Anthropocene discourse. She employed the andscape concept to reinforce her approach to design as necessarily time-sensitive, integrative, highly adaptive, and non-anthropocentric – as embracing temporalities and variabilities, rather than flattening them with catch-all solutions. The term itself was coined in 2014 by landscape architect Martin Prominski 'to overcome "outdated" dualisms of city versus country, or culture versus nature ... [suggesting] a productive conceptualization of an integrative practice in the Anthropocene' (Larjosto, 2019, p. 21). Prominski used this conception of andscapes to advocate for a 'unitary mode' of landscape architecture where 'the focus is on the dynamic relations between humans, animals, plants, stones, water, and all other elements in the world' (Prominski, 2014, p. 6).

While I do not approach andscapes here from a design perspective, I do adopt this term conceptually and pivot it towards the frame of my own artistic practice in landscapes. This essay attempts to forge a link between two interpretations of the andscape: on the one hand, as a non-dualistic approach to environment that productively problematises distinctions of subject-object, nature-culture; and, on

the other hand, as an artistic practice in landscape that is rooted in epistemological questions concerning empirical measurement. With my particular interest in the subjective, dynamic processes of measuring landscapes, I have adopted the term 'andscape' as a tool for understanding my own artistic work. In my practice, **andscapes** are landscapes **and** – emphasising the conjunction 'and' over 'but'. Andscapes are spaces defined by inclusion rather than exclusion. The additive principle of the andscape makes a space for those qualities of surfaces and atmospheres that are often withdrawn, extra-sensory, or else regarded as outlying data or noise – andscapes recuperate those qualities that, when mapped, are typically edited out, dismissed as either cartographically insignificant or too complex for the purposes of a legible generalised model of spatial units. To me, an andscape is a space that we encounter and observe while simultaneously being embedded in it; where we see a messiness of confounding variables, instead of editing them out, we welcome them into the manifold. Andscapes exact worlds from worlds. Andscapes welcome multiplicity. With andscapes, there are no 'buts'.

2. THE SUBJECTIVITY OF THE METER

For centuries, units of length remained non-standardised across empires and cultures. Very often they were based on different human body

parts, like arm-spans (e.g., under Charlamagne in France) and literal 'feet' (still an official unit of measure in the US today). This was highly practical because everyone had their body at hand, so to speak – lengths were only as standardised as the human body itself could be. For most of human history, quantifying trade goods did not require the industrial precision we now take for granted. Rigorous standardisation is now necessary to maintain the illusion of smooth, frictionless capital and information flows around the globe, or the 'space of flows', as sociologist Manuel Castells has called it (Castells, 2009 [1996]).

In 1793, following the adoption of the decimal system in France, the '**mètre**' was made the standard unit of length, and was redefined as exactly one ten-millionth the distance between the geographic North Pole and the Equator, along the Paris meridian (Nelson, 1981) – a conspicuously political line for a unit meant to be universal and atemporal. In 1889, this measurement was physicalised as a meter artifact: a bar of platinum-iridium, housed in the International Bureau of Weights and Measures. In 1983, the meter was redefined by the International Bureau of Weights and Measures (BIPM) as 'the length of the path travelled by light in a vacuum during a time interval of 1/299,792,458 of a second' (The 17th General Conference on Weights and Measures, 1983). But in these many shifts of reference, from body to planet to physical artifact to abstract formula, the ultimate meter still aspired to capture the exact length of the 1793 standard – that fraction of the distance a quarter-way round the globe. This means that today's meter still represents a particular perspective: the distance between the North Pole and the Equator, determined from a bird's-eye-view, flying over Paris, in perfectly virtual and smooth two-dimensionality. That distance, and the subsequent meter, was not measured from the point of view of any walking human or land-dwelling being, which means the circumference of the Earth – currently calculated at just over 40 million meters – has not been extrapolated from the planet's surface features at all: this figure does not account for hills or ravines or trees or textures of any kind, let alone the myriad ways these surfaces change over time. Rather, this distance is calculated **as the crow flies**, between virtual points, triangulated by an aerial (if not celestial) point of view, and related to explicitly outerworldly bodies. Surface roughness is altogether disregarded. The meter measures a world for crows.

3. AS THE CROW FLIES, AS THE BUG CRAWLS

'We cut over the fields at the back with him between us – straight as the crow flies – through hedge and ditch.' – Charles Dickens, *Oliver Twist*, 1838

The factor of distances between points on the ground is a chief organising principle for how we broadly understand and relate to landscapes. My point of departure for thinking about andscapes here is a critical look at the default perspective of distance across landscapes: distance **as the crow flies** (a turn of phrase first put into print in 1838 in Dicken's classic *Oliver Twist*; see Allen, 2008, p. 185). Mapmakers tend to measure by the imagined straight line of a crow's flight (even though, in reality, the flight paths of crows meander like any other bird's), virtualising the true distance across the Earth as an uninterrupted flight path, at the expense of every 'hedge and ditch' along the way. The crow here represents the modern prioritisation of the disembodied eye in the sky, which, in its height, flattens the contingent clods and bumps in the field – this straight line smooths space to the point that it is perceived as 'purged of conflict' (Dorrian and Pousin, 2013, p. 298). To be carried over the Earth in a straight line, whether mentally by the idea of a crow or physically by an airplane or strip of asphalt, conceals a landscape's surface irregularities and risks diminishing our sensitivity to it. Especially in urban spaces, the landscape does its job of getting us from A to B without much resistance, and we hardly notice its surface until the moment when it stops functioning properly, when it fails to carry us smoothly, whether because we trip over a crack in a sidewalk or because our bus hits a pothole. Otherwise, the rough qualities of the Earth tend to escape our notice. Although it would be valuable to develop a more attentive walking practice to cultivate awareness of the roughness of the surface of the planet (see Lucius Burckhardt's 'strollology', Burckhardt, 2015), I would like to go one step further, beyond the walking sphere of the human being to a nonhuman animal scale – a point of view that is similarly terrestrial, but whose tininess could further help us to see the ground below anew.

What might be learned about a landscape if we measure its distance from a more surficial, earthbound perspective than the crow's – for instance, from a bug's point of view? As my figure of measurement, I have chosen the generalised 'bug', rather than accounting for the specificities of species or sensorium, in order to contrast the human view with a general smallness that encounters the haecceities of the surfaces it crawls along. I also embrace the double meaning of 'bug' here, to additionally connote a glitch or disruption in the system – like a pothole in the road that interrupts continuity while also calling heightened attention to the path. To measure distance from a bug's-eye-view could be to embrace a more contingent planet, one comprising assemblages of irregular and shifting surfaces and life-worlds, a landscape perpetually transformed by puddles, volcanic upheavals, erosion, lawn mowers,

construction sites, tire tracks, debris heaps, germinating seeds, extraction, cow pies, harvests, burials, dunes, wars, landfilling, demolition, burrowing bugs, and so on (and-scape on). I'm using 'assemblage' here in the spirit of anthropologist Anna Lowenhaupt Tsing's use of the word, which she takes from Gilles Deleuze's **agencement** and joins in his configuration (2015, p. 293): 'a mosaic of open-ended assemblages of entangled ways of life, with each further opening into a mosaic of temporal rhythms and spatial arcs' (p. 4). The surface of the Earth is pocked with impressions and encrustations, witnesses to the passage of time. The Earth not only records but is formed by its recording, by accumulation, degradation, calamity, serendipity, creativity, erasure, violence. To measure distance from a bug's-eye-view is also to make contact with the planet millimeter by millimeter, and to be more sensitised to its surface and impressions, perhaps even be impressed **by** it.

To make contact with the irregular surface of the Earth close-up from inside one's own body – whether a crawling human body or crawling bug body – is to be impressed upon by the Earth, and I think that impression can lead to a more profound, visceral recognition than can be offered by a map or other representation. For example, one day in summer of 2015, when I was backpacking with a friend through the Indian Himalayas near the border of Tibet, we had to scramble across a huge sloped boulder field (Fig. 1). Based on the distance shown on the map, we estimated that it would take about an hour to traverse, but instead it took over four hours because we had to climb almost entirely on all fours across the relentless ups and downs, and it was impossible to simply step over any of the boulders. I was cut by flaky shards and bruised; scree got stuck in my palms; every now and then came the dermal reprieve of an unexpected patch of moss. Had I not recognised the mountain before this experience? In this crawling encounter, the mountain leapt from the bird's-eye abstraction of the map (Fig. 2) to the granular, granitic body that pushed, punished, dehydrated, and winded me, that struck me with the thought 'What am I doing here?!'; that also pumped me with endorphins and wonder for its enormity, and the anonymity of this or that particular square meter – one that could easily be obliterated by a rockslide – embedded in the larger knownness of the mountain. The mountain I understand while **in** the mountains is wholly different from the mountain projected by the map; being in it and on it, and having it in and on me, being **impressed by** it, transforms my relation to it. 'This is impressive!' I declare as I take in the vista and pick gravel out of my knee-skin.



Figure 1: Artist crossing boulder field in the Himalayas, India, 2015. Photo: Luke Wolcott

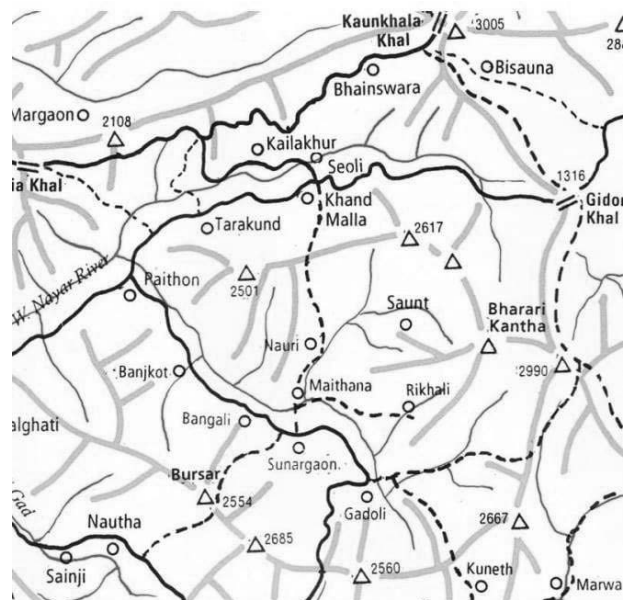


Figure 2: Detail of a not very useful map of Himachal Pradesh (Kalpa-Kinnaur Spiti & Simla) in the Himalayas, India. Leomann Maps

I think about how this confrontation with an irregular Earth surface chimes with intersectional scholar Sarah Ahmed's idea that a surface is recognised through impressions, as exemplified by stubbing her toe against a table leg:

The impression of the table is one of negation; it leaves its trace on the surface of my skin and I respond with the appropriate 'ouch' and move away, swearing. It is through such painful encounters between this body and other objects, including other bodies, that 'surfaces' are felt as 'being there' in the first place. To be more precise the impression of a surface is an effect of such intensifications of feeling. (Ahmed, 2004, p. 29)

She goes on to describe how this intensification through felt encounters with surfaces and other bodies constitutes both the boundary between them and a 'reconstitution of bodily space' of the subject. While my research context does not do justice to the

complexity of Ahmed's research as it extends to feminist theory, critical race theory, queer theory, and postcolonialism, her writing has helped me think through this close encounter with the Earth's surface, the skin of the Earth, as an act of recognition that can reconstitute a bodily space for potential reciprocity.

The impressions we have of others, and the impressions left by others are shaped by histories that stick, at the same time as they generate the surfaces and boundaries that allow bodies to appear in the present. The impressions left by others should impress us for sure; it is here, on the skin surface, that histories are made. (Ahmed, 2004, p. 39)

To crawl along the Earth is perhaps to co-create many small histories and mutual embeddednesses, and to yank the crow's eye right out of our heads – to remove the removed view.

Observing distances as the bug crawls is to thwart any expectation that the Earth is a fixed, unencumbering shell upon which we move. Instead, it recognises the existence of landscapes as complex enmeshments of living and nonliving systems and events. Perhaps a consciousness deepened by this perspective can create a path toward more nuanced and intentioned human-to-nonhuman recognition and reciprocity, and a political resistance to mythic smoothness. Perhaps to acknowledge grasses, bacteria, and even inert rock as all having agency is 'to reimagine human life through a mutually constitutive infiltration of bios and geos' (Yusoff cited in Reinert, 2016, p. 95). In other words, performing actions that recognise the surface of the Earth not as a passive backdrop, but rather as a shape-shifting world of agencies – one that at times slows us down – could help emphasise the relation between humans and landscape as a constant cycle of feedback and change, especially in light of the 'geological turn' of the Anthropocene (Reinert, 2016, p. 96). The Earth is not fixed, and it cannot be fixed by representation or information. If we take on the kinetic practice of measuring distances as the bug crawls, perhaps we will be more productively confronted with the mutability of the Earth that complicates traditional cartography. What qualities of the Earth's surface might **surface** through this action?

4. SITUATED PRACTICES

'Walking thus, hour after hour, the senses keyed, one walks the flesh transparent. But no metaphor, transparent, or light as air, is adequate. The body is not made negligible, but paramount. Flesh is not annihilated but fulfilled. One is not bodiless, but essential body.' – Nan Shepherd, *The Living Mountain*, 1977

Specificity of research (not to be confused here with specialisation) is key to many practices across the arts and sciences (e.g., Haraway, 2016). It is specificity that gives a higher-resolution picture of a situation in the world, and while this often troubles goals of scalability, it opens the door to an assembly of pictures that can allow insight into the whole. I use 'pictures' here as a shorthand for all senses and media, without preference for visuality. Specificity can mean we do not have to count out variables and that we can retain idiosyncratic loose threads, loose dirt, loose narratives – the informal, unplanned, untidy experiences that emerge from kairotic time, that is, narrative time (see Lambotte and Meunier, 2013). In common tendencies to clean up messiness around research (see again Lambotte and Meunier, 2013) – eliminating outlying data, disregarding extraneous variables, wiping mud off our setup, modelling impossible objectivities – in what ways have we oversimplified and abstracted the world **away** from ourselves? What andscapes can be recovered through the specificity of practice, or the specificity of a bug's view?

In Bruno Latour's 2016 lecture at Cornell University, 'Is Geo-logy the New Umbrella for All the Sciences? Hints for a Neo-Humboldtian University', he calls for approaching the Earth as a world that is changing and has been changed by us, in a re-cognition of the planet. He describes this as an 'injunction to rediscover a planet that we thought we knew. This time it is not a novel continent in addition to the land we used to inhabit – as was the case at the time of the European land grab – but the same land whose behavior has become unrecognizable.' He is not suggesting a new colonial frontierism or a quest to find virginal worlds heretofore unknown; his is a call to **look again** at the ground already under our feet, to engage in different, more sensitive modes of observation to study a world we presume to understand but likely hardly know. Thinking alongside Latour, I often consider how we take scientific measurements of the Earth for granted. We agree with the figures presented us, but it is a passive agreement, which may prevent a person from encountering the world on their own terms. Referring to the critical zone network, Latour writes that 'the scientists I follow seem literally to discover a new planet, each locality having its own idiosyncrasy' (Latour, 2016, p. 4). It is this idiosyncrasy as a quality of andscapes that I wish to discover when measuring distances as the bug crawls.

This idea of situatedness emphasises a non-universality while also recognising an implicit wholeness of the planet, ala James Lovelock and Lynn Margulis's famous Gaia hypothesis, which describes 'the biosphere and all of those parts of the Earth with which it actively interacts to form the hypothetical new entity with properties that could not

be predicted from the sum of its parts' (Lovelock and Margulis, 1974, p. 3). The Gaia hypothesis was anticipated by Alexander von Humboldt's realisation, while climbing the brutal slopes of Chimborazo in 1802, that 'everything was interwoven with "a thousand threads", that "nature is a living whole" [...] not a "dead aggregate"', and that there is 'unity in variety' (Wulf, 2015, pp. 87–88). Likewise, the andscape of the critical zone is steeped in many fluxing timelines, processes, and worldings, and is certainly more than the sum of its parts. In her memoir *The Living Mountain*, an intimate reflection on her lifetime of walking the Cairngorm mountains in Scotland, writer and poet Nan Shepherd wrote of that landscape: 'Knowing another is endless. The thing to be known grows with the knowing' (Shepherd, 2019 [1977], p. 108). To move from the crow's view to the bug's is to heighten intimacy with the planet's surface, to render that surface that we might assume to be finite and smooth into one that expands with every re-cognition of its limitless texture, both spatial and temporal.

5. THE PROBLEM WITH TEMPORALITY

Just as Prominski's term 'andscape' seeks to blend the boundary between nature and culture, this essay seeks in part to trouble the presumed distinction between a mythological scientific objectivity and the subjectivity that is intrinsic to all empirical measurement. One essential variable for making this trouble is time. In her book *Timefulness: How Thinking Like a Geologist Can Help Save the World*, geologist Marcia Bjornerud points to 'time denial' as one failure of understanding in our approach to the world in the Anthropocene. According to Bjornerud, the academia of the natural sciences

privileges certain types of inquiry ... owing to their quantitative exactitude. But such precision in characterizing how nature works is possible only under highly controlled, wholly unnatural conditions, divorced from any particular history or moment. [These sciences] are pure in being essentially atemporal – unsullied by time, concerned only with universal truths and eternal laws. (Bjornerud, 2018, p. 13)

Bjornerud's project foregrounds the **timeful** science of geology, which concerns not just **chronos**, time as an abstract variable, but also **kairos**, time as narrative and embedded in many stories, as an essential organising principle (Bjornerud, 2018, p. 26). She contends that geology's acceptance of messiness – which I see as embedded in the field's own psycho-geological terminology, from 'shifting divides' and 'unconformities' to 'incompetent rock', 'defeated streams', and 'swelling weirdsma' (McPhee, 1981, pp. 31–32) – can be a model for our thought: Indeed, it may be the only way forward

in understanding the planet's past and imagining its possible futures, not least our human place, our **situatedness**, in deep-time stories. But is it even possible to attain this big picture, or are we just paddling up a 'defeated stream'? If scientific inquiry is essentially a large-scale project to map human knowledge of the Earth (and galaxy and universe and beyond), this territory in which we live, what are the limits of this giant map?

Jorge Luis Borges's short story '*Del rigor en la ciencia*' (1946) – fictionally attributed as having been written by Suárez Miranda in 1658 – comes to mind as one possible answer. Typically translated as 'On Exactitude in Science' (Borges, 1998, p. 325), the story's title can be more literally rendered 'On Rigor in Science'. In the story, cartographers attempt to construct a one-to-one map of a fictional empire, but the map is eventually rendered 'useless' not just **in** time, but **by** time:

... In that Empire, the Art of Cartography attained such Perfection that the map of a single Province occupied the entirety of a City, and the map of the Empire, the entirety of a Province. In time, those Unconscionable Maps no longer satisfied, and the Cartographers Guilds struck a Map of the Empire whose size was that of the Empire, and which coincided point for point with it. The following Generations, who were not so fond of the Study of Cartography as their Forebears had been, saw that that vast Map was Useless, and not without some Pitilessness was it, that they delivered it up to the Inclemencies of Sun and Winters. In the Deserts of the West, still today, there are Tattered Ruins of that Map, inhabited by Animals and Beggars; in all the Land there is no other Relic of the Disciplines of Geography. – Suárez Miranda, *Viajes devarones prudentes*, Libro IV, Cap. XLV, Lérida, 1658

It is not the future time of subsequent generations that renders the map obsolete: Even as the map of the empire was being constructed, its accuracy decayed with every day, hour, minute, and microsecond that went by. The map was unmade by its own making. Landscapes in real time simply are that unstable, which makes them absolutely incompatible with a 'true' map (see also Eco, 1994). By the end of Borges's story, the map is 'inhabited by Animals and Beggars' – and so the map itself becomes absorbed into the existing territory shared by multiple species and human strife, assimilated into the existing assemblage and incorporated into its **andscape**. Time at all scales – not least seasonal 'Inclemencies of Sun and Winters' – makes **exactitude in science** an impossible project. Though **rigor in science** is perhaps more attainable. After all, we can still be rigorous while never arriving at exactitude.

6. THOUGHT EXPERIMENT: A CORN FIELD AS THE BUG CRAWLS

Building on the approaches of these past artworks, what might measurement tell us about the Earth if we adopt a different frame of reference, such as a bug's? In a recent hypothetical experiment, I investigated distance across a landscape as the bug crawls. To reproduce some of the two-dimensionality and smoothness of a map in order to foil it, I chose to measure a famously flat landscape – Iowa State in the US. Visiting the Iowa Hall ('a 500-million-year adventure through Iowa's geological, cultural and ecological history') at the University of Iowa Museum of Natural History in 2019, I learned that not only is Iowa's landscape **not** mountainous, but it has **never** had mountains, for as long as there have been continental plates. This makes it geologically unique: It is flat not only in space but also across time. And its flat terrain is made metaphorically flatter by being covered in mono-agricultural corn fields. My hypothetical case study is an easily imagined acre of what is known as simple 'field corn'. Iconically, and perhaps ironically, the corn field is the traditional home of a figure that might serve as the bug's sidekick in this essay: the scarecrow. A field with a scarecrow in it is the one landscape that cannot be measured 'as the crow flies': It forms a no-fly-zone for covid cartographies, requiring an alternative frame of reference.

For this measuring project, my question was simple: How long would a straight line through an acre of Iowa corn be as the bug crawls? I measured first by using standard conversion formulae and mathematical averages (figures from the Iowa Agriculture Literacy Foundation, 2019):

1 square acre = 4046.86 square meters = 63.6 x 63.6 meters

The length of one acre as the crow flies = 63.6 meters

Corn is planted in rows on average 26.5 inches apart, or 67.3 cm apart = 0.673 meters

Per square acre in Iowa, there is an average of 30,000 corn plants

On average, there are 94.5 rows of corn plants per acre, which means 317.5 corn plants per row.

Average height of a fully grown corn plant = 2.4 meters

If a bug crawls from one end of an acre of a corn field to another along a single row of corn, it will have to travel the vertical distance up and down every corn plant, plus the horizontal distance of the acre. Of course, there are further fractal qualities of each corn plant, which would make the distance travelled by the insect even longer. But for the sake of simplicity, I considered the overall plant heights only.

Number of corn plants per row x corn plant height (x 2) + length of one acre =

$317.5 \times 2.4 \text{ meters} (\times 2) + 63.6 \text{ meters} =$

The length of one acre as the bug crawls = 1524 meters

Comparing the distance as the bug crawls to the same distance as the crow flies, the difference comes out to 1460.4 meters! Next I extrapolated from the length of this Iowa corn-field acre (which is some of the flattest land in the world, meaning its surface roughness is relatively modest) and adjusted for the circumference of the entire Earth.

The length of one acre as the crow flies = 63.6 meters

The circumference of the Earth as the crow flies = 40,007.863 km = 40,007,863 meters

The length of one acre as the bug crawls = 1524 meters

If the Earth were 'flattened' to the level of Iowa corn fields, the circumference of the Earth as the bug crawls would be 958,588,397.48 meters. Next, adopting the aforementioned formula for determining the standard length of the meter – one ten-millionth of the distance between the geographic North Pole and the Equator – I calculated a revised length of one meter as the bug crawls:

The length of one meter as the bug crawls = 23.96 standard meters

One meter as the bug crawls, then, would be 23.96 times longer than the standard meter as we know it.

7. PRACTICAL EXPERIMENTS: FIGURING EARTH WITH ANDSCAPES AND ANDMETERS

Following the corn-field thought experiment, I moved to a practical investigation, making 11 meridian measurements across 11 landscape samples in Berlin, Germany, and in Iowa City, USA. For each, I selected surface line segments in the landscape – mostly exterior, some interior, ranging in length from 1 millimeter to 10 meters – and measured them in such a way as to account for both their roughness and temporality in their overall distance. The 11 individual methods range from measuring with my own body (thumbs, hands); to measuring with sensors and scanners; to measuring with drawing and printing techniques; among others. With these widely varying methods, I demonstrate how different surfaces render different results, as well as how different methods and times of measurement generate wide variability. I have collected my data in a growing archive of sample **meridians of specificity**, which together compose an alternative, ever-changing, never-finished, heterogenous (anti)map of the Earth. Brought together, the data can never arrive at an average that could inform a standard, but instead provoke a confrontation with paradoxes of scale when attempting to measure landscape.

A main goal of astronomers and cartographers is to determine 'the figure of the Earth', a term of art in geodesy that refers to the measurements we use to model Earth (itself a unit against which other celestial bodies are measured). In this phrase, the Earth is unwittingly bodied; in my practice, I meet this embodiment with my own, returning units of measure to the multitudinous specificities of body, landscape, and time. I am **figuring Earth**.

For each of these meridian samples, I have extrapolated a revised meter (which I call an 'andmeter') based on the specificity of each segment, and thereby calculated many 'new' circumferences of the Earth, using the original meter formula and multiplying each andmeter value by ten million, arriving at the distance around one quarter of the Earth, then multiplying that number by four to find the distance around the whole Earth. In this way, my subjective, highly contingent evaluations of distance are plugged into the 'objective' equation for distance, revealing the arbitrary assumptions that empirical cartography and metrology make when attempting to quantify space and matter. Metrology mainly seeks to establish absolute, atemporal quantifications of the world: I aim to play with those premises to produce new ways of knowing.

7.1 The 'andmeter'

I propose the 'andmeter' as an alternative unit of measure. The andmeter does not represent a fixed, numerable quantity, but rather a fluid perspective on measurement as constantly being redefined every time a new method, subject, and timeframe is introduced. As the word construction suggests, the andmeter is a meter **and**. Like the andscape, the andmeter holds additive space for environmental and media contingencies. It defies reduction and standardisation.

When the andmeter is used in a practical setting, it takes on the function of a split prefix-suffix, sandwiching the terms of a given measurement's contingencies. This can be as simple as, for example, a single-factor method, such as measuring a tree by hand lengths. The andmeter for that situation is simply an 'and-hand-meter'. The andmeter construction also leaves room for describing more layered, multi-media methods, such as is contained in the 'and-circles-and-scan-and-monotype-and-plaster-meter'.

Andmeters are for measurements made specifically on the ground, in contrast to the usual aerial measurements. Distances between places on Earth are most commonly determined **as the crow flies**. In the phrase 'as the crow flies', the use of 'the' instead of 'a' is telling – 'the' suggests one master Crow that subsumes all other crow perspectives; it is THE perspective. My andmeters are determined by methods such as 'a line of thread traces pigment that marks a water surface'. The intentional use of

'a' in all my method descriptions suggests each object and situation is one of many possible objects and situations, with no standardising authority.

The following figures (Figs. 3–13) show the working objects I made and used to find andmeters for the 11 meridians I chose to examine. More in-depth descriptions are not possible in the scope of this paper.

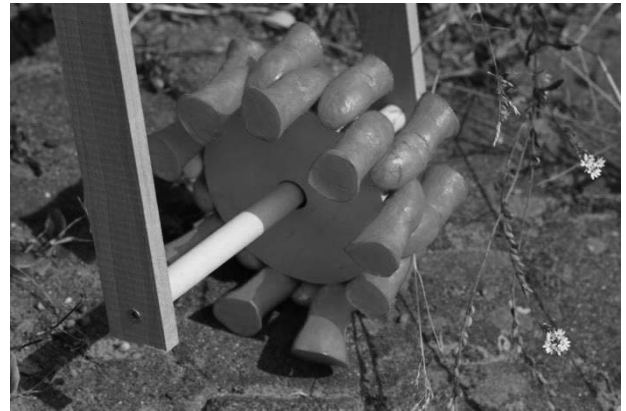


Figure 3: Rule of Thumb, 2021. A sidewalk measured as cast thumbs press along bricks, to define the 'and-thumb-cast-meter', which is equal to 1.0101 standard meters. Photo: Elizabeth McTernan



Figure 4: Map of Moving Water, with Duck Disturbance, 2021. Moving water measured as a ruler measures a line of thread that traces pigment that marks a water surface, to define the 'and-ruler-and-thread-and-pigment-meter', which is equal to 1.0224 standard meters. Photo: Elizabeth McTernan

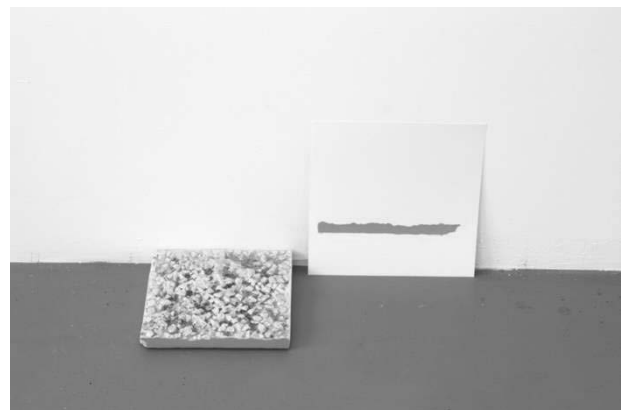


Figure 5: Tarmac Textures for Smooth Sailing, 2021. Tarmac measured as circles divide a digital scan of a monotype print of a plaster cast, to define the 'and-circles-and-scan-and-monotype-and-plaster-meter', which is equal to 1.0333 standard meters. Photo: Elizabeth McTernan

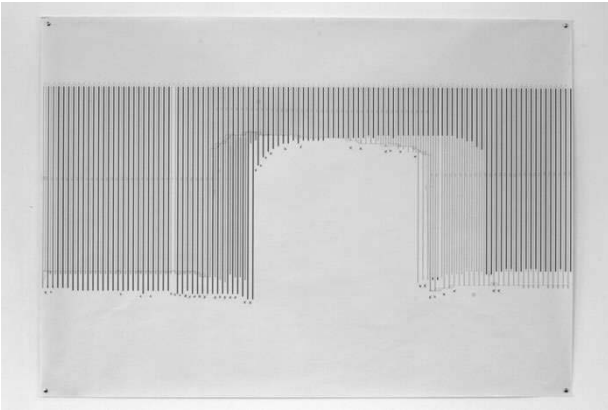


Figure 8: Paper Edge Coastline, 2021. A torn paper edge measured as a compass and crayon trace a microscopic photograph, to define the 'and-compass-and-crayon-and-microscopic-photograph-meter', which is equal to 3.6000 standard meters. Photo: Elizabeth McTernan

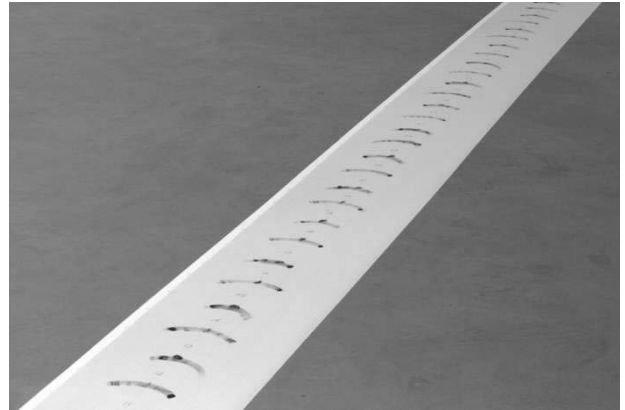


Figure 6: Sounding Landshapes (Cube), 2021. A paper cube measured as trigonometry calculates hypotenuses of data distances generated by an ultrasonic sensor, to define the 'and-trigonometry-and-hypotenuses-and-data-and-ultrasonic-sensor-meter', which is equal to 1.1573 standard meters. Photo: Elizabeth McTernan



Figure 9: A Tree Measured by Hand, 2021. A dogwood tree measured as a left hand pivots along branches, to define the 'and-left-hand-meter', which is equal to 12.3485 standard meters. Photo: Elizabeth McTernan

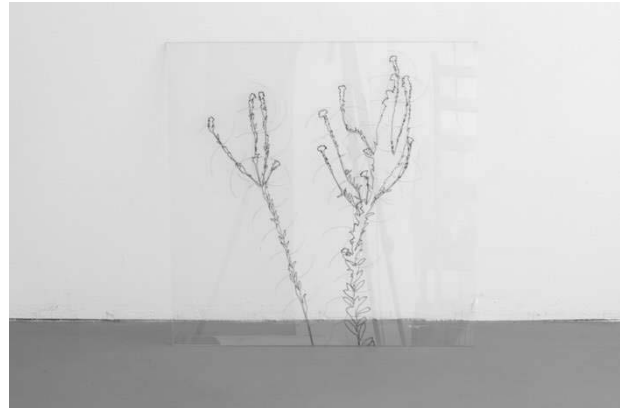


Figure 7: Meter Stick to Measure a Moment in Time (28 January 2020, 50°58'33 N 11°19'44° E), brass, 2021. A crumpled piece of paper measured as a ruled line traces a photogrammetric scan, to define the 'and-ruled-line-and-photogrammetry-meter', which is equal to 1.4368 standard meters. Photo: Elizabeth McTernan

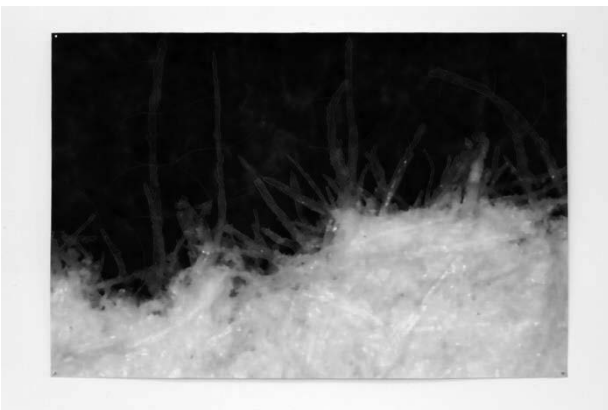


Figure 10: One Botanical Moment, 2021. Wildflowers measured as a compass passes over an ink tracing on plexiglas, to define the 'and-compass-and-ink-and-plexiglas-meter', which is equal to 28.6689 standard meters. Photo: Elizabeth McTernan

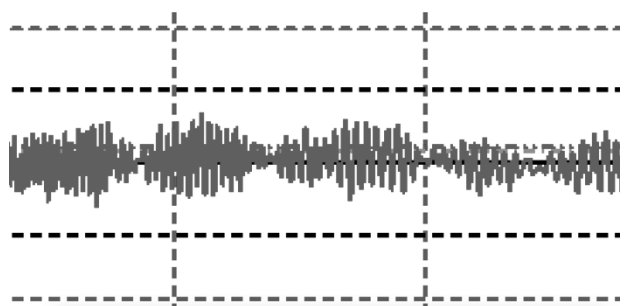


Figure 11: This Glass Is Science-Smooth, 2018. Laboratory glass measured as a graph shows a Zeiss Surfcom 1500 rolling, to define the 'and-graph-and-Zeiss-Surfcom-1500-meter', which is equal to 37.2000 standard meters. Image: Ina Holfelder



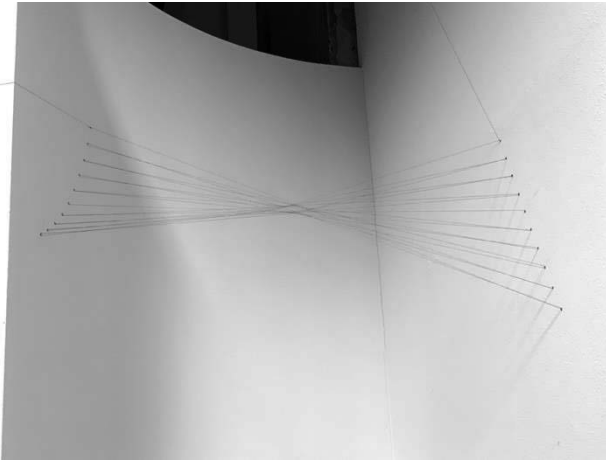


Figure 12: Rough Sees (Projected Painting Surface Length), 2020. A painting measured as a silk thread expresses a MCAx laser scan, to define the 'and-silk-thread-and-MCAx-laser-meter', which is equal to 100.8367 standard meters. Photo: Elizabeth McTernan

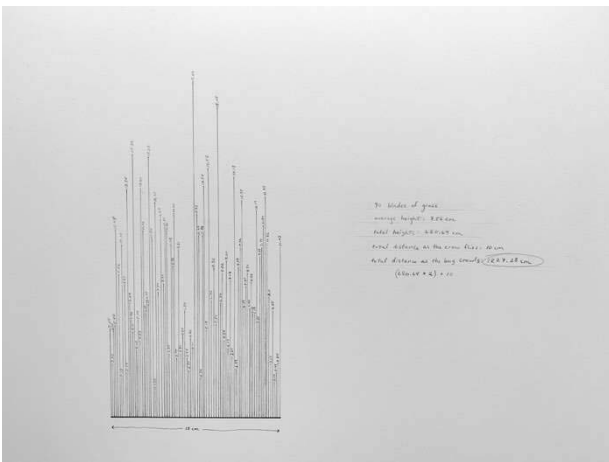


Figure 13: Measuring a Mountain Range of Grass, 2020. A lawn measured as a ruler measures pencil lines, to define the 'and-ruler-and-pencil-meter', which is equal to 122.728 standard meters. Photo: Elizabeth McTernan

7.2 Alternative Earth-circumferences

Equipped with the resulting ratios between standard meters and the newly concocted andmeters, I have made visualisations of Earths of varying roughnesses based on the roughness indices of each of the 11 cases (see Figs. 14–24). They are meant as playful alternatives to the representation of Earth as a perfectly smooth sphere whose circumference is measured as the crow flies.

To make digital drawings that would visualise the various roughnesses created by the alternative Earth-circumferences, I decided to use a program that would employ algorithms and interpolations between data to generate landscape-like textures around Earth-like circles that would reflect the data I had collected. For the outline of each 'rough' Earth, I also chose a colour that would in some way

signal the visible surface of the subject being measured.

The following are the roughness factors for each alternative Earth-circumference, from least rough to most rough: 1) 1.0101x, 2) 1.0224x, 3) 1.0333x, 4) 1.1573x, 5) 1.4368x, 6) 3.6000x, 7) 12.3485x, 8) 28.6689x, 9) 37.2000x, 10) 100.8367x, 11) 122.7280x.

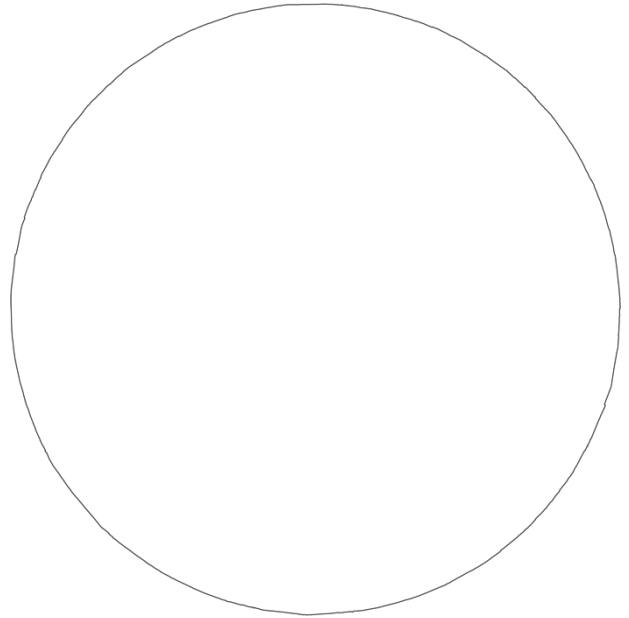


Figure 14: Measured as cast thumbs press along bricks, generating an alternative Earth-circumference that is 1.0101x the Earth's recognised circumference.

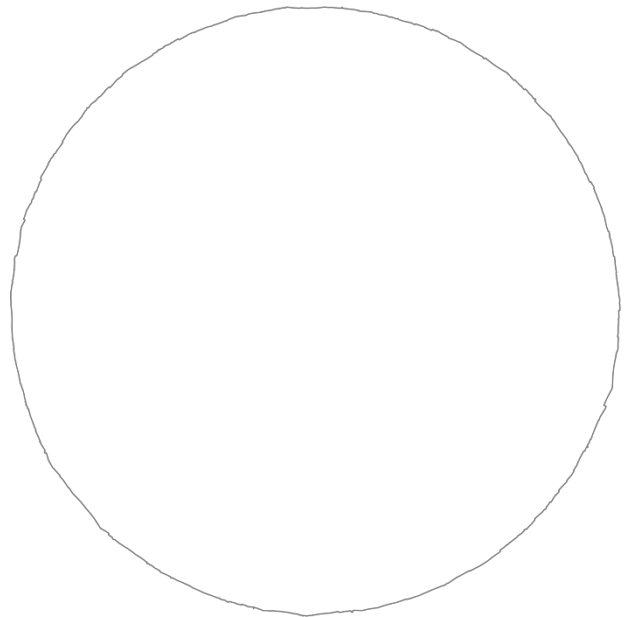


Figure 15: Moving water measured as a ruler measures a line of thread that traces pigment that marks a water surface, generating an alternative Earth-circumference that is 1.0224x the Earth's recognised circumference.

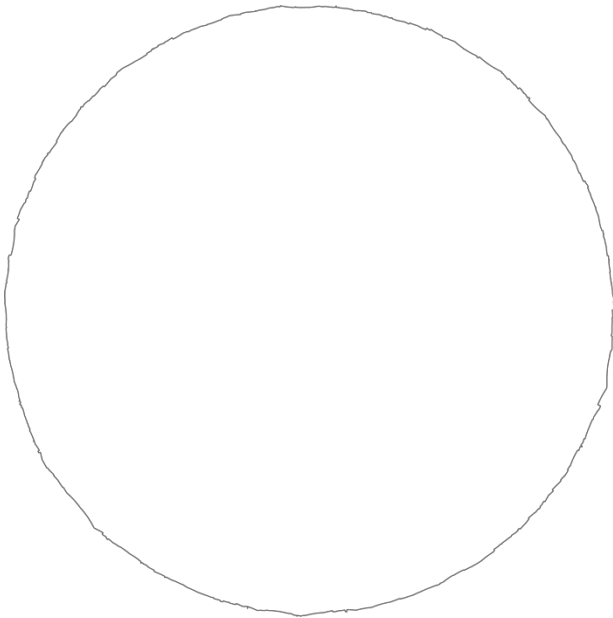


Figure 16: Tarmac measured as circles divide a digital scan of a monotype print of a plaster cast, generating an alternative Earth-circumference that is 1.0333x the Earth's recognised circumference.

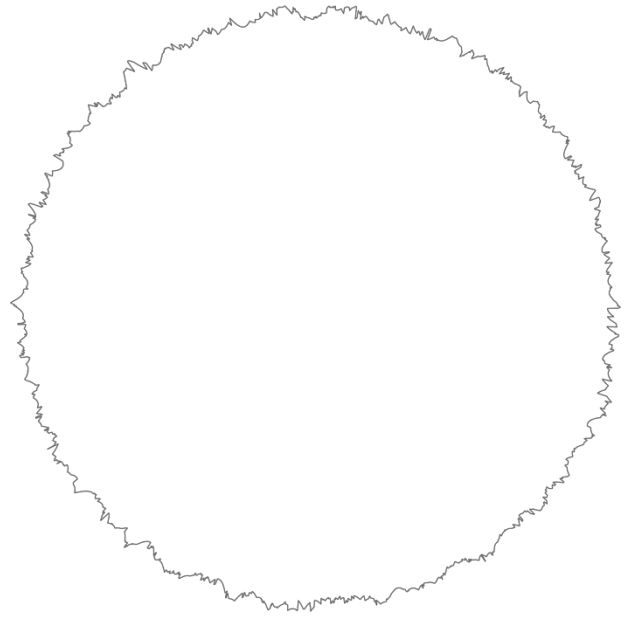


Figure 18: A crumpled piece of paper measured as a ruled line traces a photogrammetric scan, generating an alternative Earth-circumference that is 1.4368x the Earth's recognised circumference.

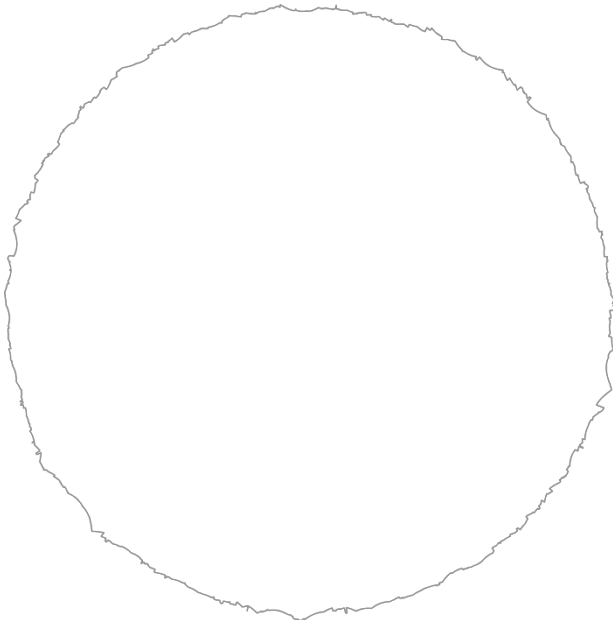


Figure 17: A paper cube measured as trigonometry calculates hypotenuses of data distances generated by an ultrasonic sensor, generating an alternative Earth-circumference that is 1.1573x the Earth's recognised circumference.

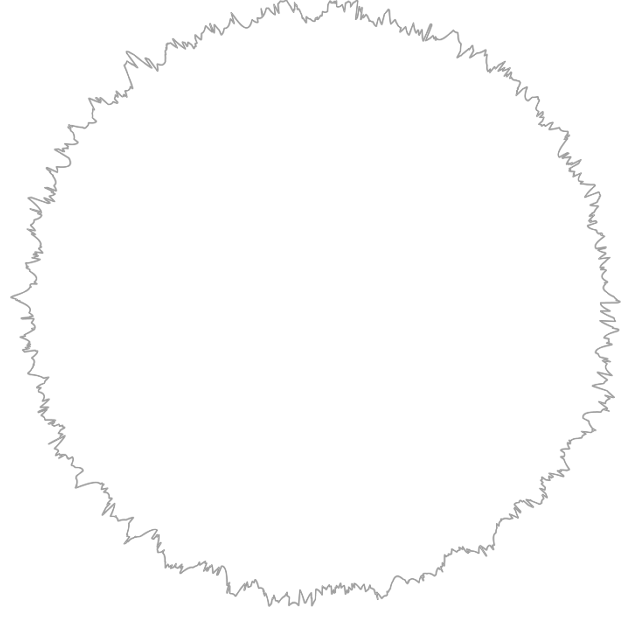


Figure 19: A torn paper edge measured as a compass and crayon trace a microscopic photograph, generating an alternative Earth-circumference that is 3.6000x the Earth's recognised circumference.

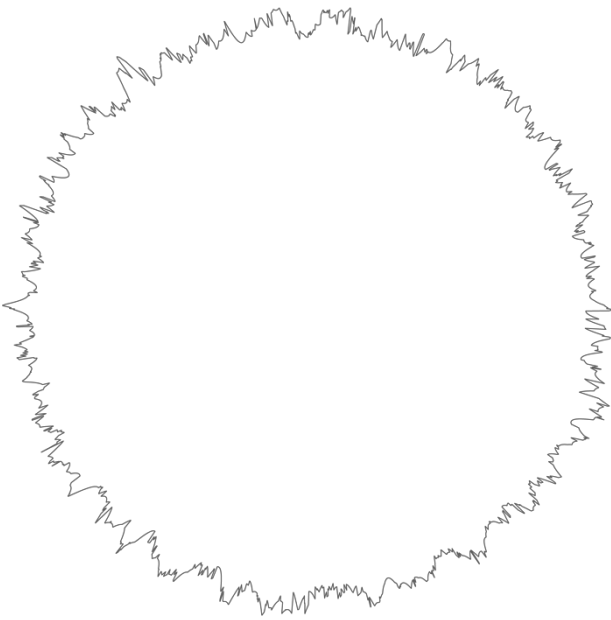


Figure 20: A dogwood tree measured as a left-hand pivots along branches, generating an alternative Earth-circumference that is 12.3485x the Earth's recognised circumference.

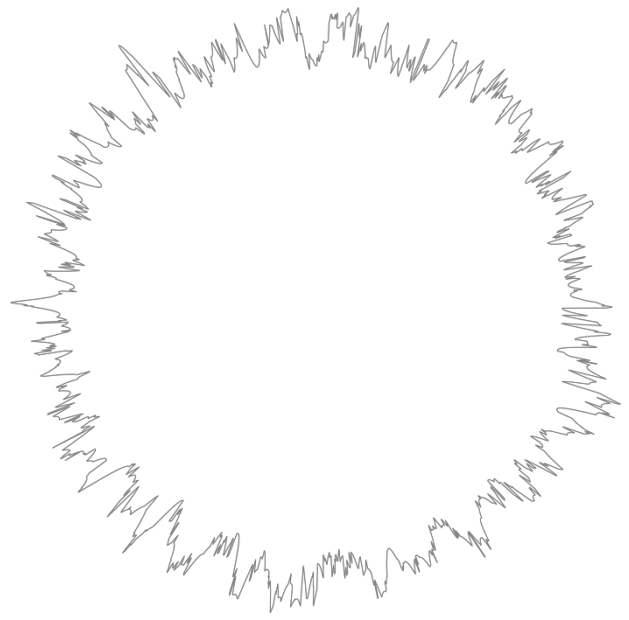


Figure 22: Laboratory glass measured as a graph shows a Zeiss Surfcom 1500 rolling, generating an alternative Earth-circumference that is 37.2000x the Earth's recognised circumference.

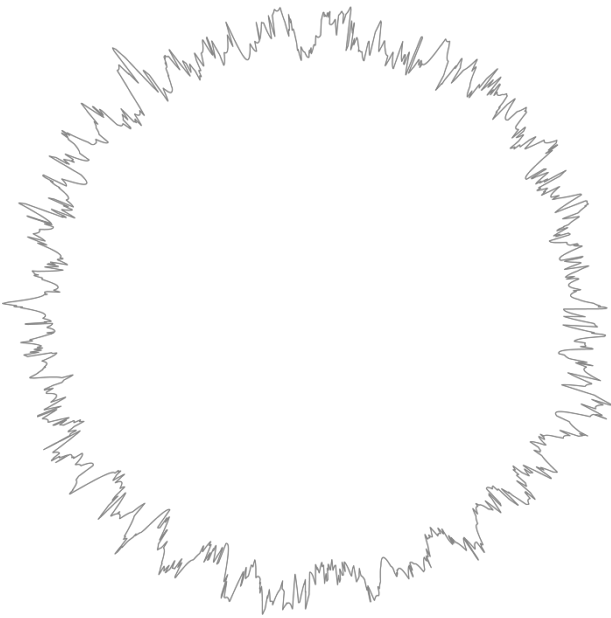


Figure 21: Wildflowers measured as a compass measures an ink tracing on plexiglas, generating an alternative Earth-circumference that is 28.6689x the Earth's recognised circumference.

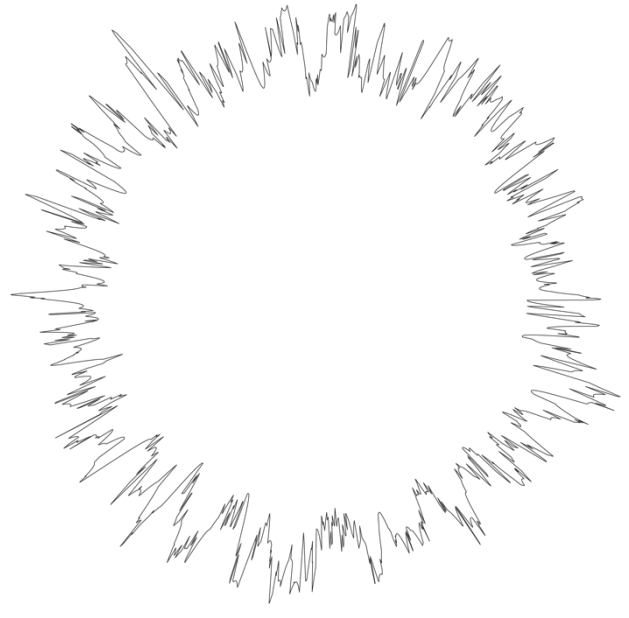


Figure 23: A painting measured as a silk thread expresses a MCAx laser scan, generating an alternative Earth-circumference that is 100.8367x the Earth's recognised circumference.

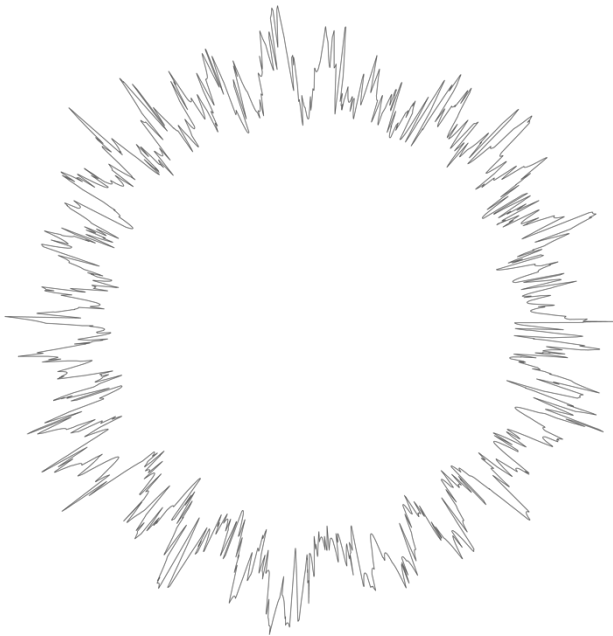


Figure 24: A lawn measured as a ruler measures pencil lines, generating an alternative Earth-circumference that is 122.7280x the Earth's recognised circumference.

10. CONCLUSION: GIVING DEPTH TO SURFACE. GIVING TOOTH TO ANDSCAPE

To examine the surface of the Earth from small-scale surficial perspectives, whether a bug's or a human's, is to confront its roughness, which is an index of difference – of change and conflict, of creation and nurturing. In this roughness we also meet resistance: physical resistance, the kind that gives the andscape tooth in relation to its occupants; and political resistance, the kind that acts in opposition to the smoothness of informational and capital flows, and generalised models. Meeting the Earth's surficial resistance in artistic practice could allow us to get caught on the world, to linger, to stay with it instead of being flung into outer space by a simplified abstract view – in Haraway's phrase, to **stay with the trouble**.

The bird's-eye-view and the bug's-eye-view and the human's-eye-view and the boulder's-eye-view and the pebble's-eye-view and the tree's-eye-view and the algae's-eye-view (where 'eye' is just another way of saying 'window of experience', regardless of sensorium), not to mention the medium's-eye-view – the pencil's, the pixel's, the plaster's – all feed into an assemblage of perspectives that make up the andscape and that counter scalability. Meanwhile, our abstractions of the world are infinitely scalable – whether by minds or by math or by digital space – and can be brought into a productive tension with the rough Earth. Just as all living and nonliving perspectives and systems overlap and shape each other perpetually over space and time, so too can abstraction become part of the andscape manifold, fleshing out the perspectives lived in our flesh.

To return to the original questions of this work, what might be learned about a landscape if we measure its distance from a more surficial, earthbound perspective? What temporalities and qualities of the Earth's surface might **surface** through this action? The attempt to scale up alternative circumferences of the Earth, based on distances determined by entangled-media perceptions of a variety of surfaces, filtered through the mind of one human thinking about a bug, is indeed an absurd gesture. It is not meant to fix facts, but to trouble them. These wildly diverging figures of Earth do not have to be disqualified for their non-universality and infinite incompleteness, but instead can each be welcomed into the assemblage as one more specific perspective that **makes up** – as in both **constituting** and **inventing** – the picture, that makes up the world. By multiplying measurements, I would like to tell the multitudinous stories that make up assemblages as such, to help think our relatedness and many relations with and within the andscapes we inhabit.

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Love Me to Death: A Performative Ritual with Rats

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Rat and human populations inhabit the same space. Rats as a species have been given different kinds of classifications, from lab and fancy rats to pests and even circus animals. The sociozoologic scale ranks humans higher than other animals within a structure of meaning that allows humans to define, reinforce and justify their interactions with other beings (DeMello, 2012: 51). Humans have labelled rats within roles that can be both good (e.g., pets and lab rats, thus useful) and bad (e.g., pests that spread diseases, thus harmful).

I argue that the spreading of diseases, such as the plague, has been one of the reasons why humans have a controversial relationship with rats, causing them to be despised. Rats, like humans, may have multiple identities. I propose that by imagining their perspectives empathetically, humans can look at rats as beings from which humans can learn. I attempt to situate rat–human controversies and their multiple relations within the era of ecocide which is environmental destruction due human actions. How could the idea of the rat be better understood within the human community, and what could this idea reveal about humans themselves? How are rats metaphorically scapegoated for human troubles, and could this metaphor be a symbol representing the relations humans within ecosystems in general? How can these questions be emphasised in a performance in the context of art?

Rat. Interspecies. Performance. Ritual. Art. Death. Ecocide.

1. INTRODUCTION

The narrative of rats spreading the plague during the Black Death (1347–1353) and the Second Pandemic (14th–19th centuries CE) has existed for a long time. It was believed that fleas on rats infected humans with plague and resulted in the deaths of millions in Europe. The plague is a painful disease caused by *Yersinia pestis* bacteria. It is divided into two types: bubonic and pneumonic. The bubonic plague is the one spread by rats and especially, the bites of their fleas (Dennis et al., 1999). The plague has been extensively described in various art forms, such as novels, movies and operas. Both real accounts and fictional stories have reinforced people's fears about rats. For instance, Albert Camus' famous 1947 novel *The Plague* describes how the bubonic plague broke out in the Algerian town of Oran when the rats of the town started to die. The novel became a bestseller again in 2020 during the COVID-19 pandemic (Flood, 2020).

Recent research suggests that, rather than rats, the plague was more likely spread by the human ectoparasites, such as fleas and lice, which were

easily transmitted during the time of the historical plague (Dean et al., 2018).

However, rats do carry different kinds of pathogens, such as *Yersinia pestis*, which is dangerous for humans even today and can directly cause the disease. Single cases of the bubonic plague appear every now and then in areas where people come into contact with animals carrying *Y. pestis* bacteria. Rodents can also spread hantavirus, Lassa fever, leptospirosis, salmonellosis, etc. (NCEZID, 2017). However, rats do not seem to suffer from the many pathogens themselves. Instead, they seem to have even developed resistance to rodenticidal chemicals through genetic mutations (Meerburg et al., 2014).

It seems that rats need to somehow be beneficial to humans to escape their role as hated misfits. For instance, landmine scent-detecting rats (African giant pouched rats) trained by the Anti-Personnel Landmines Detection Product Development (APOPO) work in countries like Tanzania, Angola, Cambodia, Mozambique and Ethiopia to remove dangerous mines in previous war zones. The APOPO also trains rats to smell tuberculosis from

samples taken from humans (APOPO, 2019). In the areas where the APOPO works, locals have started to respect rats compared to when they were considered as just pests (Oswald, 2008). This could be the case with lab rats as well, but they do not necessarily come into contact with the public in the same way as mine-sensing rats. Pet rats may also change the perspectives humans have towards rats. They can also be considered useful and serve humans under their ownership.

In the art context, rats are presented in different ways. For example, the pest perspective is described in *The Pied Piper of Hamelin*, where the piper lures the rats out of town to drown in the river. The legend dates back to the Middle Ages, but was made famous by the Brothers Grimm, among many others. More contemporarily, when looking at, for instance, urban street art, rats living on the streets have been painted on urban walls as society's misfits by French graffiti and stencil artist Blek le Rat (Street Art Bio).

1.1. Rat Complexity

In this paper, a possible point of view of the complex roles of a rat is explored by engaging in artistic research through a rat character developed for a performance or a performative ritual as part of the Hybrid Lab Network's Learning Teaching and Training Activity workshop called *Alive Together I: Human/Animal Relationships in Crisis?* (Anon, 2020). My character in the performance was the Rat of Death.

The aim of the Rat of Death character was to shift the complex, negative human–rat relationship by imaging the rat's perspective through gentle anthropomorphism, scientific knowledge and empathy. The larger setting of the performance included other rat characters, such as a lab rat, holy rat, pet rat and liminal rat, which represent the multiple identities, roles and relationships rats have with humans. As the developer of the Rat of Death character, I focused on the perspective of this character in this paper.

Rats have different kinds of relationships with humans, and instead of searching for a single true human–rat relationship, it might be better to approach the multiplicity of relations as situated practices that Koen Beumer (2014) defines as 'practical and precarious accomplishments that take place in specific settings' (8).

The performance can be considered an emphatic, secular ritual in search of a rat's point of view and the learnings they might have for humans. In this ritual, it becomes apparent that rats can also symbolise other-than-humans that are blamed for the effects humans are suffering as a result of ecocide. In this case, I refer to ecocide as the destruction of the natural environment by deliberate

or negligent human action. The term originates from bioethicist Arthur Galston's concept related to the destruction of the environment, mainly in war zones (Travis, 2016). I consider it an umbrella concept for human-caused (eco)catastrophes, such as climate breakdown, loss of biodiversity and excessive use of natural resources, that have led to social injustice and genocide. In this situation, what if the rat talks back?

2. FALLING FOR RATS

Excerpt from Rat of Death

Your black fingerprints all over my image

<what is your morality>?

What is your care?

Just like your own sick,

you stigmatise me.

Despise me.

You leave the ill

The illness.

It doesn't fit the image of fitness.

You need someone to blame

Cows.

Homos.

Chinese.

Me.

And you blamed me.

In the workshop, the group I participated in as an artist was named *RatHum*. The group's participants included animal behaviour researcher Sophie Brajon, sociologist Verónica Policarpo, project manager Vaibhavi Chavan and anthrozoologist Kris Hill. The group's goal was to develop interdisciplinary approaches to human and other-than-human relationship research. First, the group, along with the other groups in the workshop, shared skills across disciplinary practices to develop both individual and shared understandings of human and other-than-human relationships. There were different kinds of lectures and exercises led by course leaders, artist Louise Mackenzie and animal ethologist Anna Olsson, as well as guest speaker artist Maja Smrekar.

In our individual group work, we decided to look into the ideal types of other-than-humans. The ideal type

in this case refers to Max Weber's thinking, where he stresses that an ideal type describes a phenomenon, or in our research a rat, by emphasising its essential characteristics and leaves out those characteristics which are not important (Kim, 2020). This does not mean a perfect or average type but a description that does not exist in reality. An ideal type not only affirms the subjective nature of scientific knowledge, but also demands that the researcher be self-consciously subjective.

I proposed for a rat to be the other-than-human animal we investigate because rats live in very close proximity to humans and are involved in many aspects, controversies, identities and relations to humans. The group concluded that the ritual invoking of the 'ideal type' and using the embodiment of different individual rats would be the method of our interdisciplinary, animal-behavioural and artistic research. For instance, Sophie Brajon had worked as a scientist with laboratory rats, Kriss Hill had experience in researching pets and Vaibhavi Chavan knew about how rats were worshipped in Hindu culture. Each member of the *RatHum* group looked closely into their chosen rat type and discovered their habitats, behaviours, cultures and histories to finally embody the rat. Based on the research findings, each wrote a presentation text or bio for their rat characters. It was clear to all the group members that we could not truly experience the world from the perspective of a rat, simply because we are not rats but humans. Instead, we were interested in creating an emphatic performance or a performative ritual that could possibly reveal something about rats and humans using the tools of imagination and species-specific knowledge in our practices.

A liminal rat played by Verónica Policarpo and the Rat of Death were the most transcendent in relation to the other rat characters. As Policarpo describes her liminal rat character, 'He is not defined by any use value. He is not defined by any function. What he is, is not an essence, but **movement or change**; he moves **in space and territory**, and he deterritorializes our notion of a rat'. Similarly, the Rat of Death is more of a concept of a rat than a role, identity or use for humans. The Rat of Death represents the carrier of diseases or someone humans look for to blame for their miseries. From a human perspective, these kinds of rats could also be considered "bad animals" that resist being used by humans and do not fit into their human-defined proper place.

The Rat of Death character was developed in contrast to other characters as a pest and disease spreader. Essentially, it has only negative value for humans. This is the case for many other-than-human animals as well; for example, one theory is that the current COVID-19 pandemic started from bats (El-Sayed and Kamel, 2021). Arguably, these

questionable theories and stories have an effect on the human and other-than-human relationship, also in the case of rats.

Still, it is valuable to take into account that humans play an important role in the development of zoonosis diseases, which are infectious diseases that move from other-than-humans to humans (Gibb et al., 2020). Anthropogenic change and loss of biodiversity have enabled the spread of zoonotic diseases as rodents and other host species spread to new areas due to the effects of global warming (Gibb et al., 2020). Rich biodiversity was considered an enabler of zoonotic diseases, but more recent studies have shown that if humans live in a biodiverse environment, it protects them from diseases (Keesing and Ostfeld, 2021). This results from what is called the dilution effect, where a greater number of species in diverse communities dilute the impact of host species that thrive when diversity declines. Additionally, the density of the human population plays an important role in the spread of zoonotic diseases, and it is not only one species that hosts pathogens, but the whole ecosystem should be considered (Keesing and Ostfeld, 2021). Through the Rat of Death character, it was possible to switch the perspective from humans blaming rats to considering the impact of human activities on this planet when we live in unbalanced ecosystems.

The Rat of Death (Figure 1), which I developed, was inspired by the Angel in the *Angels in America* miniseries of Tony Kushner's play (Nichols, 2003). The images, videos and props I prepared for *RatHum* helped me to tune into the character and change it from a mere pest to something divine. I used images of both contemporary and historical imaginations of the plague, such as Hugo Simberg's (1896) well-known painting *Garden of Death*, in the background. Similar to the Rat of Death character, *Garden of Death* combines negative and positive notions of death with a humorous twist.

Excerpt from a human profile linked to Rat of Death:

Your role in RatHum is to be a person who died in plague, Black Death, which was most likely spread by the black rats' fleas. How would you feel about the rats in this situation: your life drawn out of you, your fingers, toes and possibly other body parts turning black and finally, dying a horrific death of suffocation? Would you have something to say to the rat? Maybe you can also listen to Bruce Springsteens's 'Streets of Philadelphia' to get in the mood.

The participants were encouraged to ask questions about the rats based on short texts, such as the one above, that described their profiles. Thus, the main parts of the performance were the presentations of each individual rat character and the following questions asked by the participants or the audience.



Figure 1: *RatHum* performative ritual online, Mari Keski-Korsu's Rat of Death character, 2020.

The dialogue between the participants and the rat characters was improvised. During the open process, the group chose characters they had some experience with before, gathered (scientific) knowledge and let this knowledge be the basis of their representation of a rat. It seemed that their knowledge increased their ability to empathise with the rat species, and the group wanted to transmit this experience to others.

The rat characters, pre-prepared human profiles and the setup gave the participants a framework for experiencing the performance. Neither the rat characters nor the participants fully knew what was going to happen, but the participants did not seem scared of taking part.

Example of questions presented by a participant during *RatHum*:

Laura: How do you feel about the fleas?

Rat of Death: The fleas are happy travellers with me.

Laura: How do you feel living amongst us humans?

Rat of Death: How do **you** feel living in between our (rat) spaces of existence?

2.1. A Ritual as a Spiritual Technology

A performance can be widely described as a mode of human action that, unlike many other human actions, has a script or a pre-plan. Concurrently,

something that is not in the script happens during a performance. A performance represents 'a creative tension between what is in the script and what happens in the actual performance' (Brown, 2003: 5). One can also take a performance approach in a ritual or a ritual as a performance.

Catherine Bell (1997) sees a ritual or the fundamental characteristics of ritualisation as 'the simple imperative to do something in a way that doing itself gives the acts a special or privileged status' (166). I argue that this happened in *RatHum*. The performance elevated the knowledge we had about rats and transformed it into something different: a joint event with a collaborative nature and a hint of spirituality. Film director Jyoti Mistry (2021) would probably call this magic: something art does and is difficult to explain. Even if a ritual has its own framework or borders—maybe in this case a light manuscript—it is still open to the situation and the connections the participants have and establish. Gavin Brown (2003) concluded that a ritual, in its strict adherence to the manuscript and repetition, expands when approached as a performance. Ritual can produce cultural values and meaning, and in doing so, it has indeterminacy, especially together with the audience (Brown, 2003).

Jens Kreinath (2018) explained that the term ritual is used to describe any symbolic act, behaviour or practice performed by human agents aimed at invoking interactions with gods, deities or any other intelligible agents (1). In *RatHum*, the other intelligible agents are rats. Still, it is questionable

whether the rats were really present as rats themselves. In the beginning, the *RatHum* group pondered whether it is possible to have any perspective other than a human one during this work. Thomas Nagel wrote about this in his well-known article 'What Is It Like to Be a Bat'? He stated that only a bat can know what it is like to be a bat, and no one else can know this objectively. Nagel argued that even if it is possible to know about a bat, his example mammal in the paper, or their habits, how they sense the world, how they fly, how they socialise and what they eat, it is impossible even with that knowledge to know the bat's perspective. According to Nagel (1974), our own mental activity is the only unquestionable fact in our experience (436).

Arguably, 'a ritual creates and recreates the world of social convention beyond the will of individual performers' (Seligman et al., 2008: 11). What if a ritual is a form of technology for humans to better understand the ecosystems which they live in? In times of crisis, such as climate change or the COVID-19 pandemic, people generally tend to perform more rituals. According to Dimitris Xygalatas (2020), anthropologists have long observed that people across cultures tend to perform more rituals in times of uncertainty. Stressful events such as warfare, environmental threats and material insecurity are often linked to spikes of ritual activity. Especially related to COVID-19, there has been a need to modify existing rituals or to invent new kinds of rituals because people cannot necessarily be together in person (Imber-Black, 2020).

What if, while inventing rituals, there could be a kind of ritual that creates resistance and an understanding of the very causes of the crisis? What if spiritual technology is a tool for the application of both scientific and artistic knowledge together in such a performative ritual?

One of the participants mentioned that *RatHum* brought Ingmar Bergman's movie *The Seventh Seal* to her mind. In this famous movie, Death plays chess with a knight during the Black Death. The knight shifts from the idea of predetermined faith to rational thinking, mastering his own death and searching for meaning. As in life, there are no answers in the end, but the movie still brings hope, and especially hope through the practice of art. The Rat of Death did not have real answers for humans either. However, it tried to bring forward the idea of evolvement through pathogens, life forms as mutations at state and the roles humans themselves have played during pandemics.

3. CONCLUSION: RAT LEARNINGS

A strong element of the Rat of Death character is death: transformation, composting, change and

mutation. Death can be seen as something other than just an end of life, even though this is what the character represents at first sight. However, death, especially in times of ecocide and the Anthropocene, can be considered a multi-species material transformation (Rodeck, 2019). A rat combines pathogens, evolves and mutates. A rat can increase human understanding of zoonotic diseases, contamination and care. The bodies that humans consider pests—something to be killed and terminated—could be carriers of knowledge instead. Maybe this knowledge could aid humans in times of human-caused ecocide.

Again quoting Seligman et al. (2008), 'a ritual rebuilds a world as if it were so, out of many possibilities' (11). There could be a world where rats and humans communicate in a different way than before, as imagined through art and based on current scientific facts and cultural knowledge of both species. The participants did not like the Rat of Death at first. It was a messenger of death, and the participants saw the character as negative. However, learning together as humans, with human species-specific tools, could change this view. A ritual, according to the *RatHum* experience, can be knowledge and experience sharing, as well as framework creation for a shift in points of view.

As the Rat of Death said:

I'm the bearer of death

I am health

For you, care is politics

with your value system

that is hiding

denying your true self

I... I... I... am death

I'm blamed but I'm blamed without justification.

Your weakness is yours. Embrace it.

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Sympoietic Soundscapes: Listening Empathically to A-signifying Semiotics

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Considering thought as the crystallization of determination through our relation with the indeterminate, and capitalistic subjectivity as intrinsically linked with the idea of a totalizing consciousness and all its human, all too human correlates —representation of the ego, unity of the person, self-centredness of identity, contempt for non-human life, etc.—, we consider technologically-enhanced listening as an ethical, aesthetic, and analytical practice through the hybrid boundaries of machinic phyla and their a-signifying semiotics, a way of delving into the limits of the human understanding of things, of making kin with the world, of living empathically towards all the inhabitants of our shared planet.

Sound Studies. Soundscape Ecology. Technology. Sympoiesis. A-signifying semiotics.

1. INTRODUCTION

Everything is alive to the ears. In stark contrast to other senses, few things truly sound “dead”. From the smallest stream to the biggest megalopolis, whether we encounter lichens, people, or any landscape to be imagined, each and every being and/in becoming is an ever-new “open sea” —in the Nietzschean expression— for our ears to forget the old law, the old names, the old doxa. Death does not have it easy around our ears.

Both traditional philosophical discourse and casual conversation usually focus on the capacity technology has to make us more “human” —whatever that may mean in the respective tradition of the speaker. However, acoustic ecologists and sound artists alike have frequently taught us to focus rather on another side of technology —maybe not the opposite, but certainly different: those specific ways in which technology allows us to get out of the realm of the human that would be otherwise impossible for us to achieve. Technological interactions with our soundscapes are indeed an example of this.

2. SOUND AND TECHNOLOGY, BEYOND THE HUMAN

Through technology, humans are not only able to hear the world that surround us, but vast parts of it that would be simply out of our reach —this “reach” being located approximately between 20 Hz and 20

kHz and loud enough for us to be noticed. This means, for example, that most adults could “naturally” hear the vocalizations of many mammals, but only maybe 20 to 30 percent of the insect world (Krause, 2016). Likewise, without the aid of hydrophones, the entire aural life of oceans, rivers, or ponds, so deeply connected to our sense of wonder towards the sea, but also so important to biological and climate research, would be nothing but a blur.

Many animals produce sounds too high or too low for us to detect or “hear” without technological support. Nature’s highest-voiced creature is —probably— the Ganges river dolphin (*Platanista gangetica*), who produces vocalizations over 250 kHz —about 6 octaves higher than the highest note on a piano. From an evolutionary point of view, by the way, the Ganges river dolphin is really interesting. Having reduced their eyes to a point of lacking functioning lenses and thus “depending” on echolocation, recent research has shown their hearing to have developed in a very singular way, particularly in relation to the shape of the inner ear in ways even unlike the other platanistoids —thus maybe a key in understanding the *Platanista gangetica*’s survival (Vigilino *et al.*, 2021).

At the other end, some whale species produce vocalizations only at 4 Hz (Krause, 2016). For the same reasons human-centred views on technology sometimes led to self-absorbed conceptions and views, trans-human understandings of technology could be the way to a wider notion of empathy,

simply because it is a way to more “ways”. At the same time, and for its own nature, the very act of listening is intrinsically connected with empathy —if anything, listening is empathetic.

The specific role of technology in sound practices involving direct intervention on the natural environment not only affects the artist but every listener, allowing all of us to decentralize the subject with respect to the question of subjectivity and its production, for it transfers the primacy of the expressing instance to a non-human enunciating substance, so a whole series of very interesting things could thus happen. In aesthetic terms, the notion of “substance” is pluralized beyond the semiotic-objectual level —a universe of ready-made definitions. In ecological and ecosophical terms, our own human all too human subjectivity is enriched, open to real contact —beyond language— with our environment, in the heterogeneity of its expressive matters.

Listening is, in itself, an ecosophical production of subjectivity. While listening, thinking about how to do it better and more empathically, trying to encompass all the creatures that we share the world’s soundscapes with, technology should always remain a part of the conversation. It certainly takes us closer to the fellow non-human animals around us that our “natural” ears and “God-given” senses could ever do. Micropolitics begins at home.

3. SYMPOIESIS AND EMPATHY

By helping us care, technology also helps us remember that nothing makes itself, that nothing is properly autopoietic but sympoietic —an expression Haraway used in *Staying with the Trouble*, 2016—. Listening-to is always, inherently, making-with. Any I-listen implies a **we-do**. Finally, “worlding” is a nice step towards rethinking our own boundaries, and certainly technology can help us through such endeavour, for it has helped listening itself to become a collective arrangement of enunciation. “Collective”, here, does not only mean part of a group or a set, but constituted by flows of every kind, whether technical, ideal, aesthetic... “[I]t” does not represent a subject; it diagrammatizes an agency” (Guattari, 1984, p. 135).

When we place our ears —particularly with the help of wonderful little machines such as headphones, tape recorders, hydrophones, hearing aids...— wherever the world opens itself, we thus open ourselves to landscapes that could potentially cease to be reified, external —at least we could begin to do so...

Listening to the world means in fact to connect ourselves to a body without organs forever oscillating between a form of anti-production that becomes re-territorialized in all the already known

significations, and a form of hyper-production that opens itself —and everyone tuning in— to new connections. The strata of signification disappear. A continuum of machinic intensities surrounds us. “Just” sound —or, indeed, an ever-new land.

Contrary to the systems of mediation that seek to represent intensive multiplicities —singularities— through negativity, identity, analogy, opposition or resemblance (Deleuze, 2014), a-signifying semiotics, such as the pure flow of sonic phyla, know no possible “signification”. These machines function independently of any “meaning” they could represent or constitute to anyone. Its desiring economy is independent of any subject-object systems, of any strata of form-and-substance double articulation. There is no “semiotic consistency” to be possibly found.

4. SOUND AND HUMANITY

Sound proliferation is, in and of itself, a collective organization of a-signifying semiotics. Sound is a myriad. Sound precedes any “subject” and any “object”. Its desiring economy of sound, as desire itself, knows no subject and no “I” —for it is of no representative condition. “Signification”, and all the interpreters that come with it, are abandoned. We are not dealing with a different language, not even with a very differently structured language —it is simply not a language in any human sense.

In the end, to disabuse ourselves of any humanist illusions around individual subjection means also to get out of the constant subjugation of the world —a world that was not made in our image. If representation forces any semiotic machine to be constrained, to adapt itself, to fit in with ready-made economies they have nothing to do with, intensive, a-signifying machines, have their own system of encoding —they need no verifier, no thesaurus, no policing. Sound could really save us from humanity.

Traditionally, both art historians and art critics have reinforced the privileged position of the individual —or individualized— enunciation as the only true —or interesting— apprehension of the world. The truth of this perspective was ultimately the “truth” of the world. In this sense, or from this perspective, contemporary artistic interventions in nature constitute one of the most radical openings to these partial machinic enunciations of these other subjectivities that surround us. Consequently, art is the seed of a different, much richer production of subjectivity. The sympoietic nature of the existential territories apprehended by the artist, in their constituent irreversibility, in their singularization, in their questioning of the categorical subject-object fetishes, enables the artist the possibility of an ecosophical practice. Such is the case, I would say, of the fascinating work of Martin Howse.

Again, when the artist puts a recorder wherever the world opens itself, they open in turn to territories that have ceased to be objectified to appear as intensive, as matters that are nothing but semiotic scraps detached from all meaning and human codification, but no less alive, less rich—rather the opposite. What they—and we—hear, particularly when it comes to the geophonic and biophonic plane, is pure immanence, infinite virtuality, the chaomic expression of the world—of our, common, world.

(Likewise, this also brings us to a reflection on technique and design. Few things like ecoacoustics question more emphatically the limits of a hylomorphic understanding of the technical object. If we think about the evolution of the devices with which we go out to perceive and record the world's sounds, the notion of imposing an idea or an external form over matter is more untenable than ever.)

5. CONSIDER THE BEES

Through sound, we confront a myriad of machinic planes of consistency. An ever-new land. But. The smell of some old tropes emerges. Of course, it may very well be that this access to an ever-new sonic land made possible by technology, where abstract mechanisms preceding any actualization of diagrammatic conjunctions between signs and matter, living and proliferating beyond our little world of social fantasies, is the biggest social fantasy of them all.

Maybe. Certainty is nowhere to be found, and perhaps for the best. The conflicting deterritorialization of the infinite existential territories that we call “world” has little to do with what us humans represent around it. It does not matter how aware we are of this at a rational level, for precisely this very rationality is constantly projecting images of a world made to our measure, gerrymandering the infinite non-human subjectivities that it contains, muting them.

We can, indeed, be too awake, and the always so different arrangements of daytime life be turned into the monsters of enclosed representations and neurosis, constraining of every machine into ready-made economies. For, as Deleuze said, it is not only the sleep of reason which gives rise to monsters, “it is also the vigil, the insomnia of thought, since thought is that moment in which determination makes itself one, by virtue of maintaining a unilateral and precise relation to the indeterminate” (Deleuze, 2014, p. 38). Aesthetics deals with this very “relation to the indeterminate” and, as such, with the analysis of a capitalistic subjectivity that is intrinsically linked with the idea of a totalizing consciousness and all its human, all too human correlates: representation of the ego,

unity of the person, self-centredness of identity, contempt for non-human life, etc.

Notwithstanding, whatever happens is always below or beyond “people”, for it is always a matter of environments and machines, in a continuum that goes between ever-different domains, through ever-different arrangements. Rather than “alienation”—“which no longer means much of anything”—, we follow Guattari in preferring to speak about “subjection” and “subjugation” (2009, p. 181), the former dealing with the construction of “people”, the latter with machinic phyla—but both with power.

We could even say that, if there is such a thing as “landscape”, it is so because the world is simply much more than what our concepts and even our bodies can assume (López Silvestre, 2019). We are always confronting a sense of **excess**, for the moment we gaze, stare, or even glance at the world around us and see the proverbial abyss, we are indeed in danger of that very abyss gazing back at us—even though we should always distinguish that very human (representational, neurotic, constantly looking backwards) abyss from the non-human sympoietic landscape that surrounds us and exceeds us: the monsters within, and the infinite horizons on the outside.

Consider the bees in Pierre Huyghe's *Untilled (Liegender Frauenakt)*. Located outside of Kassel (at DOCUMENTA13) as a sort of **dépaysage**, the central piece of this kind of extended installation was a copy of a 1930s statue whose head had been covered by a living beehive. Any anthropocentric notion of individual creation, or authorship, is at best diffuse. We listen to the beehive, we recreate ourselves in the development of a plan based on the very futility of plans. As it is frequently the case with some of the best landscape architects and designers, Huyghe was searching for the minimal, most intelligent interventions for the new or most needed paths to be opened and for nature to proliferate, and simply go on (Rodríguez-Mouriño, 2021).

“In” the buzz of the bees, we hear a myriad of contingencies. The beastly nature of sonic phyla decentralizes our humanly limited subjectivity. We realize again that listening is, in itself, an ecosophical production of subjectivity, and that listening-to is making-with. While listening to Huyghe's bees, we make with the world, we are—in—the midst of this beastly process, ecosophically worlding with it.

6. CLOSING REMARKS

If thought is the crystallization of determination via a “unilateral and precise relation to the indeterminate” (Deleuze, 2014, p. 38), and capitalistic subjectivity is intrinsically linked with the idea of a totalizing

consciousness and all its human, all too human correlates, then, technologically-enhanced listening is an ethical, aesthetic, and analytical practice through the hybrid boundaries of machinic phyla and their a-signifying semiotics, a way of delving into the limits of the human understanding of things, of making kin with the world, of living empathically towards all the inhabitants of our shared planet. Geophony, biophony, immanence. It goes. They go. We must listen.

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Fish Architecture – A framework to create Interspecies Spaces

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Fish Architecture embraces the common spaces that we inhabit with aquatic animals. Here, we develop an approach to redesign these spaces as an interspecies collaboration. First, we should empathise with the non-human perspectives, while acknowledging limitations in understanding non-human perspectives of our mutual Umwelt. Next, we imagine new spaces that do not follow pre-existing human concepts. To achieve this in the framework of Fish Architecture, we merge the two disciplines art and science and apply their complementary methods to understand and imagine Interspecies Spaces. The Fishy Manifesto captures our process and explorations, as well as, offering a practical approach to coexistence. Fish Architecture is divided into three distinct phases, each offering room for observation and experimentation in different ecosystems. The third phase allows us to join aquatic and terrestrial life at the surface, paving a path to genuine ecological coexistence.

Interspecies. Transdisciplinarity. Coexistence. Art-Science. Biology. Architecture. Marine Science. Fish.

1. INTRODUCTION

Humans are not alone on this planet. We share both our external and even our internal world with other organisms. Indeed, there are as many bacterial cells in a human body as there are human cells, influencing not only our mood but also our behaviour (Sender *et al.*, 2016). These bacteria can transfer their genes into the human genome, blurring the boundaries between individuals as well as different lifeforms. Underpinning the concept of the human as a hybrid or cyborg (Riley *et al.*, 2013; Haraway, 2006). This transgression of human uniqueness on the molecular level may be easy to overlook but has already been intensively illuminated. And today, facing the consequences of the Anthropocene, humankind has to take the next step and not only debate its existence as a hybrid but must recognise its existence in an ecological context. Existence is a reciprocal relationship with a multitude of different organisms at once. Like others before us, we argue that the narratives of nature and civilisation as they are used today are normative concepts and therefore obsolete (Morton, 2010). Rather we and other species are equally contributing agents in an ecosystem. Therefore its time to initiate interspecies exchange and co-create our mutual world.

2. COEXISTENCE

It is a truly wonderful fact – the wonder of which we are apt to overlook through familiarity – that all animals and all plants throughout all time and space should be related to each other in group subordinate to group, in the manner which we everywhere behold [...] The several subordinate groups in any class cannot be ranked in a single file, but seem rather be clustered round points, and these round other points, and so on in almost endless cycles.

In this extract from *On the Origin of Species* Darwin (1996) described the interconnectedness of all species, organised in a network-shaped relationship. Nevertheless, the image of the tree of life, which he also adopted in this very book, was better disseminated, and is often depicted with the human on the treetop, resulting in today's western speciesism as described in *Animal Liberation*. As pointed in Timothy Morton's *Dark Ecology*, the Anthropocene might just be an example of speciesism or it may even be its result, the human species claiming its superiority, treating the planet and its ecosystems without any consideration of other inhabitants and therefore a consequence of the artificial division between nature and civilisation. In this narrative civilisation corresponds

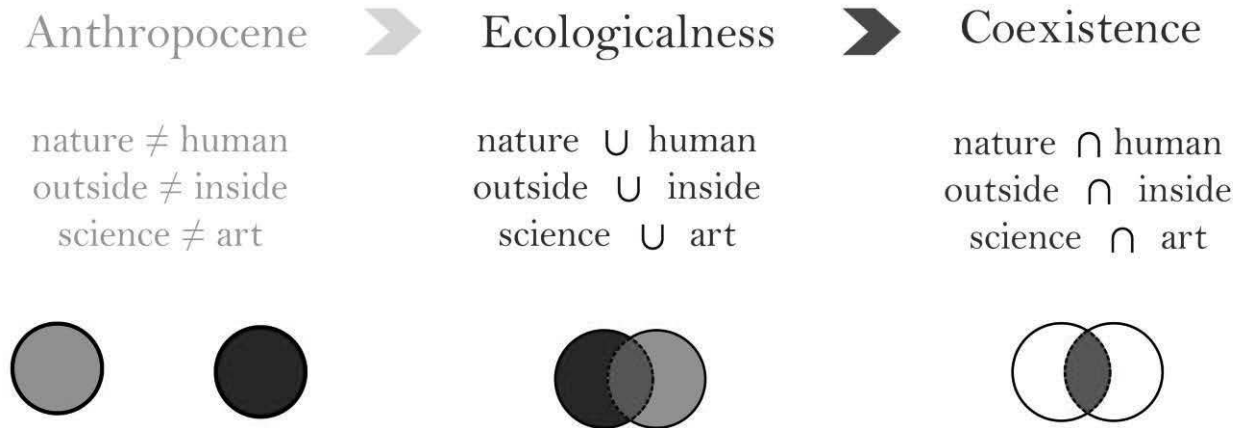


Figure 1: Steps toward Coexistence. Fish Architecture offers a tool to transition from ecologicalness to coexistence. The transitions between the different phases demand paradigm shifts substantiating new ties between existing concepts. First unifying opposites will enable us to then work on the intersections where new concepts, ethics and politics can be developed.

to progress and development, and nature is often associated with a pristine, unspoiled, unchanging landscape, narratives that gained momentum particularly during the Enlightenment. Humankind created an inside and outside to free itself from the inner animal by banishing it to the outside and diminishing its intellectual value. During this period formerly intertwined disciplines, such as art and science, became progressively separated into a subjective (pristine) and objective (progress) realm. Biology and Architecture grew into very distinct disciplines, yet both disciplines attempt to connect and compare “exterior bodies distributed in space and time” to develop a deeper understanding of the biological and architectural interiority of those bodies (Ingraham, 2006). With Fish Architecture, we want to reunite those two different disciplines that over time have taken on very distinct perspectives, but which may follow the same underlying motivation to understand the world surrounding us.

In *Dark Ecology* Morton suggests a concept of three threads or phases at whose core lies the idea of ecological awareness, the realisation that we coexist with other animals and organisms on this planet. Embracing this coexistence and living it implies a shift not only of our mindsets but also of the socio-culture structure of our society. *Dark Ecology* questions the nature-civilisation dualism and organises our awareness in a loop structure, a cyclical conception because obtaining and keeping ecological awareness demands constant reflection of oneself. The first phase is the darkness and depression of the Anthropocene, which separates worlds and concepts of the same origin (Fig.1). This first step realises the human is non-independently evolved organism, humans descend from other species, our organs did not evolve to make functional humans but to make other

organisms from which we evolved. This organises the human in a network of organisms, one species transforming into another and many organisms doing this simultaneously while humans only play a minor role, one little node in a huge network, the big evolutionary spectacle. Understanding this leads to the second bittersweet phase during which one becomes aware of their ecologicalness. This implies acknowledging other species and their form of consciousness and accepting that other species also influence the human species. Vinciane Despret calls this the ‘anthropo-zoo-genetic practice’, a practice that is not only focused on the agency of one species but considers the interaction between them, which eventually gives both an identity. One of her conclusions regarding the scientist and their study organism is “[...] some of these scientists create access to the creatures they study, the way they are moved by their subjects of interest, the way they give them a chance to be interesting and to articulate other things, [...], subjectivity and objectivity, are redistributed in a new manner.” (Despret, 2004) The scientist studies the other animal and their behavioural repertoire, which attributes an identity to this animal. Thereby the observed animal proposes new ways of being together and influences the scientific repertoire of the scientist. They shape each other’s behaviour and offer each other new identities through their interactions. Hence, biology can offer a platform to engage in a reciprocal interspecies exchange. Such an exchange will always contain an anthropomorphising component since human beings are not able to experience another animal’s consciousness. But the attempt to understand another animal and to empathise with it does not mean to become it but to be aware of its existence and to talk about how and what this existence implies. With this awareness, the third thread of

Dark Ecology sets in, when new ethics and politics have to be imagined and created to build an ecological coexistence together with other species.

Fish Architecture can be considered a tool to reach coexistence, which is found at the intersection of concepts, disciplines and species (Fig. 1). It takes the bittersweet darkness of ecologicalness, the awareness of being part of an ecological network, and envisages a future in which humanity will have already reached the state of bittersweet acceptance of non-uniqueness, and rather want to exist an equitable coexistence with other organisms. Creating and shaping those new habitats follow the cyclic structure of *Dark Ecology* but it also follows the biological, cyclic concept of niche construction (Day *et al.*, 2003), the ability of an organism to select and modify its direct environment and thereby influencing the exerted evolutionary pressure. Hence influence on its world but also on the world of coexisting species. Thus, Fish Architecture considers the human in a network with all other species, some of which we share habitats. And shared habitats or spaces offer the possibility to enter an ecological and evolutionary dialogue with those other species, shaping the ever-changing cyclic processes we are part of while celebrating our ecologicalness.

2.1. Three Phases of Fish Architecture

By acknowledging our ecologicalness, we can eventually commit to a dialogue with non-human species. Fish Architecture offers a new entry point: instead of dominating a space, we aim at co-creating spaces with other inhabitants. By combining art and science, two disciplines often considered as opposing realms, we aim at converging two domains often perceived as incompatible, the human world on land and the fish world underwater. Former attempts to elevate the non-human on the same level as the human include Donna Haraway's text about her dog

Cayenne, Laurie Anderson's documentary about her dog Lolabelle or Jacques Derrida's text about his cat Logos (Haraway, 2013; Heart of a dog, 2016; Derrida, 2008). Haraway and Derrida consider the human and non-human relationship from a philosophical perspective questioning the status of the human and the non-human. Though Haraway tries to rethink ideas like domesticated and wild, she and the others examine relationships with species that for generations have been bred alongside humans. Hence, over the last centuries, the evolution of those animals has been immensely and deliberately impacted by humans. Targeted breeding rendered it easy for humans to connect with the. Additional to behavioural adaptations in dogs, Haraway's companion species, the facial muscle anatomy of dogs adapted through domestication to facilitate communication with humans (Kaminski *et al.*, 2019). This deliberate interference into natural selection and evolution delineates the opposite of coexistence but shows how these non-human animals have been subjected to human will. Interspecies Architecture, therefore, Fish Architecture, focuses on the others, the animals we live with yet often ignore and thereby miss out on an opportunity for exchange and mutual evolution. In particular, the ocean is a world few humans have access to, although we can no longer deny the anthropogenic imprint on this largely unexplored world (Doney *et al.*, 2012; Halpern *et al.*, 2008).

Fish Architecture is a commitment to coexist and co-create spaces of encounter and exchange, when agency does not have to be granted but is inherent in all involved organisms, who together shape new ethics and politics (Morton, 2010). The process of Fish Architecture consists of three phases together forming Fish Architecture. We refer to those phases as "Deep/Them", "Surface/Us", "Land/We". In the evolution of Fish Architecture "Land/We" represents the first stage,

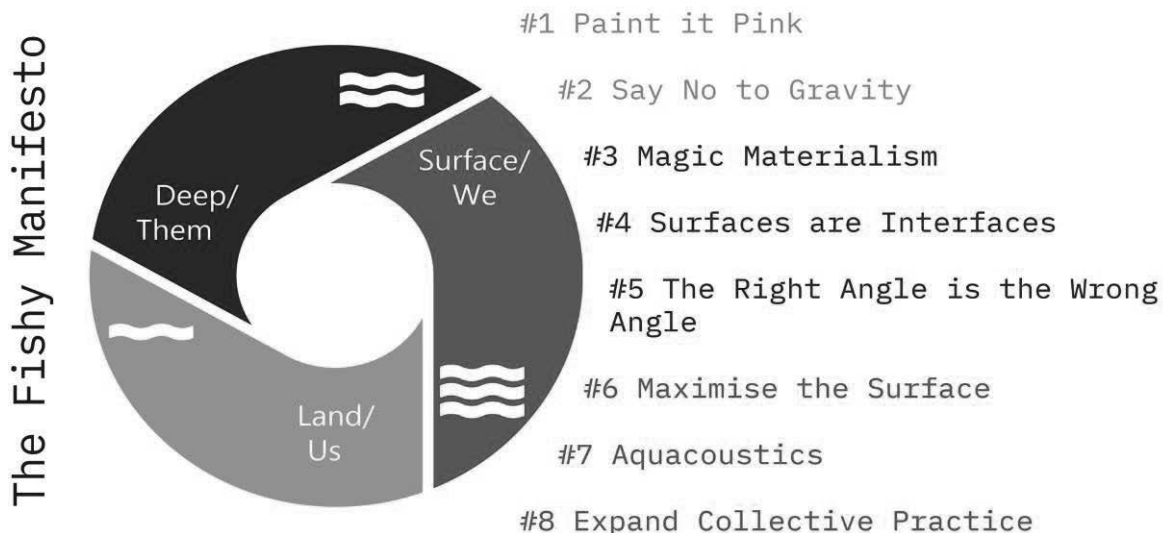


Figure 2: The eight theses of the Fishy Manifesto developed during the evolution of Fish Architecture.

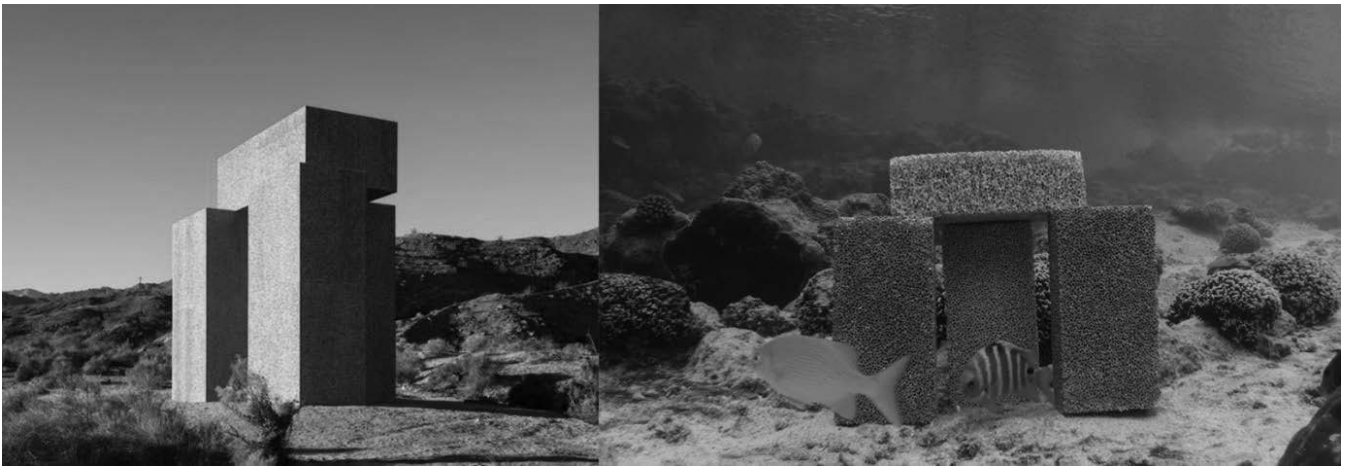


Figure 3: *Dive-in*: originally commissioned by Desert X in collaboration TBA21–Academy with music composed by Dark Morph (Jónsi and Carl Michael von Hausswolff). Photo: Lance Gerber (left). Fish-sized Dive-In at the Alligator Head Foundation in Port Antonio, Jamaica. Picture: Alex Jordan (right).

immediately followed by “Deep/Them”, both of which transition into the phase “Surface/We”, where our and other species come together and coexist. The three distinct phases do not emphasise the separation between the unknown outside and the known inside but rather value the differences and acknowledge that other lifeforms experience and exist differently than we do. This age-old discourse on the unknown, unheimlich or the uncanny generated concepts such as Derrida’s monstrous arrivant, Haraway’s cyborg and Morton’s stranger strangers (Haraway, 2006; Derrida, 1995; Morton, 2010). And as pointed out by those scholars, we should welcome the monstrous arrivants and the uncanny strangers and appreciate the different ecological relevance and experiences before engaging in a collective practice with other species (Shildrick, 2002).

Fish Architecture started as a joint exploration of SUPERFLEX and the lab of Integrative Behavioural Ecology with a focus on social behaviour of fish. The first phase started with SUPERFLEX and Alex Jordan asking what fish want from a space and if elements of human architecture can offer a space where fish will exhibit their social behaviour. Explorations happened in Tonga, Portland, Jamaica and Palm Springs, US offering fish and humans the same structures. After testing human structures and deconstructing its elements in a fish context the second phase zoomed mainly on “Deep/Them”, the fish. Anja Wegner then considers the social interactions of fish in a specific physical space, so we can better understand how their social network is impacted by physical features. For the quantitative biological component of the projects, damselfish populations in Portland Jamaica and Corsica, France were chosen because of their social behaviour their typically exhibit in groups and which is linked to their physical environment. Structures were designed by SUPERFLEX, following continuous discussions

that happened in the field, studio and lab. The third phase zooms again out and considers multiple species who together co-created spaces which address the needs of all of them and simultaneously offers a possibility to change the perspective to better understand our co-species. During the Fish Architecture journey, eight theses concerning living with or by the sea were formulated - The Fishy Manifesto (Fig. 2). The manifesto is one out of many possible approaches to coexistence of the aquatic and terrestrial, aiming at a utilitarian and architectural purpose but allows explorations from different perspectives and for different purposes. The here defined theses matured during the evolution of Fish Architecture and might change during the ongoing process.

2.1.1. Land/Us

Before designing novel architecture that meets the demands of both marine and terrestrial creatures, the long-established elements of human architecture should be analysed and reimagined in a different ecological embedding. We started with “Land/Us” to re-examine human architecture and long-established concepts but from an aquatic perspective. With the intention to reduce human architecture to the simplest elements, which then can be revised in a different ecological context. With *Dive-In* (Fig. 3), an installation by SUPERFLEX, the elementary principles of a human shelter, such as walls and a ceiling, mainly arranged in 90°-angles, were used. Those elements were then presented to the marine world in Port Antonio, Jamaica. During this first experiment, the first two theses were established:

- (i) Paint it Pink: A tribute to the oldest architects on the planet, the polyps, builders of the first underwater coral cities. And who prefer to settle in pink surroundings due to their affection for the



Figure 4: *Pink Elements: Tobacco basslet (Serranus tabacarius) as first resident on Pink Element at Alligator Head Foundation, Jamaica. Photo: Anja Wegner (left); There are other fish in the sea by SUPERFLEX in Galería OMR, Mexico City, 2019. Photo: Enrique Macías Martínez. (right)*

pink crustose coralline algae (Mason *et al.*, 2011).

- (ii) **Say No to Gravity:** Since humans are bound to the 2-dimensional surface of the Earth, the human-built environment follows the same pattern. Gravity is a fundamental force in the universe as well as for the culture of human habitation. Other animals are less concerned and burdened by this infinite force. We should blend the horizontal mindset with the vertical mindset and build less concerned by gravity, as other fellow species do who move in a 3-dimensional world.

2.1.2. *Deep/Them*

After a self-reflection, the subsequent phase shifts the focus from the human-animal to the non-human marine animals. “Deep/Them” does not reinforce the old narratives of the separated outside (nature) and inside (human) but acknowledges the different worlds and ecological niches inhabited by different animals. Therefore, we want to study those diverse lifeforms and appreciate them in their uncanny strangeness. Complementary to the architectural imagination, behavioural ecology, a sub-discipline studying the evolutionary origin of behaviour, should focus on the influence physical structures have on social groups of structure-dwelling marine organisms whereas artistic imagination creates shapes and forms that may appeal to substrate-dwelling marine fish. Systematic and repeated observations of the emerging social dynamics inform us about the wants and needs of those non-human species. *Pink Element* was a first attempt to systematically track other species on this new structure, meanwhile, the same elements were rearranged in a human space on land (Fig. 4). Another approach to underwater construction is *FishLego* (Fig.5) a modular set that consists of rearrangeable pieces with two round and two angular sides. The pieces can be arranged on the

respective underwater site depending on the needs of the inhabitants. *FishLego* was installed in the Mediterranean Sea to offer a nesting substrate to the damselfish *Chromis chromis* during the spawning season in the summer months. Only during this period, the males of this species dwell on substrate, where they establish their temporary territories, court females and carry out brood care. Both *Pink Element* and *FishLego* should offer surfaces but also crevices to hide, feed and mate. Corner and angles are produced by stacking tubes or cubes. Nevertheless, to offer modularity the cube-shape remained inherent in both cases. *Scutoids* (Fig. 6) moves away from this human idea of efficient construction and rectangular building blocks, mimicking marine structures and thereby creating fissures and surfaces that resemble naturally occurring rock formations, while it still consists of basic building blocks. *FishLego* and *Scutoids* are both parts of ongoing biological and artistic research trying to reveal structural preferences of Mediterranean *C.chromis*. We consider individual choice, which spot does a male chose, but also group-level dynamics. In the case of the *C.chromis* a group of males will decide on an



Figure 5: *FishLego: Chromis chromis on FishLego in Corsica, Mediterranean Sea. Photo: Anja Wegner.*

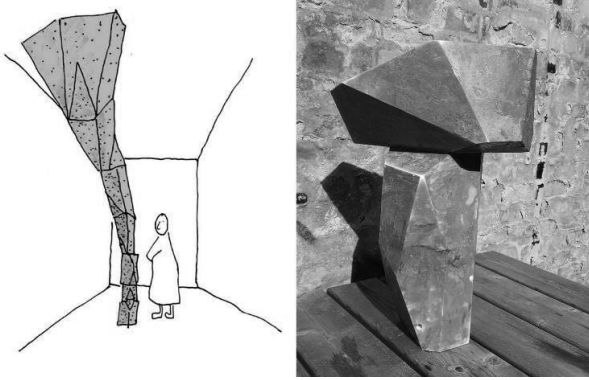


Figure 6: Scutoids: Sketch of Scutoids installation for humans (left). Scutoids installation for *C.Chromis* in the Mediterranean Sea. Photo: Zeno Riz A Porta (right).

area in which the individuals will establish their territories, a commitment to a temporal site-attached coexistence. To acknowledge the group level dynamics, individual characteristics and site-specific qualities the quantitative analysis comprises methods from social network analysis (SNA). Due to the above explained network-like theoretical framework we apply quantitative methods which follow this principle. Through social network and multi-layer network analysis, we can account for the inter-dependence of the system both in the spatial but also temporal domain.

As a result of the different “Deep/Them” explorations and experiments, we propose the following three theses:

- (iii) Magic Materialism: We propose to clash two opposing views that material durable over time is of high quality and material that changes over time is weak. Rather future materials might have several concepts of time embedded with transformation as an intrinsic value. Buildings should mutate and transform over time.
- (iv) Surfaces are Interfaces: A surface might appear like a boundary between two phases. However, on the microscopic scale, they may exhibit thickness but on the atomic scale, these surfaces are porous, holding free space, negative spaces

between atoms or molecules. Once a structure is in the ocean there is not inside or outside of the ocean. Marine life demands the possibility of penetrating all surfaces through holes and alleys where they can hide, nest and play. The focus of Architecture has always been the definition of spaces. We are aiming to flip this way of thinking Architecture. The negative space has the same value as the space itself. The space that is not of value for us, will be of value for someone else.

- (v) The Right Angle is the Wrong Angle: We consider the right angle as one among many occurring in the environment of animals. But in human culture, this angle provides the most efficient way of fractionating the main space into sub-spaces, thus serving the concept of private property. We object to the idea of subversively passing on the concept of private property to other species by only using “the right angle”.

2.1.3. Surface/We

The last element of Fish Architecture is the transition to Interspecies Architecture at the “Surface/We”, a narrow layer, also ecotone, where one ecosystem transitions into the other and species can come together. Such ecotones can have sharp boundaries or gradually transition into each other, we consider the land-water interface as a layer of continuous transition, a boundary without boundaries where land and water can engage in collective practice. The different architectural elements discovered during “Land/We” and “Deep/Them” and the concepts linked to them should help to develop spaces that are not only defined by physical structures but the idea of coexistence to develop together a shared Umwelt.

The experience of the *Superpier* is an example of a structure, which is developed for both worlds, land and water, to allow similar physical experience but from different perspectives (Fig.7). Another step toward a collective interspecies practice is the *Interspecies Assembly*, an assembly for all species affected by the climate crisis, not only the human species. The other two stages of Fish Architecture

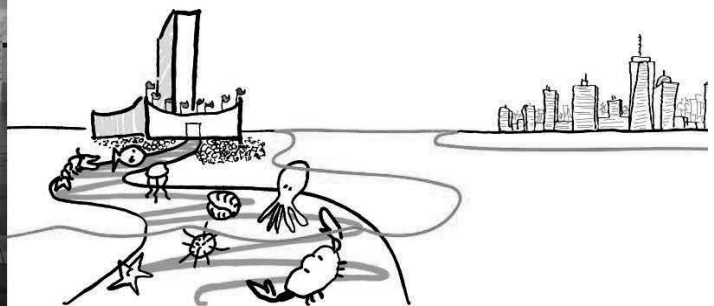


Figure 7: Superpier – nakskow: rendering of interspecies pier (left). Interspecies Assembly (right).

are different approaches to understand but also to create different perspectives, whereby “Surface/We” rather offers an opportunity for imagination and action. Coexistence is at the very core of this phase and does not need any further explanation, but it structures behaviours and experiences of all involved species.

The final elements to create Fish Architecture:

- (vi) Maximise the Surface: Research points to the hard surfaces of the wrecks as enhancers of biodiversity in degraded marine ecosystems (Lengkeek *et al.*, 2013). Consequently, design must maximise the extent of hard surfaces to help proliferate marine life from the first moment, while offering humans the possibility of closely witnessing the phenomenon.
- (vii) Aquacoustics: Darwin would play his tuba to Earthworms. He wanted to understand if sonic stimuli would distract them. The tuba did not distract them (but vibration and light did). Noise pollution of the subsurface world is rarely a topic. But we do need to consider aquatic acoustics.
- (viii) Expand Collective Practice: Through our imaginative power, we should aim at integrating other non-human beings when considering both clients as well as practitioners of architecture. The practice of shaping our environment should integrate elements beyond the human sphere on an equal scale.

3. THE SYMBIOCENE

Fish Architecture is a proposition to engage in an interspecies existence but depicts only one of many possible processes to get there. Nature and civilisation are constantly changing objects and do not adhere to the human narratives they are often given. Rather we propose to think in terms of ecosystems, which comprise non-human animals and other organisms, and are finely tuned by all their inhabitants. But this tuning is a dynamic, a never-ending process that brings continuous evolution rather than pristine and virgin stagnancy. We cannot say how or if other animals consciously commit to this process, but as humans we can decide to do so and become ecological agents. Through an anthropo-zoo-genetic approach, we can even empathise with alien species such as fish in an ecological manner and thereby together create spaces, taking the biological needs and behaviours of multiple agents into account. Evolution is a design process, and every involved organism can become a designer, an architect or a creator. In an interspecies endeavour, we can together create ecological

niches to coexist and enter the Symbiocene, the ecological era. Because to exist is to coexist.

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Spectral Choreographies: Electromagnetism after Conceptual Art

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This article navigates between several conceptual artworks. The first is Robert Barry's '0.5 Microcurie Radiation Installation' – an object buried somewhere in New York's Central Park since 1969. The second is Walter De Maria's 'Lightning Field' installation, erected in New Mexico in 1977. The two artworks are separated by eight years and 2,200 miles. The former is concerned with electromagnetic transmission (or its lack), the latter with electromagnetic reception (or its potential). Between the two resides the vastness of a non-ocular spectrum without which aesthetic experience, art, and human communication would be impossible. The lineage connecting them, as much physical as it is conceptual and imaginary, is explicated in this article alongside ideas about art and artifactuality, as present in and presented by our series *Spectral Choreographies*.

Robert Barry. Walter De Maria. Ocularcentrism. Electromagnetism. Conceptual art.

1. INTRODUCTION

(L)ived electromagnetism has its historical basis in such things as rainbows, electric motors, and telecommunications, from which are derived the spectrum, the correlation of electricity and magnetism, and the speed of light and its global and cosmological manifestations.¹

The English-language phrase 'visual arts' marks a stark difference between *matter* and *energy*. This is routinely regimented by notions of *authorship* and *perception*. Applying or removing matter, moulding or destroying it, manifesting or concealing it determine authorship and (albeit indirectly) have strong relevance to questions of property (in the sense of traditional ownership). Conversely, energy may be applied or removed (i.e., filtered). It may be moulded but is hardly ever destroyed. Put differently the first law of thermodynamics has much bearing on what constitutes art, both historically and contemporarily.

Energies influence, determine and constitute every lived experience, but in and of themselves, mostly fall outside the purview of our minds. This is especially surprising given that they are unmistakably within the purview of our senses. This inherent contradiction is present in other languages as well; for example, in the German-language word *Bildkunst*, denoting visual arts (literally, 'picture art'). Therein the contradiction is even more troubling if we consider that the word *Kunst* can

also be taken to mean 'knowledge'. Arguably, the most profound expressions of art are such wherein matter is harnessed for the transmission or reception of energy, authorship is rendered moot, and perception – and its spectral or electromagnetic manipulations – replaces it.

This article straddles two seminal artworks. The first is Robert Barry's '0.5 Microcurie Radiation Installation' – an object buried somewhere in New York's Central Park since 1969. The second is Walter De Maria's 'Lightning Field' installation erected in New Mexico in 1977. The two are separated by eight years and approximately 2,200 miles. The former is concerned with electromagnetic transmission (or its lack) and the latter with electromagnetic reception (or its potential). Between them resides the vastness of a spectrum without which aesthetic experience, art, and human communication are rendered impossible. The lineage connecting the two artworks, as much physical as it is conceptual and imaginary, is explicated below, alongside ideas about art and artifactuality as present in and presented by our series *Spectral Choreographies*.

2. CARRIERS OF LIGHT

'0.5 Microcurie Radiation Installation' was one of five artworks presented at the *January 5–31 1969* exhibition at Seth Sieglaub Gallery in New York, all exploring electromagnetism and radiation and their

artistic yield – whether through transmission, reception, or their potential (figure 1). In this relatively obscure work, a small amount of the radioactive isotope barium-133 was buried in the ground somewhere in Central Park on the first day of the exhibition and has been decaying there ever since. Barium-133 is the longest living artificial radioisotope, with a half-life of over ten years. This means that its radioactive transmissions typically decrease by approximately 50 percent every ten years after its creation. It also means that while its transmissions clearly diminish (like those of other radioactive materials) they never vanish. In Barry's piece, they continue long after the exhibition. Somewhere below Central Park, they persist in this, ad infinitum, 'unbeknownst to the ballplayers, dog walkers, and picnickers on the grass above.'² They thus represent the radioactive-artistic version of Zeno's dichotomy paradox.³



Figure 1: Robert Barry, photograph of the installation site for 0.5 Microcurie radiation Installation (1969), Central Park, New York

Radioactive radiation is not only invisible but also undetectable by other sensory modalities. Although it can be identified by common Geiger counters, the likelihood of a visitor to Central Park (or a traditional exhibition space for that matter) carrying and using such a counter is slim, requiring ordinary visitors encountering the wall labels indicating the existence of radiation in the park to accept the artist's concept on faith. In fact, to the extent that an artwork requires 'materiality' to be manifested and that it is still of concern, the only materiality that can be ascribed here is that of the infrastructure(s) for energy transmission. Put differently, nothing about the materiality of the work is the work itself. Nothing about the artefact (if such even exists) is the artwork. With that, our human senses become contingent and temporal, and with regard to spectatorship of art, they are made self-conscious by the absence of anything spectatable, let alone spectacular. Any autonomy of the artwork is shifted onto the viewers and their perception

thereof. Further, with sensory perception deliberately denied by artists, the perceivable becomes the new threshold for artistic attentiveness (or for academic concern, for that matter) in Barry's artwork and by extension, in all.

In keeping with the logic of the artworks, the photographic documentations remaining from these early pieces show empty spaces free of any indication of waves, other than the photo captions. What these provide is a static extension of Barry's conceptual program: just as the viewer, once made aware of the carrier waves, becomes self-conscious of the act of viewing, so too does the visible documentation invoke the possibility of an artistic experience that is rarely aesthetic in a traditional sense. Such documentation is, in its own right, a fine example of harnessed energies: transmission and inscription, photography at its purest.

What's more, such artistic experience is enabled only by becoming conscious of invisible energies that are essential not only to Barry's but to *any* artwork. Indeed, artist James Turrell noted the projected light of the slide projector during an art history lecture as more interesting to him than the screen images of the actual paintings.⁴ Light per se becomes the carrier wave for the transmission of visual art history. Even when it is not modulated for the projection of images, it remains the underlying condition for all forms of knowledge since Plato, as made clear by such phrases as 'I have seen the light'. Notwithstanding, there is more to electromagnetism than its relationship with visible light and occidental ocularcentrism. Electromagnetism is arguably like water, necessary so long as it is transparent. It is also akin to air, imperative but present only in its absence. The more we hark back to the sensible or the perceptible in all their manifestations, the more it becomes clear that electromagnetism is the fundamental principle with which not only art but also all human communication is made possible. In fact, converted into chemical energy to fuel an organism's activities, it is the infrastructure through which all life is lived. Thus, can we not accept that the fossilization of electromagnetism is also a precondition for any artistic endeavour?

3. DIMENSIONALITY, DIRECTIONALITY, ABSTRACTION

While electromagnetism is arguably at the core of every artistic experience, not every artistic endeavour is *about* electromagnetism. This is clearly evident in all modernist traditions of abstraction, wherein worldliness is purged from representation through the gradual removal of physical dimensionality. Russian painter Kazimir Malevich, a protagonist of many art-historical narratives who was

famously resentful of all idealistic views, captured this insight by declaring, 'No more "likenesses of reality", no idealistic images, nothing but a desert!'⁵ Therefore, the pictorial plane was emptied out in 1915, rendered hollow but inhabited by a single black square, which to this day remains the iconic image of non-imagery. Such fanciful asceticism was historically enabled by what Friedrich A. Kittler famously called the *n-1* dimensional signifier,⁶ which reduces one dimension in every phase of representation (from world to sculpture to picture to text to code), but also conceals, disguises, and distorts the signified, the *n* dimensional. That being true, we argue that the *n-1* dimensional signifier does not annul dimensionality; it simply pronounces its ephemerality. Considering electromagnetism to be the 'carrier wave' of all artistic phenomenon, its ephemerality (its omnipresence notwithstanding) is precisely what affords all forms of signification and indeed all manifestations of embodied and lived knowledge.

Back in ancient times, mystical beings of the forest were traditionally likened to an animal or a plant, an ongoing semblance of perceived reality. In contrast, desert gods that were mostly undepicted were worshiped as abstract beings, much like the sun, the stars, and other celestial bodies. Perhaps the invisibility of such dreamed up desert-gods confronts us with realities beyond our senses: 'The desert is less 'nature' than a concept, a place that swallows up boundaries', argued Robert Smithson.⁷ But the fact that the deserts rarely have anything for our naked eyes to picture does not mean they are ever empty (even when romantic paint cracks are discovered in turn-of-the-century abstract paintings).

What is it then that escapes our sensorium and makes the black square, the desert, so conceptually appealing? Malevich's black square is the absence of representation, but contrary to common opinion, it is also a celebration of the spectrum, the existence of other sections thereof, rendered knowable thereby, if not visible therein. Clearly, some colour field paintings represent subsequent exercises of a similar nature: experiments at acknowledging the spectrum. Accordingly, post-conceptual art electromagnetism declares the use of spectral energy changes, eternal alternations, fluctuations, and sinusoidal functions as another response to abstraction, perhaps the ultimate artistic one. Despite its origins, however, this response rarely exists in stable form. In fact, it is rarely unidimensional and need never be unidirectional. Just like electromagnetism, this response is multidimensional and omnidirectional.

4. SENSORIAL THRESHOLDS

With viewer consciousness tentatively attuned to the expressive possibilities of an electromagnetic

infrastructure, how can artworks reframe the aesthetic possibilities of electromagnetism? How does an artwork make manifest patterns and activities that the human sensorium is simply unequipped to process? And how can such patterns and activities, themselves meaningless to the hydrocarbons that we are, be harnessed to make meaning? To pronounce the use of the electromagnetic spectrum, our *Spectral Choreographies* series comprises of various sensors (on Earth and beneath its surface) – antennas, transmitters, transceivers, and peripheral output devices (speakers and monitors) – some intended for physical installation within the exhibition space.

The first work in our series is a live broadcast of carrier waves alternating between several International Telecommunications Union (ITU) standard frequencies. These carry their sound signal in perfect symmetry to their carrier waves, with the frequency transmitted being identical to the signal laid on top of it, and the carrier wave completely identical to the sound wave. Drawing an 'electromagnetic self-portrait', these transmitted waves are undetectable by the human sensorium and can be experienced only with and through a technical apparatus – a receiver – installed in the same exhibition space. The band to which the receiver is tuned constantly changes as well, alternating between several carrier-wave frequencies in a pseudo-random fashion. At unpredictable intervals, when the receiver's tuning matches that of the transmitted wave, the signal is played as a sound. Although these unpredictable correlations are the only point in time at which the signal is discernible by humans, it is rather just a hint at the ongoing, ever-changing, omnipresent spectral choreographies that constantly radiate through the exhibition space – and the universe. With sounds fading in and out of sensory presence, this contingent behaviour directs the visitors' attention towards the negative 'desert' space, in which transmission alone is performed, without a receiver end. The question how exactly humans can register such an activity remains the conceptual point of departure for this and subsequent works.

While this work, like Barry's transmission works, utilizes carrier waves, it includes an important addition echoing the cultural logic developed since – the receiver. Transmission used to be a vector, a directional activity, moving from speaker to listeners, from the mouth of the news presenter in a radio or TV station to the eyes and ears of an entire nation, or the whole world.⁸ Conversely, our contemporary idea of live electromagnetism entails multiple transceivers, a network, a mesh, an interconnected web of telecommunication apparatuses at varying scales, much larger and

more complex than we humans are ever able to grasp.

'Spectral Choreography #2' is a computer-generated video based on a model of the space in which its installation was originally conceived. The rendering's perspectives, scales, and architectural details would likely look familiar to anyone who has ever walked through the originally intended exhibition space at the Forum Stadtpark in Graz, Austria (figure 2). Outside the virtual installation, desert-like planes displace the lush green park and fountain seen through the Forum windows. These are reminiscent of the arid Middle East where we were, unable to install the exhibition physically, or to attend it. It is also a more suitable metaphor not only for the work's backdrop or exterior, but also for its interior. Built according to architectural plans without ever visiting the original locale, the model of the space depicted in the video correlates with the physicality of Forum Stadtpark. Emptied of its visitors and locked down during a global pandemic, the virtual model created from the original floor plans becomes as valid an interpretation of the architecture as the brick-and-mortar variation thereof.



Figure 2: Yanai Toister and Nimrod Astarhan, *Spectral Choreography #2*, 2020, generative radio broadcast (virtual installation view, Forum Stadtpark, Graz Austria)

Components of the virtual installation include stock models, the virtual installation parallel to a found object. Treated as such, and following additivist principles, they have been manipulated, brought together, and extended, including the addition of lights, cables, and relationships with other objects. The work also contains a visualization of a radio signal transmission from one technical apparatus installed inside the virtual installation space to the other. Sinewaves seem to move through the air, emitting light in one of the base colours each time, while a monotonous sound is heard. The sound is composed by the same waveform, a sinewave whose frequency correlates with that of the colour emitted. The visualization of waves is created using a simulation software that generates a 3D model, later brought into a 3D composition software.

Perhaps the most appealing affordance of contemporary CGI technology, simulation software allows for visualizations that are based on purely

mathematical, or rather abstract models of the world. In other words, harnessing electromagnetism affords the most efficient method of abstraction to date. Used to plan and design civic, industrial, and military utilities, such software becomes a layer of abstraction built on top of another such layer: physics. It thus becomes a retinal interface with a mathematical model of reality. Even while correlating with reality this way or that, it remains however impossible for a non-informed viewer to determine whether the interpretation of electromagnetic movement through the air is true to physics, simply because that physics is indiscernible to the naked eye. The same principle holds true in an exhibition where such electromagnetic energy is active.

How can the same indiscernible energy characterize a work of art as any of its relays? As the limits of the sensory remain a pressing issue for this series, some of the formal properties of electromagnetic waves can be used to conceptualize further by practicing infrastructural sensibility. If infrastructure binds us to the world in motion, to quote Lauren Berlant,⁹ it is the sinusoidal alternation of waves that has come to define that motion. Oscillating at a rate much faster than they eye can see, everything from the images on our screens, through the power in our grids, to the electromagnetic radiation of our electronic telecommunication infrastructure – *everything* oscillates in some frequency or another. These oscillations trace downfalls and avalanches, pauses, and stalls, just as much as growth, ascent, continuity, or acceleration. And with zero disturbance, they are also perfectly symmetrical.

5. EARTH CAPACITIES

'Lightning Field', by Walter De Maria, is a seminal work of land art situated in the high desert of western New Mexico, in a high-frequency lightning area (figure 3). The piece is comprised of 400 polished stainless-steel poles installed in an exact grid array, measuring one mile by one kilometre. The poles, which are two inches in diameter and average 20 feet and 7.5 inches in height, are spaced 220 feet apart and have solid pointed tips that define a levelled horizontal plane.¹⁰ Importantly, all poles are also connected by grounding wires to protect their structure against lightning damage by intercepting flashes and guiding them to the ground beneath.¹¹ The poles have been laid on concrete foundations, but with time, soil erosion, and humidity, they may very well become connected to each other. In fact, as with all electricity, the poles use the ground as a constant potential reference against which any other potentials can be measured. The edge of the spectrum of any energy transceived by the field is therefore defined by the Earth.

Notoriously, most visits to the Lightning Field site are unlikely to yield an actual sighting of a lightning strike. However, as a technical apparatus, the field suggests an infrastructure for the reception of electromagnetic energy as a work of art. The components of this infrastructure become, as Richard Aldrich put it, 'the objects through which we can see the invisible'.¹² In their rectilinear configuration, the field's rods 'quantify the landscape',¹³ while also turning it into part of a receiver. The spatial configuration of the rods is therefore not informed by relationship to vision or visibility – certainly not exclusively. Rather it reflects their function in an artistic apparatus designed and constructed for the reception of energy. Put differently, they maintain a technically configured relationship with the invisible.



Figure 3: *Walter De Maria, The Lightning Field, 1977.* © Estate of Walter De Maria. Photo: John Cliett

Interestingly, the glow emitted by the steel rods, which have been meticulously polished by De Maria and his team using dedicated tools and techniques, was described by the artist in 1972 as 'pure light.' However, at noon, the work becomes literally invisible as the shadows cast by the 400 steel rods disappear completely. Similarly, the artwork's physical properties are outshined by the mere appearance of a thunderstorm. Struck by lightning, the work fulfils its potential by dissipating and vanishing, becoming a mere enabler for the sight of pure electromagnetic energy.

For this to happen, all rods are also connected to a common reference point underneath the landscape: planet Earth. 'Lightning Field' thus brings forth the infrastructural capacities of the earth as a reception device for electromagnetic energy and indeed the only infrastructure we know that pertains to lived electromagnetism. Rigorously abstract yet geometrically precise, this artwork takes the faith and vaulting promises of modernism into the wilderness, the ionosphere, and beyond.¹⁴

6. MAGNITUDES OF SENSIBILITY

'Earth Signal Universe Wide' is a radio sculpture created via transmission by several earthbound stations as well as the International Space Station. The transmission extends beyond the solar system, refracted by celestial objects, traveling at the speed of light through the vacuum of space and dissipating as they expand away from the locus of transmission on the station. Radio waves inside the Earth's atmosphere and ionosphere encounter damping caused by surfaces, the air, and geomagnetic weather, and will always eventually dissolve in such a material environment. In space, however, radio waves never lose their energy, only decrease in amplitude as they spread onwards and away to infinity. 'Earth Signal Universe Wide' is thus a gradient of energy, a never-ending brushstroke that begins at the International Space Station and ends at the edge of the universe. Importantly, the carrier wave transmitted to the station is modulated by a signal generated by a seismometer installed on Earth, delineating an earth signal at the size of the cosmos. The work is cultural and human: the transmission of a message from earth's inhabitants that is an extension of the Earth itself.

Zhang Heng's device from 132 CE, built to detect earthquakes, was constructed from stone frogs holding brass spheres in their mouths. The clash as a ball fell into a brass vessel served as an alert. The device therefore transforms the energy of one of the multiple waves produced by an earthquake and brings it into an apprehensible part of a spectrum, in this case, of sound waves. Similarly, one of the visualizations of 'Earth Signal Universe Wide' is a programmed simulation based on a game engine, in which a set of physical equations relating to the propagation of electromagnetic waves in space is used for the first time to create a real-time visualization, in an attempt to bring the unique shapes and magnitude of the sculpture into the sensible spectrum.

7. SIDE OF THE SPECTRUM

Electromagnetism after Conceptual Art sets out to highlight an underexplored interpretation of a specific kind of artwork. Rather than being straightforwardly visual, these artworks function and develop at the borders of the visible, which are but weak anchor points indicating the vast spaces of the electromagnetic spectrum. While these works are apparatuses, devices, sculptures, and spectral performances, they also function as an infrastructure for the activation of the spectral environment. In so doing they act as an interface for the development of our relationship with the unseen. Just like a prism, they remain a manifestation of potential flows of energy, a

tentative transformation in and of the electromagnetic spectrum. Without flows of energy, these works are like a prism in the dark – extant but stripped of its transformative potentialities; present perhaps, but absent nonetheless. Importantly, the energy perpetuated or implied by these works cannot be attributed to any kind of objecthood. It is prescribed but not authored, conditioned but

ungoverned. Just like light breaking through a prism, it denotes not only the activation of an electromagnetic spectrum, but also a spectrum of possibilities for non-artefactual artmaking. The exploration of this latter spectrum through these and future articulations in our series will further crystalize the conception of electromagnetism as a new form of conceptual art.

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¹ Douglas Kahn, *Earth Signal Earth Sound: Energies and Earth Magnitude in the Arts* (Berkeley: University of California Press, 2013), 10.

² Peter Eleey, "Thursday," in *The Quick and the Dead*, ed. Peter Eleey (Minneapolis, MN: Walker Art Center, 2009), 31.

³ The paradox involves repeated division in two, as in the case of the hypothetical runner required to run an *infinite* number of *finite* distances.

⁴ Hilarie M. Sheets, "A Tribute for Turning Light into Art," *The New York Times* 2013.

⁵ Kazimir Malevich, *The Non-Objective World* (Chicago: Paul Theobald & Co, 1958), 68.

⁶ Friedrich A. Kittler, *Optical Media: Berlin Lectures 1999*, trans. Anthony Enns (Cambridge, UK: Polity Press, 2010), 226-7.

⁷ Robert Smithson, "A Sedimentation of the Mind: Earth Projects," *Artforum* 1968.

⁸ Wark accurately points out that such flows are rarely omnidirectional. McKenzie Wark, *A Hacker Manifesto* (Cambridge, MA: Harvard University Press, 2004), 156.

⁹ Lauren Berlant, "The Commons: Infrastructures for Troubling Times," *Society and Space* 34, no. 3 (2016): 394.

¹⁰ The terrain under "Lightning Field" consists of several elevation discrepancies. Therefore, some poles were intentionally manufactured shorter whereas others were manufactured longer or taller.

¹¹ Terry Winters, "Field Work (for Hayden)," in *Artists on Walter De Maria*, ed. Katherine Atkins and Kelly Kivland (New York: Dia Art Foundation, 2017), 84.

¹² Richard Aldrich, "You Can Go Your Own Way," *ibid.*, 16.

¹³ "The entire landscape becomes more quantified or visible, more animated and intense, and is an integral part of the work." Winters, "Field Work (for Hayden)," 74.

¹⁴ At close proximity to "Lightning Field", placed on a similar landscape, is the US national radio observatory, the "Very Large Array". The VLA is a cluster of 27 radio telescopes mounted on railroad tracks, searching for and capturing signals from deep space. Signals spanning different parts of the electromagnetic spectrum are received and later combined to produce images that lie far beyond human perceptibility in terms of magnitude and sheer vision, from galaxies to black holes. These form yet another device for interacting with the invisible through the transformation of energy.

Zugzwang* or the compulsion to find a common baseline in sound

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This text is comprised of a multi-platform discussion between the members of the Zugzwang* working group between 03 July and 30 August 2021. Focused on notions of taking up space, acting, and intervening, this discussion expands on previous presentations and research by the group by highlighting how the participants' artistic and scholarly practices are engaged in making a difference within environments that are increasingly subject to anthropogenic devastation. As a discussion evolving over multiple platforms, this text is intercut and interwoven with questions, elaborations, and linkages, uncovering common themes, shared practices, and mutually-unanswerable questions in our collaborative work. This discussion itself follows the logic of our working practices, documenting a generative exercise in conversation, which in this case led toward an increased sensitivity to timings and scalings of observation and action. Particularly, the capacities of the group's sound art practices when it comes to engaging with multiple sites, species and temporalities is put in evidence.

Climate Change. Sonic Literacy. Bioacoustics. Worlding. Environmental Art. Environmental Sensing. Machine Listening.

1. INTRODUCTION

The following is an edited transcript of a conversation that took place across platforms between Natalia Domínguez Rangel ("N."), Samuel Hertz ("S."), Christina Gruber ("C.") and Emil Flatø ("E.") in the summer of 2021, the second set of conversations the group has had around a shared sense of living through the uncanny condition of "Zugzwang".

Zugzwang is a German chess term for the "compulsion to (make a) move". To us, it denotes a discomfort – in our various work on environmental issues – with remaining mere observers to processes of destruction that are the result of human actions. To live within an environment is to be entrained to move constantly, by something more than ourselves; yet, the urgency, the compulsion, to move is compounded by the recognition of just how many things humans ourselves set in motion.

The group first convened in the early days of the pandemic, as we were grappling with the audible silence in environments across the sites in which we were based, caused by the anthropogenic standstill. In this sudden withdrawal, human impact was paradoxically palpable.

2. RECONVENING

E. (remarks in a Zoom call, August 2nd and 10th; Google doc, August 21st and 29th): I just wanted to add something about, erm, taking up space / acting / intervening as opposed to observing / discussing / listening to environments?

Which is that what seems to me to mark you as artists coming to this question is how natural it comes to you to take up space, with your bodies or technologically aided bodies, doing something about the questions at hand.

I think there are specific reasons why questions of anthropogenic – human-impacted – environments require that knowledge workers, or "scientists", become more comfortable with the fact that they are in it as well. Indeed, all the way back to Hanna Arendt, it has been argued that the erasure of the work humans do on the planet in the traditions of knowing on which the modern world was built (i.e. science) is how we got to this uncanny place of being more impactful than we are able to know (see Arendt, 1998 [1958]), especially the Preface). While it might seem obvious that no one can pretend to be a mere observer anymore, I really don't think we

have integrated that insight into common academic practice yet.

There is a lot of interest in “pragmatics” and “performative” qualities of science and the likes. A touchstone in the literature is Isabelle Stengers’ admonition that ecologically concerned researchers

... be required to construct and present what they know in a mode that makes them ‘politically active’, engaged in the experimentation of the difference that what they know can make in the formulation of the issue and its envisaged solutions. (Stengers, 2005)

But academics are still mostly writing papers, mostly assessing, observing, analyzing. I think there is a long way to go before we will see a form of thought that is quite simply comfortable coming from real bodies acting on the world.

Many artists, to my mind, routinely relate to how creating is a way to act on the world, however vexed that responsibility may feel. Which means, to me, to engage with the environmental realities that humans are increasingly affecting, shaping, cultivating, or creating anyway. I see it so evidently in all your work. So, I was wondering whether we could circle in on specific aesthetic choices you’ve had to make in your work, that speak to the dilemmas of taking up space and acting on the world?

3. TAKING SPACE OUT LOUD



Figure 1: Still from video documentation of DOOM.

“DOOM is a vibrating and reverberating vision of the end of the world... maybe just after, or right before. DOOM is an accumulation of grievances, and a mapping of those grievances onto an entanglement of snarls. Without committing to the aesthetic regime of metal music, we take serious influence from the time-based approaches of the doom/drone-metal genres, understanding that the performance of this music creates a unique, atmospheric and temporally-expansive way to experience sound... as an embodied and enmeshed part of sounding networks, rather than a being separate from, or an observer.”

DOOM had its film premiere in August 2021 and performance premiere in November 2021. Credit: Ethan Folk. <DOOM: Sophiensaele Homepage>

N. (on Zoom call, August 10th) S., in DOOM, you use a lot of very loud sound. Why? I mean I love

loudness, but it is a striking choice. When does loud become loud? Is it when these high decibels are used as sound weapons, resulting for instance in hearing loss? Is it the physical aftermath of loudness? The cloud, the lightness, the way it is like being high without taking any substance...

I think of it as the quiet economy of movement unleashing sound storms. Sound filling the space, reviving, accumulating, morphing, reverberating, and bleeding unexpectedly into and out of silence.

It is not eternal. It will end. It will end in peripheral sounds of soundings, like in John Cage’s 4’33”, where the performer (D.Tudor) sits on the piano and plays nothing. The piano performance loses focus but the peripheral sounds are the work – the humans coughing, uncomfortable silence sounds, etc.

S. (submitted to the Google doc, August 24th): Loudness for me is temporal – things can of course be suddenly loud, but the loudness with which something sounds is a function of time, the way it performs time on the body, or as Alexander Weheliye puts it: “making time palpable as a sensation” (Weheliye, 2005). Because, for DOOM, loudness (extreme volume) is a lens... a methodology that allows us to sound time, sound the stretching of time, or delineate fine scalings of temporal sensations. Loudness – an amplification of everything, perhaps – ensures that nothing falls between the cracks or out of earshot, understanding that every movement or event sounds and resounds.

E. (submitted to the Google doc, August 24th): S. how do environments – or more specifically, long temporalities of climate change – enter the music in DOOM? Are there recordings? Of what?

S. (submitted to the Google doc, August 25th): E. there are ‘environmental sounds’, yes, (i.e., ‘typical’ environmental sounds: specifically, some high-density recordings I’ve made at the Prespes Lakes region in Greece) which are also played at an increasingly high volume. But part of my approach to environmental sound comes from the ‘disappointing symbolism’ of environmental sound/environmentality), encapsulated by this Ed Roberson poem that I referenced for the previous Zugzwang* publication¹:

We in the morning / catch, from the train, in the green garbage runoff, / sight of white herons and the cormorants. / When they’re here in the evening, we safely assume the world hasn’t gone anywhere (Roberson, 2006).

For me, the appearance of nature’s regularity (the presence of bird song) projects an aura of pristine

or untouched nature. Even in an office building elevator, we're reminded that nature (still) exists because we have a recording of it! So, I have a complicated relationship with including environmental sounds in this context. Or if I would use them, I imagine them more as... let's say a 'calming nature soundtrack' from one of those smartphone meditation/stress apps, but one that spans such a long frame of time that you would hear the animals start to disappear... not so meditative really! My eco-pessimism shines through... Though these bird songs do appear again later, a bit more diminished (less dense, and at a lower volume), as if we could have fast-forwarded through time.

So, 'environmentality' in the sound is more temporal than literal, I would say. The doom metal segment of the piece itself is one way in which it works: it is less about addressing sounds of climate than it is about addressing temporalities of changing climates. The idea is to feel time slow down, and then to speed up ever so slowly. To feel the changes that happen within those 'event markers' of timed sensation. Later on (in non-doom-metal sections), the sound works quite similarly... some of the other music I'm performing also has elements of slowly changing rhythms or durations. One piece works with a sort of generative tempo function, which makes it able to slow down suddenly and lose any sort of tempo. Even though it is always, if ever-so-slowly, moving forward. Similarly, there is a 'baroque' section which uses the micro-timings of baroque music to zoom back into a 'human' time frame and show the ways in which music itself is constantly full of temporal holes. Gaps within which even smaller events are constantly at work.

E. (a fudge in the Google doc, August 30th): So, why the loudness?

S. (submitted to the Google doc, August 24th): It's exactly that periphery of sounding sounds that N. mentions above ... actually in a way it moves into discussions of ambient music/'environmental sound' in the sense that a generalized loudness is ubiquitous. The problem is that so many discrete networked material elements are lost in the noise. This makes me think of the conversation C. and I had in Lisbon when we met, regarding listening to environmental recordings in a club environment as a way of activating the sensual potential and access points of field recordings.

4. A SHELTER MADE OF GLASS

N. (excerpted from email, July 3rd): As for myself, I already produced half of the sculptural part from

the collected recordings I have from March 2020 till March 2021 concerning our acoustic noise footprint and as listening bodies. Sculptures are made of glass and inspired by some sea creatures and several cocoons.

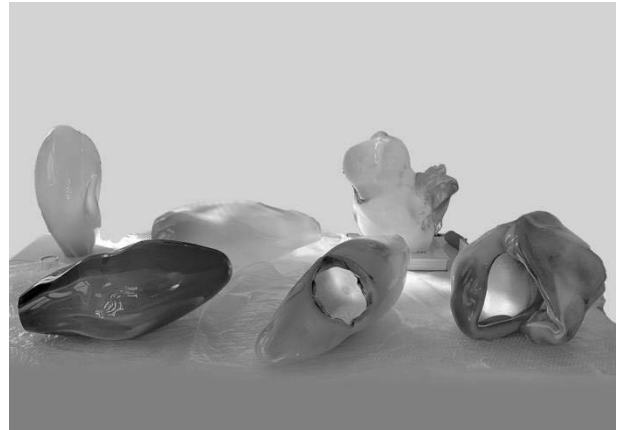


Figure 2: Work in progress "Connecting Acoustic Spaces" sound and light sculptures. Studio view. "Connecting Acoustic Spaces" are sound and light glass sculptures with a multichannel soundscape created with 500 collected audio recordings from around the world since the corona lockdown in Europe. Dating from March 2020 till March 2021. Credit: Natalia Domínguez Rangel. <<http://nataliadinguezrangel.com/pages/works/listening/>>

Metamorphosis and transformations. Thinking of the nature of glass material. The transformation from sand to liquid, to hard glass. Fragile, yet very strong. Its own acoustic space and sound reflections: glass transmits a lot of sound energy. It also disperses and multiplies ... How similar we are--as bodies--to those materials.

E. (outside of time and space, August 30th): I think the choice of sounding through glass is an excellent example of taking up space, but before we dig into the specifics of that material choice, could you just narrate the process of creating this work?

N. (response on the Google doc, August 27th): From the 15th of March, 2020--the beginning of the lock down in Europe due to COVID-19--I invited artists, friends, colleagues and people to send me recordings of their acoustic environment.

I am involved in the way we listen to and interpret our surroundings, especially in this time where we are experiencing a global pandemic, partial lockdowns in different time frames, intensities, and outcomes.

I find it very relevant how, gradually, our noise footprint increases and how unaware we were (are?) of the huge impact it has. This has brought

me to reflect on: How do we imagine ourselves as listening objects, bodies? The need to understand our own acoustic agency and how it tunes in or makes sense with the sonic environments of ours and others.

Connecting Acoustic Spaces exhibits these recordings through sound and light glass sculptures with a multichannel soundscape. The glass ocean creatures create personal acoustic arenas for those specific pandemic audio files collected and shared by my peripheral community.

These biological shell creatures serve as a protectorate and demarcation of acoustic spaces allowing us to observe and listen. The shelter became a means to isolate an ecology at the same time it made an idealistic environment differentiated from the exterior of the present acoustic moment.

E. (submitted to the Google doc, August 22nd): The ocean creature metaphors are interestingly poised between biologies and imaginations, which you are exploring in part for their sonorous qualities, i.e., the sound-sheltering features of a conch; and then re-creating in the medium of glass, which is an interesting material and sound medium in itself. I was left fascinated by questions of where these sculptures leave us or position us as caretakers and/or observers of environments, even at a basic level: Where do we listen to them? Can we experience the sheltered sounds within the shell shapes, for instance?

N. (response in the Google doc, no time stamp): It leaves us as observers, as critical listeners, though I don't want to dictate that to the one who experiences it.

I created these fictions inspired by nature acoustic shapes for these audio files to re-exist and resonate. These sheltered sounds can be heard and felt through the transparency and reflection of glass.

The sculptures will embody all those different listening ears. Audience can touch the glass (I am still seriously thinking about it because I don't want any broken pieces, lol) or surfaces where the sculptures are placed and feel the resonating audio files.

E. (comment on the Google doc, August 24th): Did you say something at some point about creating shelters having to do with how the pandemic has been such a private, enclosed (and sheltered?) experience for many people? If so, could you spell out what that was about?

N. (response, August 27th): Indeed. I would say shelter and/or metamorphosis. We are in a "zugzwang" moment coming out of shelter, metamorphosis; What does it mean to coexist with a pandemic?

N. (additions in the Google doc, August 23rd): Now, taking up space with glass... Glass is rigid, brittle, an amorphous solid made of lustrous material made by igneous fusion of silica. It transmits sound energy at its resonant frequency and at low frequencies. Its resonance changes with thickness. It vibrates like a drumhead when its body meets equal frequencies.

E. (commented on Google doc, August 24th): How did you end up choosing glass?

S. (commented on Google doc, August 25th): +1 here – also curious for more description of the glass elements!

N. (response on the Google doc, August 27th): I love glass as a material. I chose it because of its natural character, its physical transformation from viscous to solid, the flux, the beauty of blowing such material with our own breath and the quick act of shaping/sculpting it in seconds. There is no time to overthink when you work with fire.

I knew I wanted to exhibit these recordings through the medium of glass because as I received those recordings that I define as intimate moments, private spaces, and unique unreproducible environments, it was clear that glass performed those qualities.

The sculptures are unique. Each piece was glass blown in Denmark at Homergaard Værk. Taking inspiration from natural shapes that provide shelter, mainly from seashells, sea peaches, but also from insects in the metamorphosis phase, revealing the spirit of the received recordings.

5. EAR STONES

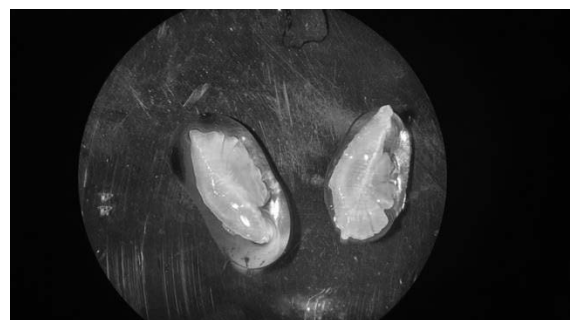


Figure 3: Microscopic view of otoliths, extracted from a sardine during C.'s Biofriction residency at Cultivamos Cultura, Portugal in July 2021. They are part of the bioacoustic research project "Houston, can you hear me?" And explore embodied ways of listening of environmental changes in aquatic ecosystems.

Credit: Christina Gruber.
<<https://biofriction.org/artists/christina-gruber/>>

C. (submitted on the Google doc, August 24th): After years of listening to streams, collecting recordings of sediment transport, noise pollution, land loss, and sturgeon thunder, I felt the urgency to take the next step.

Hearing and observing all the alterations and problems caused by the overflow of human impacts made me think of ways to overcome the endless research and data streams. The reason I started listening was the constant feeling of being too loud using standard sampling procedures to assess the ecological status of a river. It felt as if we, the scientists, were the biggest invaders with our noisy fossil-fueled engines to extract specimens by exposing them to electric currents that stun them (some kind of vertigo?).

So, the idea evolved to submerge an underwater microphone and try to find out about the status of the river. Though, this meant the creation of endless recordings stored on personal computers, hard drives, and cloud storages all over the world. To a certain extent the fish never stopped to stream and caused further infinite white noise. However, this method could not gain significant insights; it only felt like a steppingstone in critically discussing the status of water bodies.

The next step would be to focus on the physical sensation. How to make for instance noise pollution audible for humans but from the position of a fish? This links to the conversations about how environmental recordings should be listened to in sterile lab situations or preferably in a loud, drone club environment. As S. mentioned above, this was how we started talking in the first case.

One of the main questions I started to ask myself for approaching the idea of "Zugzwang" was: How to hear like a fish? And if so, what alterations and activations in my body/sensorium would it take to hear beyond my human ears, even though they are the only ears I have.

I became allies with an ancient fish species, the sturgeon.² At the moment, they are considered the most endangered animal group in the world (IUCN, 2010), even though they have inhabited the northern hemisphere for more than 200 million years already. Through my work at the sturgeon hatchery, I deeply engaged with the fish and learned the hardship of care work in all its facets and felt an even stronger urge to find out what these prehistoric beings and I have in common. Where is our common ground? This turned out to be less of an attempt to transform oneself but to understand that we already have it. We are composed of an ultra-sensitive sensorium called our body. We just need to learn how to use it again, to then re-discuss how much space we want to

take up. I think this is what I aim for in all my work. I don't want to have gills, otoliths (fish ear stones), or fins. I want to be able to accept my position as being shared and in constant transit. For instance, I have gone to the river every day now for the last three years, checking the water for turbidity, current, and temperature, just to know if the fish are well. It would be a mistake to think that self-erasure can be the answer, for instance I hope someone will need my body to exist too, at a certain moment in time.

It was this search and longing for groundedness and an episode of ongoing vertigo that brought me to otoliths, or ear stones: calcium carbonate structures that allow fish and humans to sense linear acceleration and gravity to maintain bodily balance. In fish, they also mediate hearing. Ear stones occur in almost all vertebrates and help them to keep their balance as they follow their movements for instance when standing up or turning the head.

These biominerals are where we meet, to arrive here on earth. In this place. Human ear stones (otoconia) are more like crystals and develop into their final form during the formation of the embryo, while in fish, they grow throughout their entire life. The age of a fish can actually be determined by the number of layers of mineralization in its otoliths; we can also use them to see which environmental stressors³ they lived with.

The extraction of otoliths can only be done after the animal is deceased. Otoconia are invisible to the human eye (3 to 30 microns; a micron is one-thousandth of a millimeter) and rarely extracted. However, the stones can dislocate on their own account, causing vertigo and disturbances in proprioception (i.e., bodily perception). In these cases, modern medical technology cannot really do much: A surgeon could not intervene and put them in place, for example. Instead, one of the most efficient treatment methods for relocating the tiny crystals relies on the patient recalibrating their own body, by following a set of maneuvers, guided by a physician. Performing quick directional changes, aided by the powers of acceleration, can unclog the crystals. I see these activating movements as a way to reconnect with our aquatic ancestry and the material (and anatomy) we share with fish. It demands actual work on one's own body to hear beyond our strictly human capacities to understand we're porous and permeable.

I became intrigued by the sense of the geological within all bodies, and the more discrete issues that happen when constitutions change, like in a river our composition changes continuously.⁴ Kathryn Yusoff states:

Examining fossils as material and discursive knots in the narrative arc of human becoming, I

argue for a 'geological turn' that takes seriously not just our biological (or biopolitical) life, but also our geological (or geopolitical) life and its forms of differentiation. Fossils unlock this life—death, time—untimely, corporeal—incorporeal equation, suggesting the need for a theory of the geologic and a reckoning with the forces of mute matter in lively bodies: a corporeality that is driven by inhuman forces (Yusoff, 2013).

Now, going back to where I started: river assessments. Trying to understand a river means to zoom into the molecular structures of the sediments but also to go beyond the river shores and roam the entire catchment (all the areas of land where water collects and drains into the river, as common outlet). Temporal scales start to dissolve, and prehistoric sands mix with sewage sludge heavy with anthropogenic pollutants. To calibrate in all this, it needs certain sensorial skills to stay afloat. For fish and humans, calcium carbonate crystals form the baseline to sense self-movement and beyond. Over time, the continued maneuvers to activate the crystals will enable humans to traverse the river to hear the river of before, of the now, and the after. Ear stones make us realize that we are the river itself, all the time.

Not only through listening to the river - its history, present and futures - but even more we actually contain the river in the shape of our ear crystals and are part of the riverine cycle.

S. (comment on the Google doc, August 25th): I absolutely love this discussion of (re-)calibration... it's a word I never really used before in terms of scale, but it makes a lot of sense. I'm especially loving the idea of forming the interior crystal as a calcified piece of the stream itself... or making the river interior as a natural way of calibrating/contextualizing the sensorial self. Also definitely tracing the crystallising lineage to N's text beyond the material similarity... having trouble verbalizing it at the moment! But there's something floating between those mineral ideas that is working on my brain...

S. (coming back to the Google doc, August 25th): For me there is also a connection here with glass, which is something to do with freezing time, making it hold still for a moment. You have this amazing breadth of acoustic snapshots, which are sort of taking place through the context of glass figures which are also (essentially) a material snapshot of a particular molecular process.

N. (responding in the Google doc, same day) Indeed, Sam. Such a lovely connection.

6. CONCLUSION: FREEZING TIME

Zugzwang is an ongoing discussion between sound artists, an ecological researcher and a time scholar

about the "compulsion to move": about the weirdness of how anthropogenic environments situate humans in. Zugzwang denotes how we are simultaneously compelled by the movements of planetary flows, multispecies entanglements and accelerating societal impacts on its surroundings, and compelled to move ourselves, thus putting the whole ensemble into motion ourselves. The transcript above summarizes a discussion about how to ethically take up the latter role, the one in which affecting is inevitable. Can art serve as a fount of inspiration, because of artists' relative comfort in taking up space by giving form to things to come? If so, how?

Having reflected upon what transpired in the conversation, the point about art freezing time stands out; the importance, in the flux of lives and processes within which we find ourselves, of making time hold still for a moment, even if only in the fiction an artwork sustains. In the artworks we discussed, freezing time was not a matter of "pressing pause" on some universal, abstract temporal flow, but to provide distillations of the kinds of temporal complexes we are usually busy living in.

The multispecies, geological and anthropogenic times that may all register in sturgeon otoliths, or human otoconia, given the right form of attention.

The century-long unravelling of climate change condensed into a doom/drone metal concert.

A multi-sited, audio history of the early pandemic, resonating in these marvellous creatures of glass.

All of these art works, or proposals for art practices, take care in the way they do or would take up space in the world; in the forms of embodiment, being or mediation they engage in. These are first moves in processes of giving form; hopefully, some may also find them generative for inquiry.

The environmental humanities tends to unite around the notion that Western scientific modes are inadequate to the "global weirding" of human-induced environmental change. With the according sense that the universe is more multiple than singular accounts of the nature of reality allow, knowledge also becomes about "pragmatics", or the difference you can make (Savransky, 2021a).

With these ways of implicating ourselves in multi-sited, multispecies, multitemporal process, however, it seems inappropriate to offer conclusions in the sense of an ending. These conversations and art works are created in the key of the "generative" (Savransky, 2021b), they are open-ended events meant to beget more questions, insights, perspectives and problematizations.

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² For more information on the project (in German), see <<https://life-sterlet.boku.ac.at/index.php/home.html>>.

³ e.g., higher water temperatures, lack of nutrients, chemical pollution, acidification.

⁴ University of Rochester. "Estrogen Controls How The Brain Processes Sound." ScienceDaily, 6 May 2009. <www.sciencedaily.com/releases/2009/05/090505174543.htm>.

(MICRO)BIOCONTROL AND ETHICS OF CARE

From Data to Matter: Anti-Systematic Interventions and Explorations of the (Micro)biopolitical Organism

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Abstract: In this essay, we draw on multidisciplinary scholarship and artistic interventions that we consider to be instances of anti-systematic *practice*, wherein artists' use of their own biological data and matter supports material research, and catalyzes alternative, embodied knowledge production of the self. While an anti-systematic practice builds on systematizing biomedical tools and practices, its primary aim is to integrate that general knowledge with complex, contextualized experiences for deeper collective self-understanding. The datafication of the self through wearable self-tracking technologies expands our capability to build bodily knowledge, but simultaneously entails pervasive (micro)biosurveillance and reproduces an internalized, isolating neoliberal ethos. Technological advances can constitute forms of (micro)biopower that dominate, control, classify, and govern our life on a molecular level. We consider theory and art practice that domesticates and demystifies biotechnology and citatresits or subverts forms of (micro)biopower, while engaging with medical knowledge and biotechnological capability for bodily observation. The works we describe invite participation in collective body projects and empower self-understanding that arises from collaborative conceptualization of alternate futures.

Bioart. Biological materials. (Micro)biopolitical matter. Material research. DIY/DIWO/DIT. Biology. (Micro)biopolitics.

1. INTRODUCTION

In this essay, we synthesize multidisciplinary artistic interventions and practices that subvert or resist the (micro)biopolitical challenges that are revealed in these explorations. We propose the lens of the anti-systematic intervention for bringing into relation different works at the intersection of bioart, DIY/DIWO/DIT biology, activism, and biodesign; as well as for recognizing how experimental body practices already undertaken, outside of art, can also be rendered subversive. Embodied (micro)biopolitical manifestations and processes result from the relatively wider accessibility of the technologies of microscopic seeing and serve as catalysts for (re)inventing the future pathways for understanding of an individual or collective organism.

In this work, we answer the following research question: What are the conditions within these different art practices that render the use of (micro)bio-technological data and matter subversive?

The artistic examples we present suggest ways to tackle the (micro)biopolitical challenges that emerge from contemporary forms of surveillance

and the increasing development of new tools and instruments for categorizing and policing human bodies in a molecular level. The projects discussed in this essay explore biological self-experimentation and aim to common molecular engagement with the self: to render more widely accessible the tools and ideas of working with hormones, for example, to build embodied collective knowledge, and as a political act. We emphasize another quality that these works entail: storytelling and the creation of new subjective and embodied bodily narratives as a counter-systematizing force.

We argue that the highlighted works bring relatively obscure biomedical knowledge about under-represented bodies into active, embodied discourse with lived experience. In this way, medical material and epistemology is instantiated for self-exploration in a non-representative, anti-systematic way. In our reading, what is being subverted is not the tools or methods of medical knowledge production, but the tools for policing and categorising human bodies on a molecular level and the ways in which that practice is systematized and filtered through a normative lens. This essay is an interdisciplinary synthesis intended for artists, scholars, activists and citizen scientists with an interest in, but

perhaps concerns about, the intersection of biotechnology, (micro)biopolitics and self-experimentation.

Institutions that develop tools also influence both access to and legitimacy of the applications of those tools. Consider: whose work gets to be ambiguous, uncertain, or unfinished, but still legitimate? Self-experimentation has notable precedent in microbiome research (Gimbert and Lapointe, 2015). In another example of self-experimentation, Borbély et al (2017, p.191) report on a longitudinal study of the first author's sleep with technical and analytical notes, as well as personal narrative. The use of self-experimentation is relatively legitimate within institutions, and subversive outside of them - even if the tools, processes, and practitioner qualifications overlap. We draw from research on the use of consumer self-tracking devices (Lupton 2016; Sanders 2017) as well as artworks that subvert or resist institutional norms while engaging in a critical, generative way with those institutions. We investigate how extensive bodies of medical expertise and biotechnical advancement can be mobilized to construct tools and processes that support communal self-understanding.

Biotechnological institutions, socio-culturally constructed imaginaries and new technologies of the self can distance us from ourselves. However, these tools and practices may be brought into anti-systematic interventions and explorations, empowering the human body to instrumentalize its own data and matter in counter-hegemonic strategies. The notion of "anti-systematic" aims to highlight forms of knowledge production whose aim is individual or collective self-understanding, rather than generalizable claims, and which bring aspects of existing rigorous methodology into an essentially subjective, narrative, and embodied practice. Embracing biological materials helps us construct our own narratives, subjectivities, and subversive biotechnological materialisms. Furthermore, an alternative embodied knowledge production of the (micro)biopolitical organism challenges the social and institutional judgments inscribed into mundane encounters with such materials.

One aim of subverting biopolitical and sociocultural meaning of bodily materials is to reclaim bodily autonomy from totalizing and obscured institutional knowledge production process. At the same time, the accumulated institutional knowledge is not lost, but maintained through tools and practices that are brought into an individual practice. These practices thereby become tools for (re)inventing, engineering, speculating, and imagining alternative futures for bodily experiences and processes.

The interdisciplinary artworks reviewed in this paper speculate future uses of and self-experimentation with personal biological data and

matter, including the artist's own menstrual blood in tissue culture and engineering in WhiteFeather Hunter's "Mooncalf"; vaginal flora and secretions in Giulia Tomasello's projects "Future Flora" and "Alma"; and combined DIY ramifications and explorations of the hormonal body and gender politics, in Mary Maggic's "Open Source Estrogen" and "Genital (*) Panic". We consider these examples as instances of anti-systematic practice: each centres an embodied experience, while critically engaging with the institutional backdrop that renders these works possible. From the end of the 19th century, microscopic tools of seeing the body led to new biotechnological materialism that instrumentalizes and recontextualizes an artist's use of their own biological data and matter as material research (Ede 2000; Kuksenok and Satsia, 2021). The resulting embodied (micro)biopolitical manifestations catalyse alternative modes of body knowledge production aimed at the self.

This essay is structured as follows. In Section 2, we contextualize contemporary (micro)biopolitics, molecularization, and datafication of the self. In Section 3 we review several artistic interventions and explorations of the (micro)biopolitical self through the proposed lens of anti-systematic practice. In the concluding Section 4, we recapitulate the key ideas of this essay. Self-experimentation may be individual or collective; in all the projects reviewed, the focus is on bodies or bodily experiences typically marginalized. Focusing on personal experience is a process that subverts representativeness and systematization, particularly when those experiences are marginal edge-cases excluded in the act of generalization. Such an anti-systematic practice does build on a systematic and systematizing knowledge production practice, but with the primary aim of integrating general biomedical knowledge with complex, contextualized personal experiences for deeper (collective) self-understanding.

2. (MICRO)BIOPOLITICS, MOLECULARIZATION AND DATAFICATION OF THE SELF

By (micro)biopolitics, we refer to the infiltration by biopower and biopolitical governmentality at the molecular level. Šlesingerová (2017, p.8) highlights that synthetic biology and the engineering of artificial life are examples of contemporary biopolitical population management. Ironstone (2019) considers microbiopolitics from the perspective of "the organismic self [which] defends itself against a microbial non-self or other" and argues for an "affirmative microbiopolitics" that emphasizes "generative multispecies relationality." In our use of (micro)biopolitics, the "other" entails institutional agents, processes, and knowledge, while the "organismic self" is composed of individual and collective persons, including their

disparate biological matter. Whereas Ironstone (2019, p.8) describes “the metaphors of the self” as “inadequate to describe the symbiotic activities of what may better be understood as a generative multitude or crowd”, we similarly extend our understanding of an organism to include not only individuals but collectives and communities of practice operating in relation to other communities of practice, even in instances where that relation is animated by an intent to subvert or resist.

The molecularization and datafication of the self makes our biological existence a political concern in new ways (Rose, 2001, p.1). Ironstone (2019, p.6) writes that “molecular biology and increasing computational capacity have [significantly influenced] what it means to be human [by conceptualizing] the body on a small scale... through the means of so-called ‘big data’, producing vast databanks of genomic data in order to classify and separate out the genetic information of plants and animals, thereby making it possible to identify connections between them and to conceive of novel modes of biomedical management and bodily optimization”. Foucault’s “medical gaze” (1963) has shifted to include a molecular gaze with the emergence of new tools for rendering, visualising, policing on a molecular level. As far as the molecularization of life is concerned, Rose (2001, p.13) notes that it is “a reorganization of the gaze of the life sciences, their institutions, procedures, instruments, spaces of operation and forms of capitalization”.

The biotechnologization and datafication of the self through wearable self-tracking technologies and devices expands our capability to build bodily knowledge, simultaneously entailing pervasive surveillance (Lupton 2016, Sanders 2017; Kuksenok and Satsia, 2021). These biotechnological advances constitute contemporary forms of biopower that seek to dominate and control on a molecular (micro) level of the self by rendering the body as a visible site, one that “is visualised, catalogued and utterly controlled” (Šlesingerová, 2017, p.11). New forms biological monitoring and surveillance have “constructed our bodies as sites of visibility, malleability and changeability, even on a molecular and genetic level, and our societies have now become governed on these micro-levels” (Rabinow & Rose, 2006; Braun, 2007; Atkinson et al., 2013 in Šlesingerová, 2017, p.11).

Contemporary biopolitics pervades the design, replication and commodification of existing biological systems, organs, molecules, hormones and tools for encountering these aspects of ourselves. Currently, the informational power of living matter has capital value within data banks of bio-genetic information about species, populations and individuals (Braidotti, 2016, p.21). This new

biogenetic and cognitive capitalism is “an opportunistic political economy that turns all forms of life/zoe (human and nonhuman intelligent matter) into a commodity for trade and profit”. The capital that matters today is the knowledge and understanding about life and living systems in order to replicate them and capitalize on them. Braidotti (2016, p.21) adds that the capitalization of living matter produces a new political economy, “which introduces discursive and material political techniques of population control of a very different order from the administration of demographics, which preoccupied Foucault’s (1997) work on biopolitical governmentality”.

Collecting personalised data on a genetic and biological level contributes to biopolitical and genetic surveillance. Šlesingerová (2017, p.12) adds that there are social consequences in this information collection process, and that it signifies new ways of creating, defining, objectifying and governing bodies, especially when data become detached from embodied experience.

Technoscientific advances, including medical imaging and self-tracking, transform the human body into a site of data mining and knowledge building with the aim of control. Building body knowledge can become a form of biopower that “manifests itself in the form of daily practices and routines through which individuals engage in self-surveillance and self-discipline, and thereby control themselves” (Foucault, 1976, in Pylypa, 1998, p.21). Lupton (2016, pp. 45-51) notes that “neoliberal political rationalities rely on apparatuses of ‘soft’ rather than ‘hard’ power” under which practices of self-optimization “appear to emerge from personal desires and voluntary objectives related to the achievement of health, happiness, and success rather from imperatives issued by the state of other sources of authority” (ibid.). Sanders (2017, p.18) additionally recognizes gendered dynamics, wherein these devices “foster increasingly rigorous self-policing mentalities in women”.

While contemporary forms of (micro)biopolitics and surveillance turn the human body into a commodity, artists instrumentalize molecules, hormones, menstrual blood, and the knowledge produced from working with their own data and matter into commons rather than commodity. In introducing this essay, we questioned the agency of different aspects of self-directed exploration and experimentation with the (micro)biopolitical organism: who gets access to necessary tools and data? Whose work is granted the capacity to stay ambiguous and inconclusive, but still legitimate? In the next section, we will review methods of resistance and surveillance in speculative artworks that explore (micro)biopolitical data, matter and experiences.

3. ANTI-SYSTEMATIC ARTISTIC INTERVENTIONS AND EXPLORATIONS OF THE (MICRO)BIOPOLITICAL ORGANISM

In this section, we consider methods of resistance and subversion explored within (micro)biopolitical organisms. subRosa (2008, p.238) defines resistance as becoming “a non instrumentalized, non commodified body,” which is potent because it is “very difficult to perform in our global culture of marketing and aggressive accumulation”. Prior work on consumer use of technologies for seeing and understanding the body has suggested paths of subversion and resistance through available consumer technologies (Sanders 2017; Nafus and Sherman 2014).

Responding to the claim that self-tracking is “a profoundly different way of knowing what data is, why it is important, who gets to interpret it, and to what ends” (Nafus and Sherman, 2014), Lupton (2016) suggests this is insufficient for “resistance against algorithmic authority:” “while a small minority of technically proficient self-trackers are able to devise their own digital technologies for self-tracking ... the vast majority must rely on the commercialized products that are available and therefore lose control” over the resulting data. Sanders (2017, p.21-22) suggests “potentially subversive body projects by counterposing them to conventional self-improvement projects.” First, instead of an emphasis to use quantification to “discover an authentic self has always already existed,” Sanders suggests users “treat digital self-tracking devices not as means of self-discovery but as tools for inventing oneself as something new and not yet imagined”. Second, rather than “[defining goals] in terms of the exterior form of the body,” Sanders suggests “purposefully goal-unoriented” body projects. Lastly, with respect to exercise behavior-change related tools, Sanders (2017, p.21-22) suggests replacing “game design elements” with a “focus on the quality of one’s interior.” We have also previously applied such definitions to the specific case of building body knowledge through technology for bodily seeing by centering subjective, embodied narrative (Kuksenok and Satsia, 2021).

In the below synthesis, we adopt the lens of anti-systematic exploration and intervention. We highlight forms of knowledge production whose aim is individual or collective self-understanding, rather than generalizable theory, and which bring aspects of existing rigorous methodology into a subjective, narrative, and embodied practice. In the following examples, we highlight contemporary artworks that critically engage with the (micro)biopolitics of intimate care, menstruation, and hormones. Genital and hormonal experience are rarely the subject of constructive or inclusive public discourse, and medical knowledge has only relatively recently

centered the experiences of bodies with vaginas and ovaries, or with intersex variations in genital or hormonal expression.

In our notion of (micro)biopolitics, we consider the institutional other, and the personal or collective organism. Mularoni (2021) argues that artistic interventions are necessary in the contemporary healthcare landscape because of the biases encoded and popularized through self-tracking devices in “an increasingly commercialized medical industry”. Exemplifying a collective organism, the Critical Art Ensemble, a collective of tactical media practitioners, demonstrates how our understanding of abstract (and “other”) biological concepts can be recontextualized by reversing certain functions of organisms, molecules, and hormones (Tsang, 2017, p.13). The resulting notion of “contestational biology” describes a form of social resistance where members of the lay-public perform science outside institutional walls in order to challenge the status quo (ibid.).

The sphere of resistance in such practices could lie in reflexive work with the intention of subverting the normalizing power, sociological power relations analyses, and analyses of the processes in which technobiological data is used to supervise and sort people (Šlesingerová 2017, p.13). In response to the (micro)biopolitical issues emerging from contemporary forms of surveillance, contemporary artists combine biohacking, speculative design, activism, art, and open science, “commoning” molecules, medical tools and knowledge to cultivate accessible forms of collective care (Fraguito, 2020, p.167). In these practices, there is also an evident recontextualisation of scientific knowledge and instrumentalisation of molecules, hormones, vaginal flora and menstrual blood into catalysts that mobilise material research, self exploration and embodied scientific knowledge production of the self.

3.1. “Mooncalf” – WhiteFeather Hunter

The primary example of the instrumentalization and recontextualization of (micro)biopolitical matter in this paper is WhiteFeather Hunter’s use of endometrial stem cells from her own menstrual blood in “Mooncalf” (2019-present). In “Mooncalf” (Figures 1-3), her own biological material forms new nutrient media for tissue culture, which “could constitute a more ethical and alternative way to the fetal calf serum used in cellular agriculture” (Debatty, 2021).

In this project, endometrial stem cells from menstrual blood constitute biocapital, as they are instrumentalized into a novel source of nutrients for knowledge production, and recontextualized for material research in order to subvert and challenge cultural, scientific and social constructions of the “female body as problematic to that of innate

potential for self-actualization and, importantly, self-directed scientific experimentation” (ibid.).



Figure 1: “Mooncalf”, 2019- present. Part of the “Witch in the Lab Coat” PhD research-creation and scientific research project (in progress) that explores the intersection of feminist witchcraft and tissue engineering through the development of a body- and performance-based laboratory practice. Image courtesy of the artist.

Hunter’s collection and development of tissue cultures from her own menstrual blood during her PhD research at SymbioticA stirred institutional reactions related to “the common cultural perception of menstrual blood as somehow tainted, ‘unclear’ or dirty” (Debatty, 2021). However, as Hunter points out, “Mooncalf” politically addresses misogynist cultural taboos and explores how “the actual production of menstrual blood is still a material outside the control of the patriarchal capitalist economy” (ibid.).



Figure 2: “Mooncalf” product concept, 2019- present. Image courtesy of the artist.

In this project, Hunter calls attention to the unrealized potential of menstruation, and agency of menstruators, not in service of the institutions where this bio-matter can be useful, but in service of inspiring a different, curious relation among the menstruators themselves.



Figure 3: “Mooncalf” prototype: Constructed prototype of the imagined final product. Digital photograph. Object constructed of bacterial cellulose and polymer clay, 2021. Image courtesy of the artist.

3.2. “Future Flora” and “Alma”– Giulia Tomasello

Giulia Tomasello is a designer that specializes in wearable technology and electronic textiles. Since 2016, she has been experimenting with bacteria and developing biotextiles in order to create intimate care hygiene products. Her aim as a designer is to spark critical conversations on vaginal hygiene and their surrounding taboos, to raise awareness and provide alternatives for intimate self-care. She envisions a woman’s body in the intersection of biotechnology and healthcare whilst empowering citizens through open-source biology to become active participants in their personal health (Alma by Giulia Tomasello – RE-FREAM, 2021).

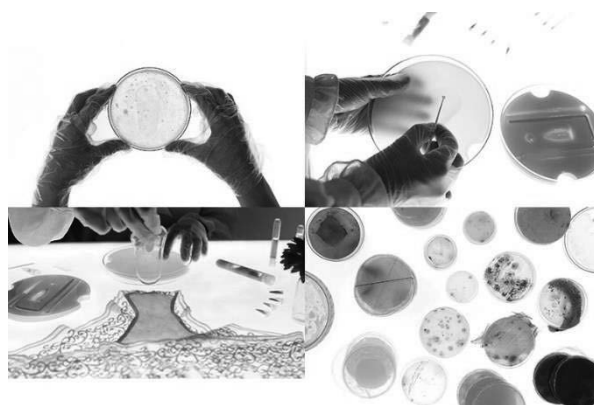


Figure 4: “Future Flora”, 2016. Images courtesy of the artist.

In both Maggie’s “Open Source Estrogen” project and Tomasello’s “Future Flora” the starting point for experimentation and development is the formation of a speculative question. In the case of “Future Flora” the question/s were: What if we can harvest our own vaginal flora in order to treat and prevent common vaginal infections? What if we could wear bacteria to empower women? “Future Flora” is a DIY harvesting kit designed to treat and prevent

vaginal infections wherein users can their own gelatine sanitary pads with healthy bacteria that could be worn in their underwear (Figures 4 and 5).

Tomasello (2021) emphasizes the lacking prevention for common vaginal infections such as Candida, exacerbating the struggle in intimate hygiene, care, and awareness. She notes that a lack of self awareness comes from lingering taboos around intimate health. “Futura Flora” allows us to rethink and reinvent products of intimate care; instead of taking probiotics orally and through the gut we can grow bacteria on a gelatine pad that we can wear in order to rebalance our vaginal flora (ibid.) (Figure 5).

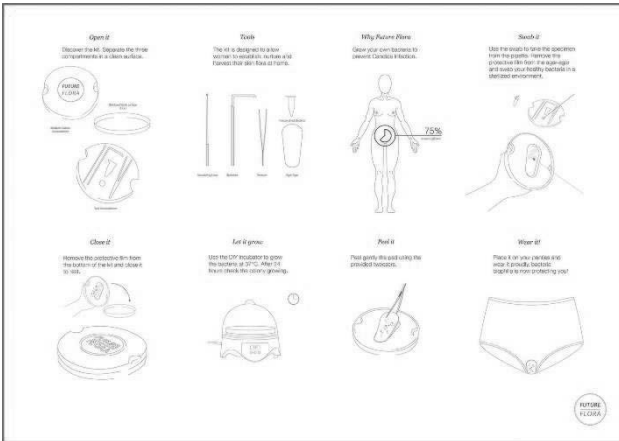


Figure 5: “Future Flora” kit manual. Image courtesy of the artist.

“Future Flora” promotes embodied learning, facilitating the production of situated and embodied knowledge through direct engagement with our vaginal flora, which is a crucial factor towards advancing intimate health (Campo Woytuk, Juul Søndergaard, et al, 2020, p.344). It also subverts the stigma and taboo attached to intimate care and challenges traditional patriarchal models of doctor-patient relationships, where the patient has a passive role in their own well-being, by empowering us to become active participants in our own intimate health. The focus on self-understanding and active self-care, as well as subversion of isolating taboos, constitutes what we consider an anti-systematic approach of engagement with, in this case, applied research on vaginal infections within an artistic practice.

Tomasello has more recently worked on “Alma” (Figure 6), a wearable biosensor designed to monitor vaginal fluids. Numerous self-tracking applications or wearables are accumulating information in order to monetize personal health data (Mularoni, 2021, p.16) and can lead to the alienation of our own bodies.

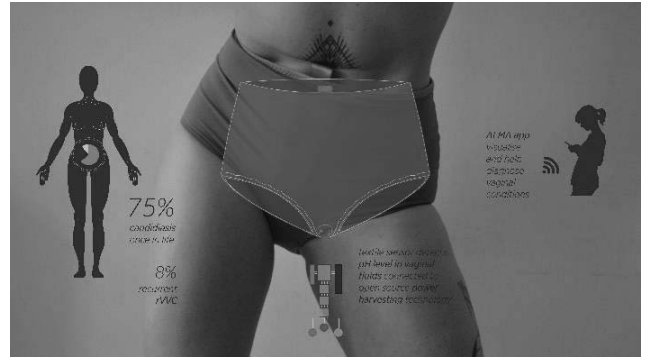


Figure 6: ALMA Smart Underwear is the first non-invasive tool for monitoring vaginal health. It measures pH and other biomarkers in vaginal fluid and interacts with user via an app. This tool enables body awareness, prevention and monitoring of vaginal conditions such as infections and STIs. Image courtesy of the artist.

However, “Alma” is designed to empower people with vaginas to become familiar with their own bodies, and active patients more willing to seek healthcare professional advice when necessary and break some of the taboos that are still attached to gynaecological health (Alma by Giulia Tomasello – Re-FREAM, 2021).

In doing so, Tomasello has combined design, active education, technology and anthropology and developed participatory workshops such as “Alma connects Flora” that invites participants to co-design educational tools, methodology and a universal online resource of experience, the “ALMA ATLAS”, for a radical cultural change in intimate care (ALMA, 2021) (Figure 7).



Figure 7: Co-designing educational tools, methodology and participatory workshops for a radical cultural change in intimate care. Images courtesy of the artist.

Tomasello's work promotes a more inclusive and participatory approach to healthcare and intimate health. Through these approaches we can improve collective and individual understanding, while destigmatizing biological processes and the language around them.

3.3. “Open Source Estrogen” and “Genital(*) Panic” – Mary Maggic (Tsang)

Since 2015, Mary Maggic’s (Tsang) research has centered hormone biopolitics and environmental toxicity, and how the ethos and methodologies of biohacking can serve to demystify invisible lines of molecular (bio)power (Figure 8). They describe their practice as socio-political excavation, or biotechnical civil disobedience investigating the role of institutional science and biotechnology in the construction of somatic fictions and mass political imaginaries (Open Source Estrogen — Mary Maggic Official, 2021).

“Open Source Estrogen” combines do-it-yourself science, body and gender politics, and ecological ramifications of the present (Open Source Estrogen — Mary Maggic Official, 2021). By making self-synthesized hormone therapy in the kitchen accessible, the artist demonstrates the institutional biopower entrenched in the estrogen molecule (Tsang, 2017).

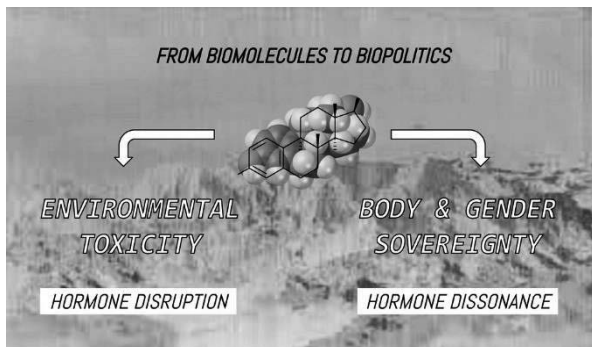


Figure 8: “Open Source Estrogen”, Biomolecules to Biopolitics, hormones with Institutional Biopower. Image from <https://maggic.ooo/Open-Source-Estrogen>, courtesy of the artist.

Maggic describe it as “a form of biotechnical civil disobedience developed in response to the various microbiopolitics of hormonal control on female and trans bodies prescribed by governments and institutions”. At the core of this biotechnical civil disobedience is the demystification of science: the way it is performed, politicized, and marketed to the masses. Through employing practices like do-it-yourself or do-it-with-others (DIY/DIWO) Biology in artistic practice we can provide greater transparency to the black boxes of science by democratizing the tools and the knowledge produced (Tsang, 2017, p.14).

“Open Source Estrogen” project began with a speculative question: what if it were possible to synthesize estrogen in the kitchen? The aspects of speculative design serve to redefine and refigure our bodies, societies, and ecosystems which have been colonized by hormones. Maggic emphasizes that this question is not purely scientific and that working with hormones does not only entail hacking

molecules, hardware and protocols. It also entails hacking and decolonising of ideas about sex and gender and the various ways institutions regulate and pollute our bodies and bodies of nonhuman species. Working with hormones “requires uncovering the socio-political history of hormones, how they were assigned their institutional biopower, and how their pervasive presence in our environments problematizes our social notions of gender” (Tsang, 2017, p.17).

Maggic’s “Genital(*)Panic” is an open, anonymous digital archive of 3D genital scans, AGD caliper measurements and demographic data that challenges gender ideas about normality and imagines a queer-feminist population study that chooses the users’ gender identity over their institutional gender assignment (Genital(*)Panic — Mary Maggic Official, 2021) (Figures 9-11).

Maggic (GENITAL(*)PANIC by Mary Maggic – Mz* Baltazar’s Lab, 2021) mentions how for hundreds of years scientific institutions have been enforcing sex and gender subjectivities through visual genital aesthetics and how in the contemporary world they have come up with new top-down tools and methods such as the anogenital distance (AGD) measurements for categorizing and policing otherness and the gender binary.



Figure 9: Genital(*)Panic, XENOBODIES IN MUTATION exhibition @ TETEM, Enschede, Netherlands, 2019. Image from

<https://maggic.ooo/Genital-Panic>, courtesy of the artist.

This method is still widely used by state-scientific institutions for measuring levels of exposure to industrial and hormonal toxicity in plastics and it is an attempt to get an analysis on how chemical pollution has become entangled with ecological normativity. Scientists have found that exposure to hormone disruptors causes shorter distances between the anus and genitals (ibid.).

“Genital(*)Panic” asks us to (re)consider institutionally constructed narratives on the “normative body”, how we are being pathologised and medicalised on the basis of our biology, and how the development of institutional normative bodily guidelines determine how we are policed and surveilled (Genital(*)Panic — Mary Maggic Official, 2021).

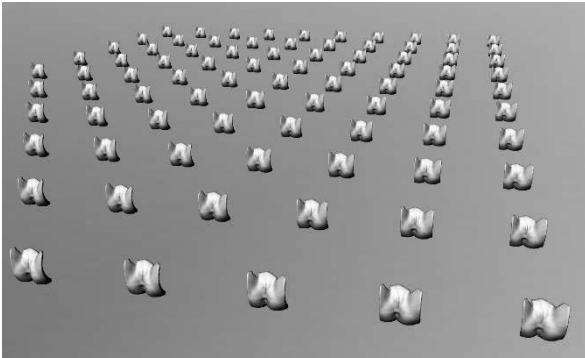


Figure 10: *Genital(*)Panic*, 3D genital scans, XENOBODIES IN MUTATION exhibition @ TETEM; Enschede, Netherlands, 2019. Image from [https://tetem.nl/event/xenobodies-in-mutation/#gallery\[\]-9](https://tetem.nl/event/xenobodies-in-mutation/#gallery[]-9).

Maggic emphasises that “participating and donating data symbolizes an act of statistical defiance, reimagining parameters and narratives for the ‘new normal,’ the ‘new natural,’ and the ‘new breeder’” (*GENITAL(*)PANIC* by Mary Maggic – Mz* Baltazar’s Lab, 2021).

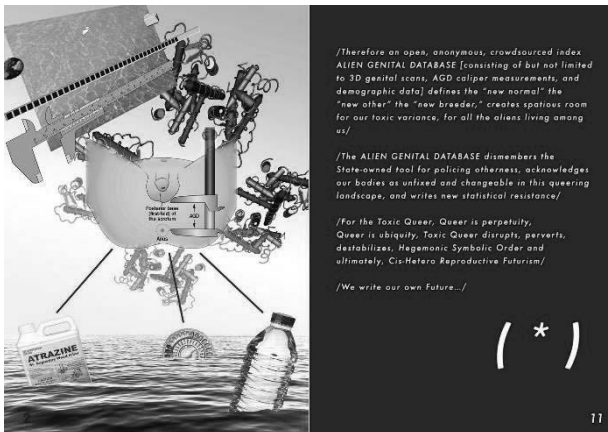


Figure 11: *Genital(*)Panic*, from the manifesto, found at <https://maggic.ooo/Genital-Panic>, image courtesy of the artist.

The anonymous digital data archive subverts normative sociocultural narratives about gender through strategies like *Critical Storytelling*. In Maggic’s strategy for creating new subjectivities for living in a hormonally-colonized world they “infuse(s) social and cultural meaning” in order to raise an alternative collective consciousness and awareness of our bodies that can “move beyond fears and anxieties and produce new subjectivities which refigure the world” (Tsang, 2017, p.17).

4. CONCLUSION

In this essay, we drew on scholarship and art across multiple disciplines to develop the notion of anti-systematic bodily observation and experimentation. The biotechnologization and datafication of the self

through wearable self-tracking technologies and devices expands our capability to build bodily knowledge (Kuksenok and Satsia, 2021), while at the same time entailing unprecedented levels of pervasive (micro)biosurveillance. Technological advances can constitute forms of (micro)biopower that dominate, control, classify, and govern our life and its biotechnological aspects on a micro and molecular level of the self. We consider theory and art practice that domesticates and demystifies biotechnology and resists or subverts forms of (micro)biopower, while simultaneously engaging with the growing body of medical knowledge and biotechnological capability for bodily observation.

While an anti-systematic practice draws from the tools and practices of a systematic and systematizing discipline, its primary aim is to integrate general biomedical knowledge with complex personal experiences within their social contexts for deeper (collective) self-understanding. The works we describe also have a speculative and participatory element, empowering self-understanding that arises from conceptualization of alternative futures and from actively undertaking body projects. By focusing on experiences or groups which are relatively underrepresented in institutionalized settings, each artwork renders experimentation and investigation more relevant to these groups and experiences. Even as they critique, resist, or subvert forms of (micro)biocontrol, they also invite a broader engagement with the biotechnology of seeing, even a kind of domestication of biomedical processes into a non-biomedical space, as in Tomasello’s “Future Flora” or Maggic’s “Open Source Estrogen”. The projects also invite the recognition or recontextualization of bodily materials, such as Hunter’s “Mooncalf” or Maggic’s “Genital(*)Panic”. The artworks invite participation through biohacking and data collection in service of collaborative speculations.

We have considered practices that call for a critical reappraisal of the relationship between molecular and microbial knowledge, power, and institutions by commoning that knowledge and thereby subverting or resisting institutional (micro)biopower. We consider such practices capable of these aims when they centre collective self-knowledge, because this resists the isolating and individuating neoliberal ethos which pervades self-tracking and consumer self-experimentation; and because it brings potentially scarce biomedical knowledge about under-represented bodies or experiences into active, embodied discourse with lived experience.

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Defining LGBTQ+ Publics Through Consumer Genomics

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What are the implications of genomic sexuality research for LGBTQ+ identities and publics? This project provides a timely and collaborative intervention as genomics moves into sexuality research, and LGBTQ+ politics gain new salience. While scholarship has engaged with the emergence of direct-to-consumer (DTC) genetic testing in relation to race, ethnicity, and disability little work has been conducted regarding more recent forays into sexual identity and the intersection of these categories. This project seeks to address this gap in the research and examine the implications of these genomic sexuality studies for local and global intersectional LGBTQ+ publics.

Direct-to-consumer genetic testing. Genomics. 23andMe. Publics. Sexuality.

1. INTRODUCTION

In 2012, the popular direct-to-consumer (DTC) genetic testing company 23andMe began explicitly studying sexual identity (Drabant *et al.*, 2012). Most recently, together with UK Biobank and the Broad Institute, 23andMe has been involved in the largest scale study into the genetics of same-sex sexual behaviour to date (Ganna *et al.*, 2019). The company frames this initiative in terms of the public good, claiming that it was driven by customer request and that diversity enables better science. Discrimination is cast as undermining public good because of excluding great minds from the scientific endeavour and participants from providing specific demographic data. While scholarship has engaged with the emergence of DTC genetic testing in relation to race and ethnicity (Blell and Hunter, 2019; Mittos *et al.*, 2018; Scodari, 2017) and disability rights (De Paor and Blanck, 2016; Schlauderaff, 2019), little work has been conducted regarding more recent forays into sexual identity and the intersection of these categories. This project seeks to address this gap in the research and examine the implications of these genomic sexuality studies for local and global intersectional LGBTQ+ publics. It provides a timely and collaborative intervention as genomics moves into sexuality research and as LGBTQ+ politics gain new salience within and beyond the UK.

In this paper, we begin by tracing DTC genetic testing insofar as it relates to the history of eugenics and the search for the archetypal, yet fictional gay

gene. Reviewing the Drabant *et al.* (2012) and Ganna *et al.* (2019) large-scale genome-wide association studies (GWAS) into sexual orientation and behaviour, we discuss our initial observations regarding the interpellation and definition of LGBTQ+ publics and the implications of these studies for these publics. We contextualise this paper within our broader proposed three-year project, which will engage with qualitative research, critical making, and network building. We conclude by outlining the pathways to impact that we visualise for this research.

2. GENOMICS, EUGENICS, AND THE GAY GENE

Genetic testing’s practical and political background has continuity with that of eugenics. A history of involuntary sterilization laws and genetic discrimination echoes through projects that claim to pinpoint a biological basis for social identities (Thacker, 2005, p. 222). Unsurprisingly, contemporary studies of genetic identity seek to shed such historical connotations, positioning participants as standing to gain fine-tuned self-knowledge while contributing to public health initiatives (23andMe, 2021). However, DTC genetic testing and “do it yourself” (DIY) genomics is still typically associated with an elite, white class of hobbyists at best and with a pseudo-scientific justification for white supremacy at worst (Blell and Hunter, 2019; Mittos *et al.*, 2018), although interventions from critical race theory (Nelson,

2018), feminist disability studies (see: Garland-Thomson), indigenous activism (Reardon and TallBear, 2012) have also had impact. Studies that claim to offer neoliberal genetic insight into characteristics such as sexual orientation emphasise this complex intersection of scientific and socio-political concerns for communities that have traditionally faced biopolitical marginalisation.

In many ways, the large-scale GWASs that we examine here are the successors of the early 90s research that established the archetype of the gay gene. Specifically, Hamer et al. (1993) argued for a correlation between the X chromosome genetic marker —Xq28— and gay male sexuality. Despite the lack of replication of this study, and repeated production of contrary evidence for the gay gene's existence, it has persisted as a powerful media object, which has contributed to the re-medicalisation of sexual identity in the 21st century (O'Riordan, 2012). The Ganna et al. (2019) study states that the identified SNPs cannot be used to predict sexual orientation; however, both Drabant et al. (2012) and Ganna et al. (2019) note correlations between genetic markers, sexual behaviour, and other traits. Mainstream and scientific media coverage of these studies further skew the narrative, framing these findings as scientific discovery despite the uncertainty and caveats.

Identity is not monolithic, and studies such as these further impact LGBTQ+ communities along the lines of race and ability. Although, as Blell and Hunter (2019, p. 2) observe, 'repeated studies of human population genetics for well over 40 years have concluded that the genetic data do not support the notion of biological races in humans', ancestry reports and medical practices alike continue to categorise people based on race. Also problematic, DTC research into health conditions often pitches the eradication of genetic disease as an unassailable good, but, in the process, risks stigmatising disabled individuals (Schlauderaff, 2019) while potentially subjecting them to life and long-term care insurance discrimination (Garner and Kim, 2019). These identity categories are not mutually exclusive; LGBTQ+ individuals interpellated through the genetic lenses of race and disability potentially face complex and intersecting modes of medicalisation and marginalisation. This project makes an intervention at the intersection of consumer genetic testing and sexual identity by examining the aims of these projects and the different publics take up and engagement with sexuality genomics.

3. DEFINING LGBTQ+ PUBLICS THROUGH DATA COLLECTION, CATEGORISATION, AND EXCLUSION

Large-scale genomic sexuality studies risk defining LGBTQ+ publics through reductive data collection

and categorisation practices and participant exclusion tactics that leave little room for the nuanced identities that exist within these communities. Warner (2002, p. 51) defines a public as a self-organized 'entity that embraces all the users of [a] text'. GWASs focused on sexual orientation and same-sex sexual behaviour hail LGBTQ+ publics through three interwoven texts: (1) the genotyped DNA that is rendered through genetic testing, (2) previous phenotypical research into these populations, and (3) qualitative surveys that allow participants to identify themselves and / describe their behaviour. LGBTQ+ identities have historically existed in opposition to norms and in relation to shifting societal perceptions of gender and attraction, making them notoriously difficult to pin down. In our initial close reading of these studies' data collection methods, we locate the tension that emerges between scientific systems that necessitate rigid categorisation practices and identities and publics that inherently reject categorisation.

In 2012, 23andMe researchers began studying the 'role genetics plays in sexual orientation' (23andMe Blog). They publicised the initiative, posting it on their blog, running an interview with the Advocate (Anderson-Minshall, 2012), and presenting their initial results at the American Society of Human Genetics annual meeting in San Francisco. The study's qualitative data collection methods involved 'a 33-item Sexual Orientation Survey [that] included a subset of 7 questions from the Klein Grid' (Drabant et al., 2012). The Klein Grid, developed in 1978 and updated multiple times since then, 'captures more nuance and complexity than the familiar, one-dimensional Kinsey Scale' (Bi.org), allowing individuals to identify along a spectrum of sexual attraction, accounting for past experiences, ideal desires, and social and emotional preferences. Ultimately, however, the study's analyses were entirely 'focused on the 'sexual identity' item of the Klein Grid' (Drabant et al., 2012), thus reducing the sexual complexity and fluidity for which the tools allow to a single concrete variable-as-text and constructing a public around it. Moreover, while 18 per cent of participants fell within the five categories associated with bisexuality, the study predominately reported on the participants who identified as 'heterosexual only' or 'homosexual only', further subdividing the community. Finally, the study refers to its target population as 'homosexuals', a medical term that emerged in the nineteenth-century through effort to shift the dialogue surrounding same-sex attraction from one of morality to one of biology, which contributes to the re-medicalisation of LGBTQ+ identities today (Eckhert, 2016). Similar complications around sorting and labelling identities persists within subsequent studies.

More recently, Ganna et al. (2019) performed a GWAS that '[revealed] five loci significantly associated with same-sex sexual behaviour', a

notably different result from that Drabant et al. (2012), which did not 'identify any genetic loci reaching genomewide significance'. Due to this study's unprecedented size and novel results, it was featured widely in scientific and mainstream publications alike. Despite the difference in outcomes, the studies' data collection and categorisation practices invite similar interrogation. Ganna et al. (2012) categorised participants based on "same-sex sexual behaviour," which is defined as having ever had sex with someone of the same sex.' Just as Drabant et al. (2012) used a single vector of the Klein Grid as the text by which it hailed its LGBTQ+ public, Ganna et al. (2019) used a single question as the text through which it interpellated a very different LGBTQ+ public, one centred on behaviour rather than identity. The language it uses to label and define this public mirrors that used by the 23andMe researchers. The article states, 'We refer to individuals who have ever had sex with someone of the same sex as "non-heterosexuals," whereas we refer to individuals who have never had sex with someone of the same sex as "heterosexuals."' Ganna et al. acknowledge the potential othering effects of these terms, and indeed, like the term 'homosexuals', the parallelly clinical terminology 'non-heterosexuals' and 'heterosexuals' linguistically re-medicalises these identities. To be studied in a genomic context, LGBTQ+ identities are often counterintuitively distilled into an artificial binary.

Study limitations and participant exclusion practices further define publics along artificial lines. Both studies note that they only studied participants of European ancestry. The choice to limit the participant sample to this population is relatively unsurprising; 23andMe's Ancestry Composition Guide (2021) acknowledges that 'a large proportion of 23andMe customers have unmixed European ancestry', and Mittos et al. (2018) observe that most of the Twitter discourse surrounding DTC genetic testing companies is generated in the US and the UK. While this demographic is by no means homogenous as it includes individuals from many different cultural and ethnic backgrounds, this limitation still actively excludes many identities that do not adhere to Western understandings of gender and sexuality. Furthermore, both studies actively excluded transgender participants. While doing so allowed researchers to generate a measurable metric for sexual attraction or behaviour between 'homosexual' or 'non-heterosexual' cisgender participants, it also eliminated a significant number of LGBTQ+ community members both in terms of gender identity and attraction. As a result, studies like this risk making generalising claims based on narrow, Western LGB publics, and fail account for the complex, dynamic, and diverse intersectional queer experiences, identities, and communities that exist worldwide.

4. IMPLICATIONS FOR LGBTQ+ PUBLICS

While many researchers do not set out to negatively impact the communities that they study, they can inadvertently do so. Ganna et al. explain that they worked with LGBTQ+ advocacy groups to ensure the use of inclusive language and effective strategies for communicating the results of the study to diverse audience. They claim that the study '[points] toward the richness and diversity of human sexuality'. This kind of language sets the intention of the study; however, the study's implications can still be complicated. These genomic sexuality studies have implications, intentional or otherwise, for intersectional LGBTQ+ communities.

Studies focused on the genetics of sexual identity potentially reinforce harmful stereotypes if they fail to appropriately acknowledge or provide research into environmental considerations. In addition to exploring genetic factors involved in sexual orientation, Drabant et al. (2012) 'aimed to understand the relationship between sexual orientation and non-genetic phenotypes, including previous findings on substance use and mental illness' (Drabant *et al.*, 2012). Claiming, 'we replicated previous studies showing that lesbians are more likely to be alcoholic than heterosexual women', the study showcases this finding alongside its genetic report without providing methodological or contextual information. Additionally, both studies indicate that both lesbians and gay men are more likely to have psychiatric illnesses than their heterosexual counterparts. By reproducing this data in genetic studies, researchers risk indicating a strictly genetic basis for traits and disorders that are largely caused by phenotypical and environmental factors. Researchers must use caution when conducting these studies to avoid harming the populations that they seek to serve.

These observations barely scratch the surface of the effects genomics research has on LGBTQ+ communities. Maxmen (2019), for instance, discusses socio-political issues, personal privacy concerns, and the spread of misinformation as risks affiliated with genetic testing and interpretation. In our larger project, we will examine these and other implications in detail.

5. CONTEXT AND FUTURE RESEARCH

In context, the observations discussed in this paper operate as the initial research for a three-year project that will commence in Autumn 2022. This project will take a holistic and collaborative approach to the research question: what are the implications of genomic sexuality research for LGBTQ+ identities and publics? It will interrogate the companies and

researchers who conduct genetics of sexual identity studies, analyse the individuals and publics who participate in these studies, and engage publics in developing outputs that examine the implications and narratives that emerge because of these studies. The project will be structured through three work packages: (1) Qualitative Research, (2) Artefact Development, and (3) Creative Network and Design. Here, we briefly outline the scope, design, and methods of this proposed research.

5.1. Qualitative research

The Qualitative Research work package seeks to address the research questions pertaining to the actors who conduct studies about the genetics of sexual identity and the individuals and communities who participate in these studies (i.e., why are biomedical researchers and DTC companies moving into this space, and how and why are participants engaging with sexuality genomics?). The team will perform three phases of data collection. First, the team will draw from online forums and discussion boards that are both affiliated with DTC companies (i.e., 23andMe Customer Forums) and DIY genomics initiatives (e.g., BiohackInfo, 23andMe subreddit, etc.). This online data collection strategy will allow the team to recruit participants from a diverse range of geographic locations; however, we acknowledge that limitations of this strategy include a representational dependency on the demographic of each site's users, self-selection bias, technology access barriers, etc. The process will be guided by participatory, queer ethical practices, which offer a methodological framework with a unique capacity to attend to LGBTQ+ participants in online spaces (Compton, Meadow, and Schilt, 2018; Dadas, 2016). Team members will establish their identities as researchers and obtain informed consent when collecting information. The team will use ethnographic methods (surveys, fieldwork, and interviews) to examine the ways in which these online communities discuss genetic testing and sexual identity. The survey will be designed to collect information about participants' motivations for engaging in these studies; their impressions of the studies' language and data collection practices; forms of knowledge and/or empowerment experienced through participation. This qualitative approach will allow users to self-identify in nuanced ways that extend beyond those of the binaries and boxes that we have identified in previous studies. The team will recruit participants for follow-up interviews from the pool of survey respondents. Alongside this, the team will also conduct informant and expert interviews with current and former DTC genomics companies' employees and researchers that work for or with these companies. The resulting dataset will include ethnographic observations, participant survey and interview responses, and informant and expert interview responses.

5.2. Artefact development

The Artefact Development work package will involve the critical design of a digital artefact that materialises the research and develops an interface for engaging with the core dataset. While the artefact's details cannot be determined until the onset of the project and the appointment of the team, potential examples include a simulated 23andMe style interface, a hybrid online-material installation that reincorporates embodied aspects of identity into the quantified results of a DTC genetic test, or a video game. Theoretically, the team will be guided by the principles of speculative design in that the artefact will '[highlight] legal and ethical limits to existing systems' (Dunne and Raby, 2013, p. 57), specifically biodigital systems and sexual identity categories. Practically, the artefact's procedural rhetoric will facilitate interactions with and responses to the project's core research questions and data. The aims of the digital artefact are to act as an object around which networks can gather and collaboratively engage with the research and to enable local and global LGBTQ+, DTC genetic testing, and DIY genomics publics to examine the social implications of the genetics of sexual identity. The development of the artefact will operate as an integral and iterative part of the research process and the artefact itself will function as the Artefact Development work package's output and be featured at the Creative Network and Design work package's exhibition.

5.3. Creative network and design

The Creative Network and Design work package will involve collaborative research and the co-creation of outputs with LGBTQ+ artists and activists in the Brighton, UK community. The team will recruit members and develop a reflexive dataset through a participatory action research (PAR) approach that is oriented toward 'enacting change in the social conditions of LGBT lives' (Johnson and Martínez-Guzmán, 2013, p. 405). Johnson and Martínez-Guzmán's rethinking of PAR is particularly useful as it uncovers 'transitive and fluid form of thinking of oneself and others that escapes the expectations of medical institutions' (p. 413), expectations that we see emerging through the re-medicalisation of LGBTQ+ identities within genetics studies. To initiate this work package, the three teams will work in accordance with our proposed partners to host a workshop at a local event that centres LGBTQ+ arts and activism (e.g., Brighton Festival, Brighton Digital Festival, Brighton Fringe, Brighton and Hove Pride, etc.). The teams will present their initial findings and artefact concept at this workshop and seek feedback from participants involved in local intersectional LGBTQ+ artist and activist communities. From this workshop, a targeted call, and specific invitations,

the Creative Network and Design Team will recruit five artists / activists in residence to comprise the remainder of the team. We will commission these artists / activists to create work in response to the core data that invites new modes of understanding, questioning, and relating to the topic. The initial workshop and the following meetings will be video recorded to produce a reflexive dataset that allows each team to adjust its methods, deliverables, and distribution methods in accordance with the needs of the communities with which this project engages. The Creative Network and Design work package's outputs will be public-facing and community-driven. Throughout the work package, the team will host a series of public workshops for LGBTQ+ individuals to engage with DTC genomics research, centring on topics ranging from data privacy and ownership to the ways in which genomics studies impact LGBTQ+ communities. Data generated in these workshops will offer a local counterpoint to the global data collected from online forums and discussion boards. At the end of the project, the team will organise an exhibition that features the artists' and activists' work as well as the digital artefact.

This is a multi-faceted project that will enable the institution to function as a site of meaningful connection and cultural revival.

6. CONCLUSION: PATHWAYS TO IMPACT

The implications of genetic testing and genomics research on LGBTQ+ publics are complex and still unfolding. In this paper, we began to untangle this relationship first by framing genomic sexuality research in relation to eugenics and the history of the gay gene, observing the ways in which large-scale GWASs focused on sexual identity hail and shape LGBTQ+ publics through data collection and participant exclusion, and discussing the implications of these studies on LGBTQ+ individuals and communities, subjects that often appear different from those described by the studies. Second, we have extended a plan for future, outlining a qualitative research agenda, an artefact development initiative, and creative networking and design practices. We will close with a few remarks about this project's pathways to impact.

This project will directly benefit interdisciplinary academic communities, governmental and corporate genomics researchers, DIY genomics communities, and intersectional LGBTQ+ communities, artists, and activists. Academically, this project will engage with researchers in the social sciences, the life sciences, and the arts and humanities through its qualitative and creative approaches to scientific and medical topics. Moving beyond critique, it aims to engage critically and constructively with DTC genetic

testing companies and their research into sexual identity, as such it strives to engage directly with these companies, their researchers, and their initiatives. Practically, it seeks to benefit DIY genetic testing communities both by critiquing and offering alternatives to ableist and racist ideologies that persist within them, mitigating the harm that these narratives cause, and by highlighting the marginalised voices that exist within these communities. Most tangibly, this project will impact and benefit local and global intersectional LGBTQ+ artist and activist communities. These groups are instrumental in instigating social change, and we will collaborate with them on an individual, organisational, and regional level. Inherently reflexive, the project will adapt to and grow with the network that makes it viable.

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Gender Division of Labour: From human to silkworm in sericultural practice

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Silkworm raising and silk processing were conventionally regarded as women's work in agricultural practices in ancient China, while contemporary gender division of labour in this field maintains this stereotype and witnesses more nuanced inequality in domestic and institutional settings. Meanwhile, although domestic silkworms in the sericultural industry won't be differentiated by sex except for reproduction purposes, silk spun by male silkworms are concerned as of better quality by biologists, who thus worked on the feasibility of raising male-only silkworms exclusively. Male-silk products aim to meet the high-end demand for luxury silk products in the international market, while those unwanted female silkworms were made to die in the embryo by breed selections. This paper questions the genetic suppression of female silkworms and the constructed knowledge of masculine silk of premium quality, and thus shows how sexist ideologies are intentionally copied and imposed into the silkworm community to serve humans' pursuit of cultural capital. Female silkworms thus suffer double oppression of sexism and anthropocentrism, which poses challenges to formulate trans-species ethics of care in both agricultural labour and scientific studies.

Gender. Sexism. Silkworm. Labour. Sericulture. Ethics. Feminism. Anthropocentrism.

1. INTRODUCTION

'Men farming and women weaving' (c. 男耕女织) has been a long-established and pervasive collocation in written and colloquial Chinese since ancient times. It refers to the gender division of labour in pre-modern agrarian societies where men were in charge of tilling in the fields while women weaving fabrics at home. There is an anecdote in Chinese eco-art criticism that can serve as the entry point of the discussion on such gender division of labour in human-silkworm sociality. Liang Shaoji, a Chinese contemporary artist collaborating with domestic silkworms from 1989 onwards, is renowned worldwide for his artistic articulation of Daoism-flavoured natural cosmology in his silk-wrapping projects. During my interview with Liang in 2019, he recalled the burgeoning stage of his career as a 'silkworm artist'. The most memorable feedback he received, as Liang noted, was from a reputable Chinese art critic on an informal occasion: 'Ladies rear silkworms. You, a man, why bother doing this job?' Liang didn't comment on that critic's words, just laughing as if it

was merely a harmless joke. This sexually stereotyped remark, nevertheless, was astonishing as it bears the fixed cultural imprint of gendered labour division in Chinese sericultural practises.

2. SERICULTURAL LABOUR IN CHINA

One of the earliest textual allusions linking weaving labour to women appears in 'Shijing' (*Classic of Poetry*), an anthology of Chinese poetry dated back from the 11th to the 5th century BC. Vega in the constellation of Lyra, one of the brightest stars visible to human naked eyes in the sky, got its Chinese name *zhinv* (c. 织女, weaving girl), while its counterpart star Altair in the constellation of Aquila, was nicknamed *niulang* (c. 牛郎, cowherd), as recorded in the poem 'Minor Odes: Da Dong'. Despite written historical accounts on sericulture categorising weaving as women's occupation, it remains obscure whether such gender segregation had ever been strictly implemented in everyday silkworm-rearing and silk-weaving activities in ancient China.

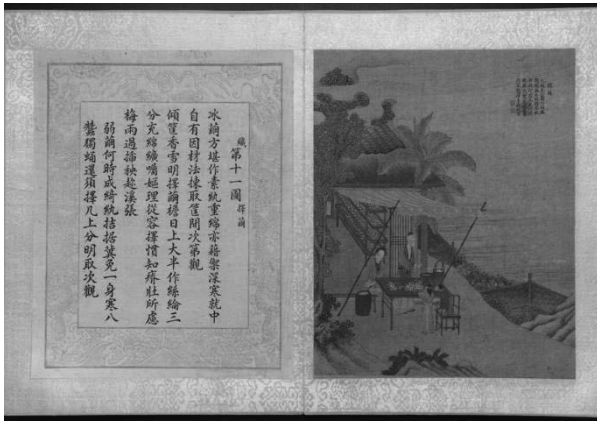


Figure 1: Sericulture Step 11: Harvest the Cocoons, in 'Imperially Commissioned Illustrations of Agriculture and Sericulture'. Picture courtesy of Library of Congress.

However, a series of agrarian illustrations dated back to the Song Dynasty, 'Pictures of Tilling and Weaving (c. 耕织图)', provide some tangible visual clues to shed light on scenes of ancient agricultural and sericultural practice (Fig. 1). 'Pictures of Tilling and Weaving' is a set of forty-five paintings accompanied with poems as their captions, depicting farmers cultivating grains, raising silkworms and weaving fabrics in forty-five sequential procedures in each folio. Since the Song Dynasty, this genre had been reconfigured and evolved by literati and officials for promoting the techniques of agrarian labour or edifying the public. Although in ancient times, the silkworm-rearing season was mainly in spring, which was also the busiest time of the year for cultivating activities (Bray, 1997, p. 189), men and women did not devote themselves to agricultural and sericultural labour, respectively, as the 'men tilling and women weaving' discourse suggests. In various versions of 'Pictures', the figures in the depictions of two essential steps in sericulture, namely 'picking mulberry leaves' and 'pulling down the cocoon frames', are all male.

As for leaf-picking, supplying fifth-instar silkworm larvae with sufficient mulberry leaves has always been physically demanding labour. The caption of male's leaf picking illustration in the 'Farmstead Manual (c. 便民图纂)' of the Ming Dynasty by Fan Kuang renders the high physical demand as the reason for men's participation in this task. As the caption narrates, 'Men go to the garden to pick mulberry leaves because women are busy feeding silkworms. Worms need to be fed and leaves need to be picked simultaneously, and therefore, the division of labour should be reasonable and proportionate' (Fig. 2). Besides, the varieties of mulberry grown for sericultural production in the past, as shown in this illustration, were mostly trees rather than shrubs. Farmers thus needed to stand on a ladder or a high stool to reach the high leafy



Figure 2: Leaf-picking in 'Farmstead Manual'. Picture courtesy of Chinese Text Project (<https://ctext.org/zh>).

branches, which needed to be cut down as a whole with a machete or axe. This task requires robust arm muscles and therefore is more suitable for men to perform, as Chen argues (2013). In ancient agrarian books, illustrations of 'pulling down the cocoon frames' also frequently portray labourers as male, probably for the same reason that men assisted with the more physically demanding steps in the claimed 'women's job'. However, as Bray notes, in pre-modern sericultural practice, though men helped with leaf picking and moving large farming tools, it was women who paid constant attention to the cleaning and feeding work in caring for silkworms like mothers (1997, p. 248).

In contemporary silkworm cultivation for the silk industry in China, men, too, are not excluded for the toil of tending mulberry gardens and feeding silkworms, almost the same as ancient farming scenes depicted in 'Pictures of Tilling and Weaving'. However, when I conducted fieldwork in Yizhou County of Guangxi Province in China in 2019, the largest silkworm husbandry centre nationwide, I noticed that it was common for a family to send the adult male to work in the city while the wife stayed in the village to take care of the elderly, the children and the silkworm babies within the household. There were also many young couples staying at home to make a living by raising silkworms. Two persons' workforce allowed them to pick more leaves, feed more silkworms and thus

make more money. On the one hand, the conventional discourse of 'men tilling and women weaving' has never been strictly executed in the domestic sphere where most silkworm farmers, men and women together, collaborated to raise silkworms in their own farmhouses. On the other hand, sericulture as a feminine field is paradoxically manifested in more institutionalised segments in contemporary China, namely in silk processing factories, sericulture departments in colleges and silkworm egg production centres.

In Yizhou, I visited a few institutions involved in the sericultural industry, such as research centres, breeding stations, silk reeling factories and the agriculture departments in local government. I noticed that most staff in positions of research and management were men, while administrative and operational works were almost exclusively done by women. The Breeding Station of Yizhou County is a representative example. Its chief manager Mr Huang holding a bachelor's degree in sericulture has been working at this station for more than ten years. He is in charge of providing professional guidance to the production of silkworm eggs as a commodity. Meanwhile, all the silkworm breeders there are middle-aged females, and their duties are cutting open the cocoons to get the live silkworm pupae, dividing the male and female pupae into two groups, assisting the metamorphosed moths to mate, separating the mated couples by hand, and handling the freshly laid eggs for further processing.

Silkworm egg production was not a very strenuous job, but the working conditions to assist silkworm moths' mating were far from friendly to those breeders. Usually, five or six female workers wearing masks and transparent veil hoods sat in a room of about 20 square metres, as the powdery scales from the moths' wings were floating in the air like a dense mist (Fig. 3). A blower was humming at the corner of the room, bringing up the wind and thus slightly improving the air circulation in the mating room. As one woman recalled when chatting with me, silkworm egg production was a much more painful job ten years ago without fans or similar equipment indoors. Even now, masks and hoods cannot completely insulate the breeders from the flying scales falling from the moths' wings. Another female worker complained that she was easily allergic during heated summers when working in the mating room, with itchininess all over her body. I asked these ladies over lunchtime in the canteen why all the breeders here were female. They looked at me in amazement as if I had asked a silly and naive question: 'Which man would be willing to do this job?'

'Which man would be willing to do this job?' I heard this expression again a few weeks later when I talked to a female worker in the workshop of a silk



Figure 3: Female breeders with masks and hoods assisting the silkworm moths' mating. Picture courtesy of Feixuan Xu.

reeling factory in Yizhou. Similar to silkworm breeding, positions in reeling faculties manifest extremely clear-cut gender segregation, both in practice and perception, where almost all workers are female. Throughout the entire procedures of sericultural production in the past and at present, it is reeling cocoons and weaving fabrics that have shown a more pronounced gender division of labour compared to rearing silkworms. Since the commercialisation of the textile industry in the Ming dynasty in the 14th century, men became the owners of most silk mills in control of techniques and machines of reeling and weaving and they employed women workers who lost access and mastering of more advanced weaving skills (Bray 1997: 184). This transformation led to a significant reduction in women's tribute to the household's finance, as Bray argues, and further reduced the status of women in the family from main tax contributor to merely a children's birth-giver and caretaker. It is a more insidious form of gender injustice than gender differentiation based on the level of physical demands, and similar power hierarchy in gender never ceased in the modern and contemporary sericultural industry in China either.

Moreover, the justification of gender segregation in sericulture presents a double suppression of women. Paradoxically, women were considered unsuitable for agronomy in college education as agrarian labour is too heavy; meanwhile, in practice, it was still mainly women who performed manual work in sericultural industry, including raising silkworms and processing silk products. Hence a large number of men trained in professional sericultural studies, have gained the opportunities to be managers, instructors, specialists and employers of these female workers. Bray in her historical study of agricultural science and technology in ancient China notes that from the Ming and Qing dynasties onwards, the sericultural industry was dominated by men who held the means of production and occupational skills, while women were reduced to pure drudgery (1997, p.

184). Till today, in the Chinese sericulture industry, a field that has been entitled as feminine since ancient times, there has been no significant improvement in the skewing of both cultural and economic capital (Bourdieu, 1993) in favour of men over women.

3. IMPOSED GENDER BIAS: THE FATE OF FEMALE SILKWORMS IN SERICULTURE

If tentatively thinking from the perspective of silkworms, it is worth exploring whether sex would matter to those nonhuman cocoon-producers in a similar way to that in interpersonal communities. In silkworm husbandry in China, most worms spend their larval stage in farmers' farmhouses, having a designated domestic space regularly cleaned and disinfected by their human caretakers. Here silkworms won't be treated differently because of their sexes. First-instar silkworm ants and young larvae are almost impossible to distinguish between their sexes with humans' naked eye. By the time a worm reaches its fifth instar whose body is as thick as a human finger, its sex can be judged by observing its reproductive organ on the abdomen. Farmers, nevertheless, were not very interested in telling the sex of each silkworm, as it is an insignificant issue. The newly hatched first-instar larvae they bought from silkworm breeding companies are of mixed gender and the cocoons they sold to silk reeling factories for profit are, too, of both sexes. Many farmers in Yizhou County I've interviewed deemed there were no noticeable differences between the cocoons spun by male and female silkworms. Even Liang Shaoji, the artist who claimed himself very acute to visual forms, has not noticed any gender divergence in terms of the shape or quality of cocoons. In this sense, silkworms do the same silk-secreting job regardless of their sexes.

Cocoons transported to silk reeling factories were usually dried at a high temperature so as to be stored for a longer period of time. Only the cocoons which housed the future 'producers' of silkworm eggs will be sent to breeding stations for the pupae inside to perform their mating duties. It is a place where sexes do matter. Cocoons will be cut at one corner so that pupae can be poured out and separated by female human workers into two groups. One afternoon, at the Breeding Station of Yizhou County, a female worker Ms Fang sat in the open space in front of the mating room, processing cocoons at a rapid speed of almost one per second. Beside her, there was one bucket of fresh cocoons and one bucket of cut-up empty cocoon shells. Two round bamboo trays contained male and female pupae respectively. She explained to me the most accurate method to distinguish the sex of those pupae, that is, to 'observe the buttocks of a silkworm'. A female pupa has a larger and fatter

abdomen with eggs inside and an 'X'-shaped gland in the centre; a male silkworm's abdomen is more pointed, with a small brown depressed dot at its end. In practice, however, a skilled worker did not need to turn the pupa over every time to make a judgement. A more efficient tip is to look at the back of a pupa. The dorsal line of a female pupa is paler as if smudged by water, and its abdominal segments are more widely spaced; a male's dorsal line, on the contrary, is relatively well defined. Fang elucidated the trick in extremely plain language: 'When teaching our children to help do this job, just tell them to pick out the bigger ones. Those bigger, fatter ones with brighter backs are females. Once you have handled enough pupae, you will be able to figure it out even by touching its body.' Those sexually segregated naked pupae will wait till moth to perform their role as fertility machines and eventually die.

Besides the employment of silkworms' reproductive capacity, the sex screening of silkworms occurs in some unexpected scenarios. Domestic silkworm, or *Bombyx mori*, has 28 pairs of chromosomes, of which 27 pairs of autosomes are the same in both sexes and one pair of sex chromosomes designate ZW for females and ZZ for males. Statistically, the sex ratio of silkworm eggs should be 1:1 in normal circumstances. Generally, energies obtained from eating mulberry leaves are used for silkworms' metabolism, development of their body organs and movements. For female silkworms, a large proportion of energies obtained from food will be used for the growth of eggs in addition to secreting silk filaments. In contrast, sperms ask for fewer nutrients from male pupae to develop than eggs from female pupae. A male silkworm thus can use more energy to produce silk than its female counterpart under the same conditions. For this reason, male silkworms have been regarded as more viable and productive for the sericulture industry, as males produce more silk, or they need to eat fewer mulberry leaves than females to spin the same amount of silk (Strunnikov, 1995). This became the motivation for some scientists' enthusiasm in working on the feasibility of raising male-only silkworms exclusively in practice.

The plot of the silkworm community contaminated by 'sexism' in human society began in the year 1975. The Soviet biologist Vladimir Strunnikov developed a strain from mutants with translocations of the X chromosome via radiation breeding. The sex-linked balanced lethal (SLBL) strain can give as many as 98% male offspring while the female eggs are eliminated in their embryonic period (1995). However, the surviving males of this strain can produce very few silk threads and are difficult to take care of, therefore the SLBL strain is hard to be widely applied in mass silkworm husbandry. There exist other laser-induced or heat-induced silkworm mutations that can differentiate the sexes

by egg colour, body marks at the larval stage or cocoon colour. These mutated strains with very low hatching and survival rates, nevertheless, can only serve the purpose of sex segregation and it is impossible to pragmatically use them for all-male silkworm rearing (Wang *et al.*, 2016). The Soviet SLBT strain was imported to China in 1996 by Zhejiang Sericulture Research Centre, and after constant selection and crossbreeding, Chinese scientists developed more than sixty 'male strains' with better economic characteristics that meet the standard for putting into sericultural production (*ibid.*). The target consumers of these sex-controlled all-male varieties, however, are not ordinary farmers and breeding stations. For silkworm egg companies, the cost of producing eggs of SLBT strains is theoretically four times higher than that of common varieties, although, in practice, scientists have endeavoured to reduce the cost to less than twice (Chen *et al.*, 2004). Despite the benefit that a male silkworm produces more silk than a female under the same conditions, the high cost of breeding SLBT strains cannot be offset. Then why researchers and commercial companies were still willing to commit to the objective of all-male variety cultivation?

Here it comes to another controversial advantage of male-only silkworm rearing other than higher productivity, that is, the higher quality of the silk spun by male silkworms. Silk thread spun by males is claimed to be stronger and purer with better elasticity and resistance to friction. Moreover, raw silk is divided into several grades from the lowest 1A to the highest 6A in China's national standard of silk quality inspection, while the processed male-spun raw silk is more likely to achieve the '6A' grade. These 'masculine' raw silk aims to meet the demand for luxury silk products in the international market. Because of the relatively small share of such a high-end market and the high production costs, only a few companies in Zhejiang, Jiangsu, Shandong and Sichuan provinces in China are now engaged in the pioneering practice of male silkworm rearing. In the APEC Summit held in Beijing in 2014, costumes of traditional Chinese style designed for state leaders and political celebrities are all made of raw silk spun by the male silkworm, and also, the raw material of silk products under high fashion brands like LV and Chanel are all male-spun (Wang *et al.*, 2016). When male silk is associated with keywords such as luxury, best quality and rarity, it has obtained higher economic value and social status in human society. When the female eggs laid by the same SLBT-strain female moth all died in embryo, the male silk lost its potential rival 'female silk' and monopolised the supply side of luxury silk products.

The plot of female silkworms in this story is familiar, as it perfectly resembles the fate of some female babies in those human communities with a history

of female infanticide. Those unwanted female unborn babies, both human and silkworm, were considered inferior or less useful and therefore unworthy of the right to life. It remains contested whether male silk is genuinely better than female silk, as it might be a gender-biased result due to gender-biased testing processes. Nevertheless, as an affirmative conclusion, male silk possessing better quality has been widely acknowledged in the community of silkworm biologists, and moreover, packaged and sold to the consumer class who seek cultural and symbolic capitals from high-end luxury goods. Meanwhile, biologists have to admit that in many sericultural regions in China, the majority of quality testing facilities in use, instead of more sensitive equipment in laboratory conditions, are not sufficiently accurate to recognise the quality gap between premium 6A male silk and 6A female silk. The unrecognizability of male silk's quality advantage in large-scale silk-processing practice hence restricts the promotion and scaling-up of all-male silkworm rearing (Wang *et al.*, 2016, p. 195). Moreover, the claimed superb quality of single-sex silk products is not outstanding enough to be distinguished by touch or by naked eyes of their human users. Thereby the paradoxes between the largely constructed gender advantage and its intangibility for sensing apparatus of both ordinary machines and human bodies can bring ethical challenges to the justification of developing the techniques to kill female silkworm embryos.

4. CONCLUSION: ON TRANS-SPECIES ETHICS

For domestic silkworms, sexism is intentionally copied and imposed into their interspecies communities, where some female silkworm embryos sacrificed their lives to human beings' pursuit of political and cultural capital. Female silkworms trapped in the web of human-silkworm relations suffer double oppression of sexism and anthropocentrism. Taking the polarised temporal scales between silkworms and humans into consideration, the negative impact of pregnancy and childbirth on the social value of females has been compacted to and drastically manifested in silkworms' short lifespan of around fifty days. Though animals' life experiences should not be reduced to mirrors or windows to observe human society, the case of acclaimed masculine silk is thought-provoking where patriarchal structure and ideology affects female bodies, rights and the social capitals they can gain not only in the human community but substantially penetrated into silkworms' social lives.

Moreover, in the above discussions on genetic suppression of females through radiation breeding and the marketing of male silk as superior, my use of the term 'sexism' can also be seen as contaminated by human ideology, as it just simply

transfers humanist concepts such as the right to life (as in female infanticide) and gender equality (as in the gender division of labour in the sericultural industry) onto the sphere of silkworms. As feminist standpoint theory (e.g. Haraway, 1988; Harding, 2004) argues, the political power structures and biased discourses in knowledge production and transmission can transform knowledge itself, and hence scientific knowledge is always socially constructed and situated instead of objective and value-neutral. As for biological trials to achieve the objective of male-only offspring via laser-induced mutation, for example, it would be impossible for such research design to pass ethics review if treating silkworm participants as human beings entitled to the right to life and equality. However, many biology departments in universities today only require projects involving vertebrate animals to go through a research ethics review beforehand, manifesting the remains of evolutionary speciesism. The ethics and ethos for animal studies in this regard need to be updated with more awareness of oppression and should devote care, respect and commitment to marginalised and minoritarian humans and nonhumans under investigation, as Puig de la Bellacasa suggests who incorporate feminist care and standpoint theory into the framework of 'matters of care' (2017, p. 95).

Meanwhile, it should be noted that extending the ethical schemas and identity politics in interpersonal societies to wider social relations with other animals and plants risks the danger of slipping into the trap of ignoring non-human living experiences as another form of anthropocentrism. The ethics of care offers an alternative pathway to speculate on this dilemma, which emphasises the contextual, relational and dependent essence of ethical concerns (e.g. Held, 2005; Adams and Donovan, 2007). It would be arrogant and reductive to formulate all-encompassing ethical codes for interactions between human and non-human entities in terms of care ethics; instead, the speculation would be more fruitful to examine the dependent relationship between humans and domestic silkworms and the situational controversies of male silk privilege rather than figuring out any decontextualized abstract rules. It becomes obvious that through such a lens the biological technique of breeding male-only silkworms cannot be ethically justified by the constructed advantages of male silk, and it is

double oppression of female silkworms by the gender bias of their human caretakers.

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(R)EVOLUTION: Optogenetics and Interspecies Microperformance

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Optogenetics is a set of biological techniques that proposes a future where many neurological diseases in humans could one day be treated with light. It also gives way to the idea that humans can control other organisms, such as light-responsive algae, through genetic modification techniques. These techniques have the potential to be utilized to alter the behaviors of light-responsive algae for the production of bio-fuel, food, and other biological materials and products. However, these techniques open the door for many bioethical issues and concerns about genetic modifications and the agency of both human and non-human cells. Inspired by the ecofeminist philosophy of Donna Haraway's "making kin", *(R)EVOLUTION* is an artistic attempt to rearticulate the relationship between algal visual perception and human technoscientific desires through performance-based approaches associated with dance and gameplay. Using the aesthetic framing of *Dance Dance Revolution*, *(R)EVOLUTION* seeks to provide a satirical exploration of human and non-human relationships using light-based choreography and gameplay while simultaneously reflecting on ethical dimensions of research in the growing field of Optogenetics and the ethical issues involved in artistic works that are created out of the bodies, lives, and liveliness of microscopic organisms. This paper explores these ethical dilemmas, the work's uses of microperformativity, and the cultural connotations of *(R)EVOLUTION* while providing critical analysis as context for the transdisciplinary approaches undertaken by the artist in collaboration with Humboldt Universität zu Berlin's Department of Experimental Biophysics.

Optogenetics. Microperformativity. Performance. Gameplay. Algae. BioArt. SciArt. Video Games. New Media.

1. CHANNELRHODOPSIN AND OPTOGENETICS: MATERIALIZING LIGHT INTO PROMISES OF BIOLOGICAL POTENTIAL

Rhodopsins are photoreceptor proteins that allow organisms to interact with light. The discovery of the light-gated ion channel protein known as a channelrhodopsin in the algae *Chlamydomonas* has given way to a new paradigm of biotechnological thinking and a realm of new potential bioengineering applications. These channelrhodopsins are encoded by DNA sequences, which include the notable channelrhodopsin-1 (ChR1) and channelrhodopsin-2 (ChR-2; Hegemann and Nagel 2013; Nagel et al. 2002; Nagel et al. 2003). Following the discovery of these two genes, researchers were able to express them in mammalian and human cells lines, thus demonstrating their potential applicability for future uses in light-induced membrane depolarization in mammalian models (Hegemann and Nagel, 2013; Nagel et al., 2003).

These discoveries and characterizations of ChR1 and ChR2 have resulted in the emergence of the field of Optogenetics, which aims to express light-activated proteins in neurons and then activate them with light pulses (Hegemann and Nagel, 2013). However, unlike other types of rhodopsins, microbial rhodopsins, such as channelrhodopsins, have faster kinetics and an easier structure to work with in terms of genetic engineering applications (Guru et al., 2015). Therefore, channelrhodopsin proteins and their associated genes have become an ideal tool for research.

Optogenetics' promising potential applications inspire visions of a biotechnological future where certain neurological diseases could one day be treated with light to control genetically modified neurons expressing light-sensitive ion channels. Outside of Optogenetics, these genetic engineering applications also offer the possibility to enhance the industrial production of biofuel and "renewable"

feedstock, as well as other bio-based materials. However, the economic and medical promises featured in these speculative visions are accompanied by ethical dilemmas surrounding issues concerning the control over human and non-human cellular entities.

Algae are microorganisms that often escape human empathetic concerns in ethical conduct due to both their size and lack of relatable needs and desires. *Chlamydomonas*, in particular, falls into the category of a “doubly invisible” model organism, which has been characterized by the work of artist and researcher Tarsh Bates in their piece *in vitro* (2011) and their following 2014 publication on the project (Bates, 2011; Bates, 2014). While humans interact with algae in many different forms, *Chlamydomonas* do not inhabit these same spaces in cultural discourse. Their bodies and liveliness outside of the laboratory are often marred by their association with “pond scum” (Peers and Niyogi, 2008). As such, *Chlamydomonas* and the contributions of their genetic material and bodies share similarities with Bates’ *in vitro* organisms, where they “do not even enter public discourse as sacrifice” (Bates, 2014).

However, genetic manipulation of *Chlamydomonas*’ channelrhodopsin cannot escape biopolitical discourse. These genetic modifications are political acts in which human desires and interests are biologically imposed and encoded to manipulate algal perception and behaviors associated with light-gated ion channels. Even more so, these acts are reliant on the responsiveness of the organisms themselves. When reading the context of research on channelrhodopsins and the field of Optogenetics in relation to Lindsay Kelley and Eva Hayward’s *Carnal Light*, these words and related ontologies enact an “antimeria” or the “transmission of beingness through intensification” (Kelley and Hayward, 2013). Even in a biomechanical sense, the encoded genetic materials and proteins are biological objects that in themselves invoke Kelley and Hayward’s concept of a potential for a sensuous more, a liveliness (Kelley and Hayward, 2013). It is this sensuous more that forms the basis of inspiration for the artwork (R)EVOLUTION. When sensation exists between species, there is an intimate and more-than-human relationship that is spawned, one that is forged in the bodies of the many and made uncanny by the splicing and tearing of hands aided by technoscientific extensions.

2. MICROPERFORMANCE AND VISUALIZING THE INVISIBLE

Scientific observation has been shaped by the needy desires of visual perception, both to see and to be seen. It is impossible to read research on

invisible entities outside of the performance of them being observed. In “Micrographia”, Robert Hooke used his enchanting illustrations and text about the world on the other side of the microscope to draw interest toward the emerging science of microscopy (Hooke, 2019). John Harwood elaborates on Hooke’s characteristically performative presentations given to the Royal Society by explaining that they did what scientific research has not yet done before (Harwood, 1989). Specifically, Harwood explains that Hooke’s performances both offered an appealing sense of entertainment and allowed for private experience to become corporate knowledge within the Royal Society (Harwood, 1989). Since Hooke’s explorations into microscopy, scientists have chased after the invisible world of the microscopic in search of hidden treasures, and these performative explorations have gone on to be well-documented in discourses from the field of the history of science.

Much like scientific observation, artistic observation follows similar performative desires. The visual arts, in particular, has a similar desire to see and to be seen, especially when examining invisible matter such as the microscopic. Jens Hauser and Lucie Strecker demarcate a current trend of micro-related performance practices as Microperformativity (Hauser and Strecker, 2020). Hauser and Strecker go on to define Microperformativity as:

a current trend in theories of performativity and performative artistic practices to destabilize human scales (both spatial and temporal) as the dominant plane of reference, and to emphasize biological and technological micro-agencies that, beyond the mesoscopic human body, relate the invisibility of the microscopic to the incomprehensibility of the macroscopic (Hauser and Strecker, 2020).

It is in Hauser and Strecker’s conceptual framework on Microperformativity that forms the theoretical grounding for the production of (R)EVOLUTION. By enacting Microperformative engagements, (R)EVOLUTION further seeks to analyze multi-species interactions from a posthuman lens. The work also draws from Donna Haraway’s call to “make kin not babies”, as it sets out to use imagination, theory, and action to seek out new ways in which humanity can relate to microscopic living entities (Haraway, 2016).

Additionally, by engaging in performance-based techniques, (R)EVOLUTION seeks to expose the disparities between human and algal scales made all the more extreme by their micro and macro planes of reference. Much like in Hauser and Strecker’s definition of Microperformativity, the work engages these disparities in both a spatial and temporal sense by examining their role in perception of light. While humans experience light and darkness within a human timescale, algae

have their own light and dark cycles, which has been of particular interest in scientific research. Algal phototactic reactions to pulses of light also exist within different timescales outside of human notions of time.

Standard *Chlamydomonas* phototactic reactions to light pulses are used to track the direction of light, which is followed by either a positive or negative phototactic reaction (Harz and Hegemann, 1991). It is during these reactions that they will either move away or toward a light source (Harz and Hegemann, 1991). This action requires them to be able to have certain levels of functional swimming capabilities and swimming patterns. Negative phototactic reactions are delayed by a stop response (photoshock response), which is when the swimming algae will stop, convert the form of its flagellar swimming, and begin to swim backward away from a light source (Harz and Hegemann, 1991).

(R)EVOLUTION engages in multi-species sensorial interactions using light as the means of interspecies communication. As a result, the work aims to destabilize human planes of perspective and ideas concerning the control of biomechanisms involved in cellular behavioral responses caused by interactions with channelrhodopsin. The performances featured in the work aim to emphasize the mismatch between human cultural desires and the often-excluded algal micro agencies. By using the performance narrative of *Dance Dance Revolution (DDR)*, (R)EVOLUTION calls for its human audience to find new ways to relate to these microscopic organisms and learn about how they perceive the world around them.

3. THE MECHANICS OF GAMEPLAY AS PERFORMANCE

(R)EVOLUTION has been inspired by the hit 90s arcade game *Dance Dance Revolution (DDR)*, which turns game players into performing dancers based on their responses to programmed choreography (Figure 01). The work adopts the game's premise to question the extent in which another organism's behaviours can be controlled through sensory perception by turning *Chlamydomonas reinhardtii* into dancing performers that respond to human-programmed light choreography. As a whole, the project probes the extent to which light can be harnessed to direct biological behaviours and mechanisms in genetically modified organisms and identifies microscopic perceptions involved in these emerging interspecies interactions between algae and humans.



Figure 1: Dance Dance Revolution Arcade setup featuring an interactive media-based interface and footpads for players to correctly match their feet to choreography that appears on a screen as different coloured arrows. Image Source: LABcrabs 2019.

While the use of the dancing game *Dance Dance Revolution* may appear to be a trivial and overarching humorous aesthetic application, it is rooted in Hooke's initial performative presentations that founded the field of microscopy. Entertainment has an undeniable power to draw attention to individual experience and thereby transform it into collective knowledge. Additionally, the game itself marks an important paradigm shift in video game mechanics. Bryan Behrenhausen further explains that *DDR* rearticulates the player-game relationship by eroding the dominance of what is known in game studies as the "seeing subject" (Behrenhausen, 2007). Thus, the relationship between the game itself and its player transcends typical game-player relationships having both "inter-objective" and "inter-subjective" dimensions, which makes the game into "a fully embodied, carnal, and fleshy activity" (Behrenhausen, 2007). The *DDR* gaming system is also able to take on the role of a spectator by assessing the movements and actions of the player and providing qualitative assessments that are announced while the player is dancing (Chien, 2006; Behrenhausen, 2007).

The mechanics of *Dance Dance Revolution* follow the premise of game company Konami's game genre Bemani by utilizing music and rhythm as interactive components in the game's design (Behrenhausen, 2007; Smith, 2004). Jacob Smith discusses the characteristic of Bemani machines by noting that "these eye-catching machines turn the player's body into a spectacle, gathering crowds and helping to revitalize an arcade economy" (Smith, 2004). Thus, the mechanics of the game itself allow

for performance-based elements that can transform individual experience into collective experience through a sense of shared entertainment.

Additionally, the mechanics of the game use performance-based elements to call into question the relationship of the player with technology. Irene Chien explains how the game itself acts as a modulator of behavior emphasizing technology's ability to move humanity (Chien, 2006). As the "dance floor" in *DDR* also exists in a technologically augmented space, the spaces of *DDR* can cross between a reality of embodied movements by the player and a virtual reality made visible by the game's main visual interface (Behrenhausen, 2007; Chien, 2006).

4. (R)EVOLUTION

(R)EVOLUTION takes on many of the qualities and mechanics of *Dance Dance Revolution*. In the work, different genetic strains of *Chlamydomonas* algae are "challenged" to complete a series of movement choreography by an external administrator that interacts with them by presenting four different "dances" created by prompts made from short light pulses (Figure 02). These pulses are designed to trigger the algae's light-gated ion channels to prompt movement reactions. The different strains of the algae include a wild-type strain (a "control"), as well as three mutant strains. The responses of each strain are displayed together in a final video installation as a type of *DDR* dance battle between four non-human players. Since the algae are usually kept in well-regulated light and dark cycles, these interactions exist outside of their "normal" perceptual experience of light. The external administrator dictating the choreography in these interactions is not only an external force that is invisible to algae due to a discrepancy in spatial scales, but they are also a presence that does not noticeably exist to algae outside of these interactions.

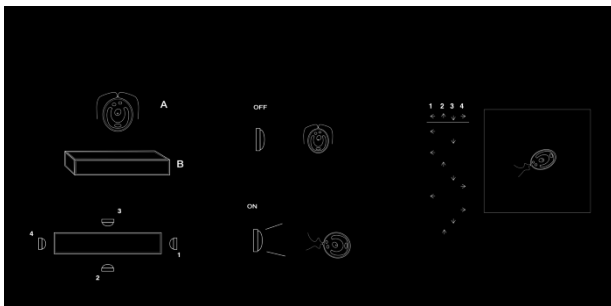


Figure 2: Diagram of light setup for (R)EVOLUTION performances.

During the dances, the algae are monitored with the use of microscopic imagining tools and timed imagining software that helps to administer the emittance of the light pulses. These recorded

performances are embedded into a virtual frame that visually depicts the different genetic strains of algae as competitors in a *Dance Dance Revolution* format where correct movements are visually indicated by the arrows snapping into place with word cues given to indicate the quality of performance, as judged by the game's administrator (Figure 03).

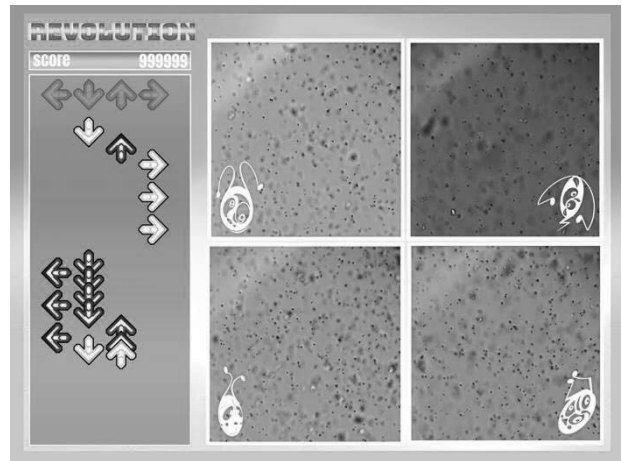


Figure 3: Design of video installation, screenshot of (R)EVOLUTION.

The final video installation of the work has been created for the human spectator, as the algae neither really seem to care for the videos nor can they perceive media outside of the realm of blue and green light waves. Since the algae cannot perceive the feedback about the quality of their performance, the project assumes that they are only acting according to the biomechanism of their molecular programming and their own internal agency. As such, all perceived refusals to dance and any other forms of "stage fright" were recorded as genuine reactions to the choreography.

During production, performances were recorded without any practice sessions designed for the algae to learn the choreography prior to their performance. However, human technical support (provided by both the artist and scientific collaborator Olga Baidukova along with the assistance of Rodrigo Fernandez Lahore) was well-rehearsed, and several research sessions were conducted to both investigate the behaviors and micro-timescales of the different genetic strains of algae, as well as the ways laboratory recording devices could be adapted to create imagining for artistic purposes. Recordings were rendered using ImageJ software and then converted into workable video files. The final video installation was made in collaboration with animator and video editor Alex Lu. Music used to create the light-choreography was designed by the project's sound design collaborators Bailey Keogh and Santiago Burelli.

While it can be inferred that the external administrator of the performances is the artist, the

final video installation leaves this matter up to the human audience's discretion, as this role takes on the same aesthetic presentation of the original *DDR* game and can also be seen as a similarly overarching omnipresent game character. While these algae are genetically different, their phenotypic differences are unnoticeable when not in motion (and sometimes are unnoticeable even when in motion). As such, iconographic figures have been assigned to characterize each different panel of the algae recordings. This also creates a visual culture to represent the algae and creates a language for fandom to develop amongst human spectators.

5. THE OUTCOMES OF (R)EVOLUTION

(R)EVOLUTION itself is intended by the artist to be a satirical examination of the social dissonance that remains between humanity and the organisms that humanity is betting on for achieving a potentially promising technoscientific future. This is a common artistic approach for the artist and follows a similar tone embodied in their work *Return of the Teratoma* (2018), which comically imagines a laboratory grown Teratoma haunting the human bodies that its biological material was taken from (Walsh, 2018). The actual outcomes of the *DDR* dance battles featured in (R)EVOLUTION are far less remarkable than the aesthetic dimensions in which they are presented. The work was made with an awareness that, in reality, *Chlamydomonas* are not particularly good at following long music-coordinated commands using light-pulse-based choreography, especially using the kind of choreography that is on par with the level presented in *DDR*.

The artist notes that the algae may also just be "bad" dancers, although this is a human-based value judgement in need of critical reflection since what algae may consider to be "good" dancing (if they consider this at all) could potentially not be the same as what humans or the artist considers to be "good" dancing. Although, to even ask this question about algae and dance deconstructs the culturally normalized view of algae as pond scum or a source of food. The disappointment created by the hype of the work's visual presentation and the actual reactions of the algae further speaks to these disparities in needs and desires between humans and non-humans. In turn, this also speaks to the dissonance in the experiences of sensation, such as with time and light perception, between human and algae, thereby exposing the inherent bias in the human planes of perspective when approaching interactions with non-human entities.

Chlamydomonas' bodies are entangled in a myriad of promises. From their use in Optogenetics research to their promising potential to be

resources for so-called "sustainable" biofuel and other biomaterials, these avenues and interactions rarely go beyond an exploitative dynamic. While (R)EVOLUTION continues this legacy of exploitative interactions for the sake of entertainment, the narrative of the game marred by the rather unremarkable performances of the algae points calls for collective attention to be given to organisms that are rarely viewed outside of the context of pond scum or their role in research in the laboratory. In the vein of other works falling under the label of BioArt, (R)EVOLUTION takes on Jens Hauser's defined "de-image-ing" role as a mode of knowledge production by questioning the very lens and baseline of human assumptions about algal behaviors used to make the images featured in the work (Hauser, 2006). This is similar to that and takes inspiration from not only Tarsh Bate's *in vitro*, as discussed above, but also Špela Petrič's *Cladocera*, which uses water fleas' phototactic responses in a poetic tuning machine to produce poetry based on the quantifiable data of their spatial positioning, and Loren Kronemyer's *MYRIAD*, which shows the tension between influences and intelligences of insects and humans throughout a series of staged interventions (Petrič, 2010; Kronemyer, 2012). Collectively, these works raise questions about what values we, as humanity, will stake other organisms' lives on and how far we are willing to go to override their sense of agency to achieve our desires, speculative imaginaries, and feelings of connection.

Outside of its biological-based connotations, (R)EVOLUTION's materialized use of light also feeds into critical perspectives concerning light metaphors, such as illumination. Kelley and Hayward further articulate that "seeing light is a trope for making visible that which is invisible or perceiving things in a comprehensible form such that they are real" (Kelley and Hayward, 2013). The sensorial exchange of light between (R)EVOLUTION's human and non-human entities attempts to visualize a surface-level of the landscape of complexity involved in creating human and non-human interactions that are on par with Haraway's "making kin" (Haraway, 2016). Rather than solving these ethical issues, the work aims to illuminate them, revealing both the invisible presence of microscopic and the invisible micro-agencies of the model organism *Chlamydomonas*. The spectacle of these interactions transforms the intimate nature of exchange taking place through the apparatus of the microscope into a collective experience for a larger human audience, with the hope that just maybe we will learn something new about our non-human kin and that this will become part of a collective body of cultural knowledge.

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OPEN SCIENCE/ CRITICAL SPACES

Coded Feminisms in Indonesia

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Citizen labs often take in the role of promoting equality and tech literacy in their community. These two aims are entangled when it comes to enabling free speech online and offline. The methods of Indonesian citizen labs were shaped by decades of state propaganda and extended colonialism. These citizen labs also have deep roots in Indonesia's history, which informs the way critical media practises are cultivated. Sharing tech skills, offering formats for critical thinking and creativity was performed with a specific form of care, one that protects participants through encoding. In this paper we want to focus on three generations of Indonesian pioneers, who set up feminist citizen labs struggling against hegemonic forces. In particular we are investigating the roots of feminist citizen labs in the grassroots organization Gerwani. In the scope of our arts-based research project interviews with survivors of this destroyed women movement and interviews with initiators and members of current collectives were translated into an animated documentary.

Indonesia. Postcolonial. Memory. Gerwani. Care. Feminist hacking. Digitalization. Activism. DIY. Citizen labs.

1. INTRODUCTION

We want to propose to analyse Indonesian citizen labs as networks of care and knowledge production and these emerging collectives' struggles as entangled with histories of oppression (Bellacasa, 2017). This paper focuses on three generations of feminist activists in Indonesia who set up DIY collectives and citizen labs to encourage literacy. They all worked at the grass-roots level to accelerate knowledge transfer. The first generation encouraged learning how to read and write, the second fostered media literacy, the third generation promoted digital literacy. All three generations experienced that women's* right for education was contested. The first generation we will look at was active 1950 until 1965, the second one – from 1980 until 1998, and the last generation we discuss here was active from 1998 up until today (Arivia, Subono 2017). The paper raises the question on how decades of stigmatisation, namely under the New Order Regime, shape today's collectives. The described collectives align with values and practises termed as "Citizen Labs" in the sense that the initiators are mainly academically trained, culturally engaged women* with a middle-class background, who encourage interdisciplinary exchange and enable STEAM literacy on grassroots level.



Figure 1: Video still of animated documentary by Stefanie Wuschitz 2022 'Coded Feminisms'

1.1. First generation: educational laboratories

In colonial times, Indonesian schools were at the centre of resistance against colonial power, countering colonial education systems (Irwin, 2019). The Dutch colonists had called these schools "wild schools" (*sekolah liar*).

The Javanese Taman Siswa (Student Gardens) were schools inspired by emancipatory pedagogy, encouraging self-governance, warmth and compassion, the child's deeper understanding of and engagement with the world. (Irwin 2019). The founder, known as Ki Hadjar Dewantara drew inspiration from the ideas of Rabindranath Tagore,

who in his educational school laboratories in Kolkata, India (Shantiniketan and Sriniketan) fostered children's freedom of expression (Supardi 2018, p. 50-57). These pioneers gave birth to the resistance education movement directed against the hegemonic colonial education system. That these schools enabled access to education showed in the growing numbers of remarkable female graduates. Compared to literacy in female citizens of the 1930s, which was around zero percent, e.g. in Sukabumi, female citizens in the 1950s were up to 58 percent literate (Vreede-De Stuers, 1960).

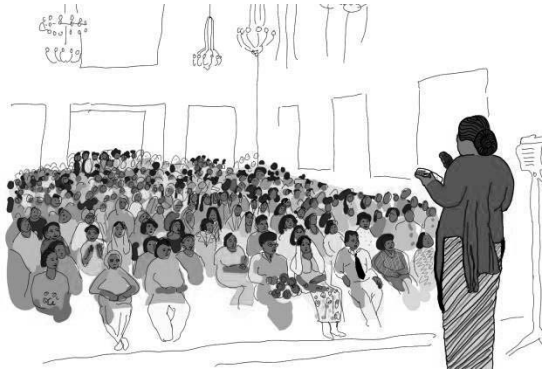


Figure 2: Video still of animated documentary, 2022

1.2. The rise of Indonesia's Women's Movement

While many European and Northern American feminists believe that their interpretation of liberty and equality was exported to the so-called Global South (Mohanty, 1984, 1993; McGregory, 2013), the women's* movement in Indonesia in fact had experienced its largest expansion between 1928 and the 1950s, presenting the largest and most progressive feminist movement in the world of that time (Ita Nadia Fatia, 2020, part 1; McGregor & Hearman, 2007). They demanded labour rights, a new marriage law, children's rights and land rights. To support women* working in factories, they initiated the first network of kindergartens and nursery systems all over Indonesia called Melati Kindergartens (*TK Melati*). Gerwani was the strongest organisation with three million members. Many of its leaders came from famous, rich or aristocratic Indonesian families and had experienced the highest possible education of their times (e.g. S.K. Trimurti and Umi Sardjono). Gerwani was founded by the most outspoken and leftist groups in this women's movement. Six women organisations joined to found Gerwani's embryo organisation called Gerwis (*Gerakan Wanita Indonesia Sedar - Indonesian Conscious Women Movement*).

1.3. A New Nation State

Gerwis' did not only assemble to share skills, but also articulate critique on patriarchal living conditions. They took a strong stance against polygamy and initiated grassroot self-help groups in

thousands of villages on different Indonesian islands (Api Kartini, 1959, 1961). By volunteering to work on the grassroots, young teachers and academics learned about the struggles of people living in remote rural areas. By 1953 their young organisation counted 40.000 members, had set up nursery and literacy courses as well as workshops for income generating activities all over Indonesia (Wieringa, 1993). In 1954, in order to mark the shift towards a mass movement Gerwis changed its name to Gerwani (*Gerakan Wanita Indonesia - Indonesian Women Movement*).



Figure 3: Video still of animated documentary, 2022

In regular meetings, covering as household lectures local women* socialised and exchanged knowledge. These meetings were also a way of distributing resources and unpaid labour to one another, from measuring the weight of newborn babies regularly to taking care of funeral ceremonies. At the same time Gerwani transferred knowledge on economy, inequality, and how it affects the participants' personal lives, e.g. when food prices rise. While teaching the alphabet, it was discussed why rice or milk became more expensive and the importance of food sovereignty (Nurvista and Mario, 2017). In combination with reading and writing, concepts that would help to understand their socio-political context were debated. The idea of connecting agency, literacy and community building was at the core of this pedagogical organisation. It was celebrated in songs, dances and other artistic formats. Knowledge on complex issues was transferred through cartoons, short stories, puppet theatre and improvised performances (e.g. Ludruk). In particular dance classes were a very popular way of experiencing and expressing personal transformation. Many Gerwani members also joined Lekra, an organisation for women artists.

In most cases, however, the goals of Lekra, Gerwani, and other related organisations had been to raise awareness of basic human needs, such as reducing work hours for pregnant women, demanding bathroom facilities in factories, or dancing and singing songs that questioned policies regarding gender equality or articulated specific notions of longing and difference. Such songs often used "traditional"

arts idioms to communicate these ideas, where the use of the idioms enabled a semi-veiled critique of the status quo, frequently targeting and satirizing certain established social practices such as polygamy and women's limited rights to education. (Larasati 2013, p. 5-6)

What attracted large numbers of people was that Gerwani was set up as commons (Helfrich, 2012; Ostrom, 1990). This way Gerwani generated a nationwide organisational structure. Committed members were invited to leadership training and some of them were sent as representatives to larger summits in Indonesia and abroad.

1.4. Global Scale

Internationally, Gerwani's outspoken standpoint was gaining impact and their representatives were invited to contribute to large international conferences. For example, the anti-imperialist *Women's International Democratic Federation* (WIDF). This network of women across the world was the largest global post-war women's organisation (McGregor, 2008). In 1952, for example, Umi Sardjono (among others) took part in a meeting in Vienna to present Gerwis to the Women's international democratic federation at the World Peace Council. Gerwis had been collecting 17.711 Indonesian signatures in support of peace (McGregor, 2013). Umi Sardjono represented the Indonesian Women's organisations also in Copenhagen and Berlin from which she and others reported in detail in their magazine called *Api Kartini* (*Api Kartini*, February 1960, p. 4). Sukarno, the first president of Indonesia, supported Gerwani. But his presidency was ended by a Coup D'Etat. When a military regime took overpower patriarchal capitalism and systematic sexual violence silenced all former Gerwani members (Mies, 1986; Wieringa, 1998, Ita, 2020; Pohlman, 2015).

1.5. Coup d'Etat 1965

On September 30th, 1965 a coup d'etat caused the death of seven military generals. It was spread in all the news sent out on the new propaganda radio station: Gerwani members had danced naked in front of the generals and then cut off their penises, killed them and thrown them into a hole. Because all other radio stations and information channels (except for Suharto's) were turned off, nobody could object to their demonization. They were abused for the military's purposes. There is evidence today that this was all a lie. In fact, the accused Gerwani members did not know anything about the whole incident (Sulami, 1999; Wieringa & Katjasungkana, 2019; Pohlman, 2017). The generals were killed by a competing part of the military to get rid of Sukarno (Melvin, 2018; Simpson 2008; Wieringa et al, 2019). Aidit (PKI leader) had tried to prevent a military coup against President Sukarno, but with this move gave a longed-for reason to the right wing part of the

military to seize power (Pohlman, 2017). A couple of innocent sex-workers were later caught, raped and brutally tortured by the military until they confirmed that the accusation would be true, that they in fact would have killed the generals and cut off their penises (Wieringa & Katjasungkana, 2019, p. 43; Pohlman, 2017, p. 88). They took pictures of these women and reenacted the act for the deliberate purpose of publishing a black campaign against Gerwani, for example in their military newspapers such as *Berita Yudha* and *Angkatan Bersenjata*. This single source of information and false fabrication provoked the mass and became the reason to start hunting Gerwani members as one of the primary targets in the process of annihilating all the leftist movements in Indonesia. Thousands of Gerwani members were murdered in the following weeks, even schoolgirls that had just taken part in a Gerwani dance course (Rachmi, 2013, Wiewiek, 2020). Thousands of Gerwani members and leaders got imprisoned (*Ibu Sarijah*), where they were tortured through sexual violence and sexual slavery (Pohlman, 2017, p. 63-92; Melvin 2018, p. 43; Wieringa, Melvin & Pohlman 2019, p. 96-115; interview with Ita F. Nadia, 2020; Pohlman 2015, p. 92). According to RPKAD chief Sarwo Edhie, and other sources, in the time period after 1965 "three million people had been killed, and most of them on his orders" (Naipospos, 1995, p. 59; Melvin, 2018, p. 30-52). Today there is evidence that the killings were in fact genocide. This could be proven by the discovery of the Indonesian genocide files, that document that "all armed forces had been ordered to completely annihilate the '30 September Movement' down to the roots." (Melvin, 2018, p. 41). Through the military 'Operation Berdikari' the military's target group was physically destroyed (Melvin, 2018, p.41). The military mobilised and armed thousands of paramilitary members to establish death squads, who recorded the killings on flowcharts and a "death map" (Melvin, 2018, p.42). The target, the "30 September Movement" stood for communist rebels and PKI (communist party) members. This way the genocide was framed as a defense move in reaction to a coup blamed on PKI and Gerwani (Melvin, 2018 p.43). But the victims were even those citizens that only remotely passed as critical and culturally active, including e.g. even kindergarten teachers. The original Melati Kindergartens were destroyed in 1965 and taken over by the military or associated militias (Wieringa, year, p. 42; Wieringa & Katjasungkana, 2019, p. 42). But also students, teachers, the entire education sector was "cleaned". Labour and farmer union members, members of leftist parties as well as nationalists and supporters of President Sukarno (and their families) disappeared. The Indonesian Chinese population was also targeted because they were labeled as sympathisers of the communist ideology. After this genocide, directed against the main political rivals of General Suharto and his Western Allies in Washington, London, Canberra,

the authoritarian government known as New Order Regime was installed. Recently published archive documents confirm that the West supported Suharto with weapons and logistics and encouraged Suharto's intentions (Melvin, 2018, p. 302; McGregor, 2018).

1.6. Stigmatization after 1965

After the coup d'Etat in 1965, Suharto became the new president. This new president was invited to join the United Nations and Western countries supported his regime until the late 1990s. The three million members of Gerwani were silenced, as was the entire women's movement of that time. The term Gerwani is still used, but only as a term of abuse in 'Gerwani Lonte', *Gerwani-whores*, applied to women* who speak up in public, to discourage, shame and silence them (Saskia, 2020). Gerwani members were kept in political prisons all over Indonesia stereotyped as communist, evil and sexually perverted. The survivors were fully under military surveillance, even years after being released. This is why, until Suharto stepped down, it was almost impossible for Indonesian intellectuals inside the country to know, study or write about Gerwani and its rich past. The last twenty years, studies on Gerwani as feminist organization were published in Indonesia. They sparked many controversies on how to even talk about the atrocities they experienced and discuss this contested period in history. The story of Gerwani is one of the most suppressed, delicate, sensitive ones. Even in 2015 magazines on this issue were still burned in public (Lentera, 2015). Gerwani and all other critical citizen initiatives are still written out of Indonesian history books (Wieringa & Katjasungkana, 2019, p.42). 'Gerwani was responsible for the coup d'etat, which the military prevented by taking over power', was the official state narration. A very specific housewifization was enforced (Mies, 2014). It only allowed the wives of public servants and men working in the military to organise as women groups. The hierarchy of the New Order women's organisation operated according to the rank of their husbands. State motherhood was constructed as the new ideal - State Ibuism (State Motherhood) - a term coined by Julia Suryakusuma (Suryakusuma, 1988). Again women were forced to stay in the house and take care of the kids. Top down housewifization was implemented through the mandatory housewife organisation Dharma Wanita and PKK (Wieringa, 1986; Suryakusuma, 1998). They funded peer to peer workshops on village level, but only on skills such as applying makeup or wearing traditional dresses or baking cakes.

In contrast [to Gerwani], the conservative PKK women's group in its present form is a creation of the Suharto government and is used by it very directly to translate government policies into programs meant to ensure that women are

obedient and fully support men and the government line. (Wieringa 1993, p. 19)

Controlling what the feminine is and the economic position that is connected to a gender role became essential to the New Order Regime. Setting up and policing the absolute bias of gender, helped facilitate terror and silenced all resistance for decades.

So, "Gender Ideology" is always part and parcel of state ideology. That is what I try to hammer into my male compatriots. Because male political scientists (...) they don't take gender into account. (Julia Suryakusuma, 2021)

Suharto allowed Western multinational corporations to enter the country exporting gold, copper, oil, palm oil, wood, and cheap labour, paying insignificant taxes. For example the Arizona based company Freeport-McMoRan started the Grasberg mine in Papua, Indonesia. Only as late as in 2018 corporate tax rate was set to 25 percent (Reuters, 2018). With Suharto's protection, Freeport-McMoRan could operate without restrictions (Freeport, 2022). Multinational Corporations started to dominate the Indonesian markets and economy. The World Bank encouraged Indonesia to restructure the economy along free market lines and invested millions of dollars that caused catastrophic inflation. Most middle-class families were thrown back into poverty (Stiglitz, 2021; IMF 2022; La Botz, 2001 p. 49).

2. METHODS

This research applies standpoint theory (Harding, 1986, 1991) and situated knowledge (Haraway, 1988) and is informed by Braidotti's affirmative ethics (Braidotti 2018). It draws from qualitative research, interviews that were conducted online and offline during the past two years with informants on Java. The field work conducted in 2019 on Java island was accompanied by a literature review on the Indonesian women's movement, with focus on the organisation Gerwani and its survivors. The interviews were prepared and directed by Stefanie Wuschitz. The survivors were interviewed by research assistants Nilu I. and historian Astrid Reza in Indonesian and Javanese, then these conversations were transcribed and translated to English by Astrid Reza. By collecting these interviews and additionally field work notes, archive films, archive photos, letters and through artistic research in form of video editing, merging and sketching connection among these materials, this paper tries to unpack how activists based in feminist citizen labs address social injustice issues today. An important source was the newly discovered original Gerwani magazine series that had been stored as microfilms at Leiden University library (Api Kartini, 1959-1961). These magazines contain precious, surprising new materials that led us to new insights. Hence, interviews were taken with leading scholars

in the field, like Ita F. Nadia, Saskia Wieringa, Svetlana and Julia Suryakusuma. Online interviews in English were conducted with younger Indonesian activists and culture workers who are based in Jakarta, Yogyakarta and Berlin. In total the authors conducted fifteen interviews. Each took 2 – 5 hours. These interviews were transcribed and coded, then edited to a video. The author uses feminist geopolitics of technology as a framework to analyse entanglements of activism, space and intersectional forms of oppression, as Margaret Jack and Seyram Avle have proposed (Jack & Avle, 2021). It builds upon feminist HCI scholarship and technofeminist theory (Haraway, 1998, 2018). The final research publication took the form of a hand drawn animated documentary, which was merging different findings to create a twenty minutes documentary film (see figures 1-7).



Figure 4: Video still of animated documentary, 2022

3. RESULTS

3.1. Underground Network

New feminists were born and the experiences of the past had not stopped activities among women intellectuals, yet they had to go underground. Marsinah, an independent trade unionist, who was missing and killed brutally by the regime on 8th May 1993 added fuel to the underground network of women activists to continue their clandestine work. In the period of 1996 - 1997, they joined the pro-democracy movement and their movement became offensive to the regime. The surviving Gerwani who were imprisoned as political prisoners had several coded languages, one for each layer of Gerwani activists (Ita Nadia Fatia interview). Once released from prison they communicated in codes, e.g. covering messages as cooking recipes, with ingredients standing for certain names (interview with Ita F. Nadia, 2020). These experimental methods of organising themselves for underground resistance were often covered as just housewife gatherings or indigenous women meetings or crafting groups (Baun, 2018). They adapted many methods of talking or publishing in codes or went undercover in their network to avoid the supervision by the military regime which were at their strongest

at those times. Through the enormous inflation, food prices had been rising tremendously (Arivia & Subono, 2017). It was a feminist activist group covering as “MOTHERS FOR MILK” that first broke the permission to protest in public (Suryakusuma, 2022; Arivia & Subono, 2017). In order to not be confronted with military violence, they decided to pretend to be mothers, demanding milk for their babies. It was the anti-Suharto milk protests, student protests and workers protests that merged with protests of the middle class, NGOs and others to create a mass movement (La Botz, 2001 p. 50-54). This mass movement succeeded and Suharto had to step down (Suryakusuma, 2021, interview; Arivia, Subono, 2017).

This year 1998 was a land shed for most young feminists active today. As students who had spent their lives hiding their activities and political opinions, this year changed their lives. Now they could openly share critical views, read books, meet for critical discussions and make art. Around 150 political parties were registered for the first free election (Suryakusuma, 1999). The activists interviewed for this paper remember this time very well.

When activists shortly after this incident gained access to the internet, the feminist network went online. Because of Indonesia's geographical size, the internet significantly helped to bridge distances between islands. Local, personal contacts were described as “vertical not horizontal” by the informants (*interview with L, 2020*), meaning that alliances among citizen lab initiators emerged between generations, not horizontally among peers. The internet helped to change this.

3.2. Needle n Bitch

A feminist citizen lab we took interviews with was Needle n Bitch. The collective provides a silkscreening and tailoring workshop and initiates conversations on feminist issues during sewing classes. In these classes, participants e.g. make menstruation pads from upcycled fabrics and re-used textiles. In the course of the workshop sensitive issues like menstruation, body shaming and domestic violence are being tackled. This way the DIY workshops provide informal, mobile safer spaces in remote areas. At the same time the collective is actively involved in online campaigns in Bahasa Indonesian and English.



Figure 5: Logo of craft and design collective
Needle n' Bitch, 2021

One of the founders, Mita, told us about how connecting to farmers was central to their work, as well as expressing their opinion through their crafts:

So back then, also we connected strongly with the farmer movement, so we decided to (...) be closer and build solidarity and farmer's fight for the iron mining back then. My collective works on gender issues, as well as land issues. Speaking of gender issues, we wanted to first prove that activism can also support your economic needs (...) So we don't want to accept that (funding) as a collective. So we want to build our own economic base. We split into two divisions, one is campaigning..all related to activism, and one is the production division, where we try to survive, to live from the craft. Speaking of the craft also, the craft became something really important to us. Because it speaks for itself. So we do the campaign, we don't say "Oh..we are anarchist group, this is our ideology, this is our political view", but we use our craft to (...) send the message directly. (Mita, 2019)

Like most of the young people who we interviewed, Mita is not excited about the nation state as a shared endeavour anymore. Her lab directs their online presence towards a global audience that shares values of feminism, digital rights and environmental justice. They skip the national level. At the same time they establish grassroots networks that are village based, local and stay hidden on the periphery. While Gerwani members were once outspoken, loud and internationally present, today's activists need to code their work to reach their goals (Wieringa, 2021; Mita, 2019).

3.3. Purple Code

We also interviewed community organisers who entered the public sphere right after the end of the New Order regime. Women's art activist L. described her personal activism as inspired by Kalyanamitra, one of the only organisations active in the mid 80s. In this NGO, initially founded as a crisis centre for survivors of sexual violence, she encountered the first (translated) feminist books, newsletters and discussion groups (L., 2021).

The internet was introduced to Indonesian universities first. With the internet as Cyberspace and as new digital public activism changed. The following section will introduce activists who experienced this time. One of our informants, Dhyta, who is a long-time feminist activist since the 1990s focuses on female identified person's safety online. Hostile conservative groups in Indonesia's society can pose a threat to feminist citizen labs (Dhyta, 2020) and harm their progressive environments. A citizen lab's twitter and instagram account was locked down by the government, while we researched their activities. Dhyta's collective, Purple Code, created a network concerning KBGO (*Kekerasan Berbasis Gender Online* - Gender

Based Violence Online). They provide a guidebook to raise awareness on digital security issues, an online training and an online campaign against gender-based violence. L. describes the way of Indonesian women*s activism evolving in the current time:

With this kind of organising slowly we understood what is missing is not only a platform to meet with one another, but a platform to critically analyse how you work as an artist, as intellectual or activist (35:32). So we stepped further from getting to know each other and going more specifically into a relationship (...) to do a kind of peer learning system (36:35).

Purple Code Collective has set up various networks with different feminist groups nationally and internationally. Dhyta Caturani, as the founder of Purple Code Collective, describes how her activities as a student introduced her into educating women on digital literacy and gender-based violence online. A government legislation on protecting women* against sexual violence has been held back in parliament for years, which frustrates many activists we have interviewed. Indonesia now counts 202,6 million users (reportal, 2022) enabling many feminists to widen their networks online. According to Dhyta the drawback is that she increasingly experienced the internet as a space that women* need to reclaim. In the interview she reflects upon the power of algorithms and the importance of speaking out in online public.

So I started to get threats and it was shifting my perspective on technology. When I thought it was democratic, it could be tools for power distribution, it could be an equal and open and free space, it was not the case. (...) this is the space we live in and like in any other space (...) the internet, digital technology needs to be reclaimed as our space. (9:37) (...) They put your safety in your own hands (11:26). Which resolves in gate keeping ourselves – (...) that kind of restriction only perpetuates the violence against us, that we have to censor ourselves etc. And censorship is a way of patriarchal silencing of women. ... (In) our space, (that) we can live equally, safely, and it enables us to challenge power structures within the space.

3.4. Art as a loophole for autonomy

As the Indonesian nation state is not funding feminist citizen labs, many feminist intellectuals piggy bag their campaigns and events on corporate funded activities, for example, the "Women's Thought Conference" (Sekolah Pemikiran Perempuan). Nevertheless, Indonesia's feminist labs have gained international recognition for exploring social issues through science and technology. In 2019 alone, this young generation of women artists was represented in several important shows (Bianpoen, 2019). Irene Agrivine is the

mastermind behind XXLab and HONF, two famous collectives based in Yogyakarta. XXLab won the Ars Electronica prize (Ars Electronica, 2022) and SAM Fund for Arts and Ecology grant in 2015 (HONF, 2022). Today her collectives develop artistic applications for urban mined materials:

(...) XXLab explores creative solutions for previously undetected or understudied links between waste management, food and fuel shortage or unaffordability, and poverty reduction. In one of its projects, SOYA C(O)U(L)TURE (2015), the collective uses digital and biological hacking methods for designing dresses and other 'haute couture'. The clothes are made from a leather biofabric, which is based on the liquid waste of tempeh and other soy industries known for polluting the Indonesian rivers and soils. (HONF, 2022)

In workshops, exhibitions and performances XXLab explores upcycling, recycling and hacking urban mined artistic materials. Also other feminist citizen labs, feminist hacklabs and DIY collectives have gained increased attention in the last years (Toupin and Bardzell et al. 2016; Toupin, 2013, 2014; Wuschitz 2015). However, reclaiming space online and offline is often connected to personal and financial sacrifices by the precarious activists. In this sense the feminist struggle for equality and a voice in public is not supported through digitalization, only extended to the digital realm. Many feel disconnected from feminist peers and claim that it is easier to connect to feminists internationally than with those within Indonesia (L, 2019). The interviewed activists belonging to the youngest generation operate with a lot of care within a risky climate and weave delicate offline ties (Bellacasa, 2017). Their activities are considerate about participants' safety and often engage in coded or hidden interventions. They are nevertheless or even more so, deeply effective, sophisticated and scalable.

4. DISCUSSION

Recent feminist HCI scholars have shown that feminist citizen labs and their grassroots education efforts are a global phenomenon (Lindtner, 2017, Avle, 2018, Toombs, 2014, 2015, 2016; Kera, 2012, 2014; Lin, Lindtner, Wuschitz 2019). The women's movement in Indonesia was based on a critical view on industrialization and techno-empires shared with international social movements. Activists in Indonesia were painfully aware of the destructive nature of colonial commodity chains. By building DIY networks, they aimed to become more independent from imperialist structures. European colonists had been violently taking land and resources from enslaved peoples living on the Indonesian islands (with VOC - Dutch East India Company being the very first one in world's

history). After Indonesia gained independence feminist citizen labs targeted patriarchal traditions and proposed new educational standards to fight illiteracy. They promoted a new image of a modern brave, social activist, educated woman in her own right "rather than as docile wives and mothers" (Wieringa, 1993).

Within a global techno-empire (Jack & Avle, 2021), in which social media channels are instrumentalized by larger players, Gerwani's 'granddaughters' stay with the trouble (Haraway, 2016). Their challenges result in new solutions. For example, citizen labs such as Needle n Bitch, Purple Code or XXLab divide their work into an online campaign that reaches out to a wider public, and a more coded, more hidden offline part that engages in skill sharing, networking, knowledge production, new subject formation. The activists we interviewed consciously decided to not register as an NGO or search for funding, but instead try to establish their own economic base, by selling crafts, offering counselling services or simply using their private income to continue their activism. To be based in a local village structure helps to organise the labs as commons (Savic, 2018, Toupin, 2015, Toombs, 2014, Maxigas, 2012, Moilanen, 2012).

This paper argues that although citizen labs run by women* in Indonesia share many similarities with feminist citizen labs in Europe and North America, their beginnings can actually be tracked back in time to Indonesia's struggle against colonialism at the beginning of the century and the accomplishments of the Indonesian women's movement in the 1960s. We find it remarkable that in Indonesia the term *laboratory* was used in connection to educational environments as early as in the 1920s (*Santiniketan*). The 'resistance education movement' of that time had set solid groundwork for future citizen labs: wild schools, Taman Siswa, Melati kindergartens, Gerwani's grassroot groups and mutual self-help networks on village basis, and most importantly the neighbourhood groups initiated by the women's movement between 1950 and 1965. They all shared central values with today's scene of citizen labs. They reshaped the very concept of learning. Autonomy, curiosity, openness and independence, self-regulation of the self-driven learner stood in the centre of their pedagogy (Supardi, 2018, p. 55).

Citizen labs therefore applied different strategies than citizen labs in the so-called West. The risk Indonesian initiators take demands intensified care. After decades of prosecution of self-educated and educated women* and their organizations, grassroots knowledge production by feminist citizen labs is suspicious, stigmatized and exposed to violence. In contrast to the New Order's societal recategorization following the "divide et impera" principle, today's collective's websites reach out to an international,

critical online public (Larasati, 2013, p.5). They raise awareness on the social implications of data-centric technologies and automation (Data & Society, 2022). The neighbourhood plays an important role in maintaining the lab. In general, content is rather shared through other platforms, such as websites, Instagram, Facebook and Twitter. Many times, activists' profiles on these social media platforms are locked down by the government or anti-feminist groups. Local educational work is then done entirely by peers, village-based (*kampung*). When their labs are closed down, they work entirely online.



Figure 6: Video still of animated documentary, 2022

5. CONCLUSION

5.1. Prevailing rupture

Throughout our interviews we could trace a clear rupture among informants we count to the second generation and those we count to the third generation (pre- and post-New Order regime). Due to the lack of historical contextualization of feminist struggles during years of state propaganda and New Order oppression, younger feminist activists and their citizen labs today act quite isolated when it comes to workshops and activities on the ground. What isolates them and slows today's initiatives down is the social trauma of 1965. It prevails, because it is not yet discussed openly in public. We heard from many sides that the trauma cannot heal, because the memories are handled as family secrets (Eka, 2019; Wieringa, 2020; Pohman, 2017, p.173). It is seen as private and framed as a-political, which replicates a hostile atmosphere. Social amnesia is co-creating today's subjectivities (Jacoby, 1997).

As a feminist, artist or citizen lab member you are aware that you are vulnerable and can be stigmatized. Sender and receiver of messages need to be considered carefully. Feminist citizen labs invest significant time and care into tactics that protect their participants. Coded feminism cares about operating in a safer space, offline and online. While the first generation could transfer their knowledge formats to the second generation, the third generation, being cut-off from the recent past,

has made digital tools and online formats their new territory.

Even if the interviewed collectives don't give credit to Gerwani, we could sense that their initiatives follow patterns that Gerwani had set up in the first place. For example, the interference of (digital) literacy workshops for empowerment within local peer to peer DIY collectives. Gerwani's campaign for farmer's land rights also resonates with XXLab's, HONF's and Needle n Bitch' projects, which seek alliances with farmers for permaculture, sustainability and food sovereignty. Listening to witnesses of all three generations it seems like they all applied and appropriated principles of the *resistance education movement* that was once installed to build alternatives to the Dutch colonial schools (Supardi, 2018, p. 55). Provocatively formulated one could suggest that they all tried to hack the hegemonic education system of their own times with similar means. Making science, art and technology accessible to citizens, in particular female categorised citizens. Open-source technologies as access to knowledge is still key. Exploring social issues through the entanglements of science, technology and art is still perceived as an effective strategy to deal with complexity.

5.2. Learning how to (en)code

Today's self-starters, start-ups, activists, makers, designers, artists set up citizen labs to explore social justice issues through science and technology. Tactics of coding, hiding, encrypting, and translating have outlived the previous regimes. Although state ideology constructed an extreme gender bias through housewifization ("State Iblisism") (Suryakusuma, 2021; Mies, 1986) and is still exercised through housewife organizations, young feminists have turned their backs towards them and turn to digitalization for weaving new critical alliances. These mutual self-help structures online are effective and enable young activists to operate following a pattern of the pre-Suharto feminist movement. The Indonesian women's movement that emerged between 1920 and 1950 therefore provides a strong base of today's vibrant Indonesian scene of feminist artists.



Figure 7: Video still of animated documentary, 2022

5.3. Bridging gaps

Crafting, designing, making and tinkering, coding and prototyping allow non-verbal forms of self-expression, even when direct articulation (or remembering) is difficult. From these practises counter narratives to Suharto's state narrative can evolve. What is different for these generations is that before 1965, setting up the nation state as a shared effort provided social glue to bridge social groups. After 1965, Suharto implemented his state ideology through segregation. The current generation makes an effort to again bridge old and new gaps by inviting diverse citizens into their transdisciplinary labs.

We could not find out whether and in what scale this vibrant art scene informs the restricted political left in Indonesia or how recently emerging feminist movements within Muslim boarding schools contribute to citizen labs. But we hope that these questions might bring new facts to light for a deeper study of Indonesian citizen lab's wide reaching, decolonial, human-centred and deeply democratic practice.

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INTERVIEWS

(if not otherwise stated anonymous)

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Eka 2019, on telephone

Dhyta Caturani 2020, online

Ita Fatia Nadia 2020 and 2021, online

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Mita 2019, in person

Ruth H. 2019, in person

Sarijah 2020, in person

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Astrid 2020, online

Julia Suryakusuma 2021, online

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Sukarti, 2021, on telephone

Democracy, science, and development: the nexus in the East African Community

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Accessibility, accountability, and transparency are crucial tenets of any democratic society. East African Community member states are hybrid democracies. Each member country's development agenda identifies science and technology as crucial drivers to leapfrog each one of them to middle-income status. For science and technology to thrive in these emerging economies where resources are limited but the demand for investment in science is high, the power of transparency, accountability, and accessibility in galvanising public support for science cannot be downplayed. Development too requires a structured and rewarding atmosphere for it to manifest – if political, public support and funding are garnered for science, desired development will occur. This article will focus on Uganda, Kenya and Tanzania, and demonstrate that science and democracy are interconnected in a symbiotic relationship. While democracy on the political front is weak at best, science needs to adhere to the tenets of democracy and spur the development of social aspects. This could in turn accelerate and inspire political actors to emulate and trek the path to true democracy.

Democracy. Science Democratisation. East African Community. Development.

1. INTRODUCTION

Starting in 1917 as a Customs Union, the East African Community (EAC) as we know it today underwent several changes including a 16-year hiatus. Initially, a tripartite-member (Uganda, Kenya, and Tanzania) union, EAC later in the early 2000s grew its membership to include Rwanda and Burundi with South Sudan joining last in September 2016 (EAC, 2021). The eight objectives of the Community include developing policies and programmes to widen cooperation among member states in science and technology for mutual benefit (EAC Treaty, 2007). EAC's 35-year development strategy christened EAC Vision 2050 identifies science, technology and innovation (STI) as key drivers for economic growth and sustainable development. 'Competitiveness of economies' is largely owed to 'dependent on the production and application of STI (EAC Vision 2050). In the medium-term, EAC Development Strategy 2016/17-2020/21 emphasises the improved application of STI for sustainable economic growth and strengthening regional integration (Development Strategy, 2016).

EAC member states share a lot in common, for instance, the democracy index report by the

Economist ranks Tanzania, Kenya and Uganda as hybrid democracies ranking at 93, 95 and 98 respectively out of 167 countries (The Economist Intelligence Unit). This indicates that EAC registers some semblance of transparency, accountability, and accessibility (The Economist Intelligence Unit, 2020).

Closely related, the African Union has for more than a decade been encouraging member states to continually increase and commit one per cent of GDP to the development of science and technology (S&T) capabilities (Lagos Plan of Action, 1980-2000). However, whereas there is considerable investment in S&T, none of the EAC member states has hit the recommended mark. Presently, Kenya, Tanzania and Uganda each spend 0.8, 0.5 and 0.1 per cent of GDP (UNESCO Institute of Statistics, 2021).

Focusing on Kenya, Tanzania and Uganda, this paper will demonstrate that democracy and Science are interconnected facets that should be treated as a unit to spur the development of EAC as envisioned in the different development agendas of each of the three nations. This paper will suggest feasible recommendations for democratizing science in East Africa.

2. DEMOCRACY IN THE EAST AFRICAN COMMUNITY (EAC)

Henry L. Mencken simplified the term democracy as a theory that the common people know what they want and deserve to get it good and hard. This definition suits EAC. EAC is a volatile region with spates of undemocratic practices littering recent history. This is in absolute contravention of the EAC Treaty specifically article 3-3(b) "adherence to universally acceptable principles of good governance, democracy, the rule of law, observance of human rights and social justice;" While Uganda, Kenya and Tanzania exercise multi-party politics, the electoral seasons are usually marred with violence, intimidation and coercion of political opponents by sitting leaders. Post-election violence is ever-present. During the 2017 general elections in Kenya, several opposition candidates were arrested and court orders demanding their release were flatly ignored by law enforcement agencies (HRW, 2018). In 2015, soon after his ascent to power President John Magufuli embarked on a crackdown of opposition political parties by persistently frustrating their operations. Criminal cases were slapped on opposition figures (CRS Report, 2020). Similarly in Uganda, soon after the general elections in January 2021, the leading opposition candidate, Robert Kyagulanyi was placed under house arrest by the military for twelve days (Athumani, 2021). Human rights violation is another area of concern within EAC. Arresting and intimidating journalists or shutting down media houses and the internet is a common occurrence too. For example, editors from the Daily Monitor newspaper in Uganda were summoned by the police for publishing details of a BBC documentary that highlighted extrajudicial killings by the Uganda Police force (BBC, 2021)

Closely related, are the emerging trade woes fuelling mistrust among member states which threaten the union's existence. Kenya has severally banned Ugandan agricultural produce on account of poor quality, this was however interpreted as trade protectionism by Uganda. In July 2020, Kenya imposed a ban on sugar from Uganda to protect Kenyan millers (Daily Monitor, 2020). In March 2021, Kenya again raised trade tensions when it banned maize alleging it contained aflatoxins and thus not safe for human consumption (Awori, 2021). In 2013, Tanzania lashed out at Uganda, Kenya, and Rwanda for behaving like bullies after the trio formed the "coalition of the willing". Tanzania considered this a "strange behaviour". The three nations preferred fast-tracking political integration while Tanzania opted for a cautious pace. In protest, Tanzania shunned EAC high-level meetings which undermined the spirit of the East African Community (Clotney, 2013).

However, while the democratic space concerning political reforms and human rights continues to shrink and show the bad and ugly side of the region, the good side of EAC can be traced to the flip side of economic growth. Despite COVID-19 continued ravaging of the EAC economies, Kenya still leads the pack with a USD95.5 GDP, followed by Tanzania at USD63.18 and Uganda standing at USD 35.17. In July 2020, the World Bank Tanzania elevated to lower-middle-income status after her Gross National Income (GNI) per capita improved crossing the threshold level (World Bank, 2020). The region continues to attract foreign investment and all governments are investing heavily in crucial infrastructures like roads, standard gauge railway and the internet. The region is further relatively safe thus improving investor confidence.

The literacy levels in EAC are also high ranging between 76.53 and 81.54 per cent. An indication that EAC is on the right trajectory to development (Macrotrends,2021).

3. SCIENCE AND TECHNOLOGY IN EAC

In the early 1970s Uganda, Kenya and Tanzania all acknowledged the role of science and technology in accelerating development in each country. This is evidenced in the establishment of national agencies for science and technology. The agencies advise their respective governments on how to best leverage science to meet desired development targets. For instance, in 1970 Uganda established the National Research Council (NRC) under the Office of the President to supervise research and guide on how research could contribute to national development. In 1990, by an Act of Parliament CAP. 209, NRC was succeeded by the Uganda National Council for Science and Technology with a wider mandate beyond research supervision to include promoting science and technology uptake (The Republic of Uganda, 1990).

In 1977, Kenya established the National Council for Science and Technology (NCST) a semi-autonomous advisory committee of the Government of Kenya. Vision 2030 which aims to transform Kenya into a globally competitive, industrialised and middle-income country, anchors to science and technology as prime drivers for socio-economic transformation. NCST was later strengthened and transformed into the National Commission for Science and Technology (NACOSTI). NACOSTI's mandate caters to the promotion, coordination and regulation of science, technology, and innovation in Kenya (the Republic of Kenya, 2013).

Similarly, the Tanzanian Parliament through Act No.7 replaced the Tanzania National Scientific Research Council with the Tanzania Commission for Science and Technology (COSTECH) in 1986.

Just like UNCST and NACOSTI, COSTECH advises the government of Tanzania on matters relating to scientific research, innovation, technology development and transfer (the United Republic of Tanzania, 1986).

Tanzania specifies science and technology as key drivers for advancing the competence and competitiveness of the country hence steering it towards development targets due in 2025. Science and technology enhance productivity through continuous learning and awareness (Planning Commission, 1999). To achieve middle-income status by 2030, Kenya recognises research and development as crucial accelerators if the country is to fully industrialise and attain economic development. The Vision alludes to improved funding to scientific research and technical capabilities (The Republic of Kenya, 2007). Uganda also considers science and technology crucial in achieving this objective. The is a national plan to set up regional science and technology parks envisaged to spur development and innovation (National Planning Authority, 2013).

Furthermore, the African Union released a strategic document dubbed the Lagos Plan of Action for Economic Development of Africa 1980-2000, recommending member countries to invest in science and technology. The plan went on to boldly emphasise allocating 1 per cent of their GDP for the development of their scientific and technological capabilities (Organisation of African Unity, 1980). Forty years later, all EAC countries still tout science and technology as crucial facets but investment in this critical area is still below the recommended 1 per cent. Uganda spends a paltry 0.1 per cent of its GDP, Tanzania follows at 0.5 per cent while Kenya stands at 0.8 per cent of GDP (UNESCO, 2021).

4. DEMOCRACY AND SCIENCE

Routinely laws, rules, regulations and policies are enacted in any democratic society. The process is as regarded deliberative given the consultative nature it undertakes. Discussions entail seeking diverse views and expertise from groups including scientists. Recommendations by scientists are considered important that many governments across the globe have since established science advisory positions. The advisories in form of policy papers help politicians make informed decisions. Almost all recent political decisions by governments against the COVID-19 Pandemic across the East African region have been largely dependent on scientific advisory. The same approach has been deployed in the past when governments were dealing with similar health challenges like HIV/AIDS, Ebola, and Malaria.

Given the collaborative nature of this role, some scientists find the closes to politics a tad uncomfortable. Politicians have a penchant for manipulating facts to suit a given political agenda. It is this kind of behaviour that drives science into disrepute. To save face, some scientists hold the view that science should remain neutral and not mix with politics (Reiss, 2021).

Conversely, some scientists believe the politics-science relationship is symbiotic and should be embraced. Science could take advantage of this relationship to lobby for more funding from politicians in exchange for pragmatic knowledge. Politicians can in turn influence or attract private sector investment to research and development through waiving taxes (Simões, 2018). For this to happen one needs to understand and appreciate the operations and challenges of each field. In a democratic society, sectors do not stand alone they speak to and with each other hence creating transparency.

Democracy and science relationship is evolving so fast and along with it, new terminologies like the knowledge economy have since emerged. Propelled by globalisation and technological advancement the knowledge economy concept fronts the consumption and production of wealth dictated by intellectual capital or the ability to monetise scientific knowledge or research. Research has transformed from independent practice to one driven purely by profit through innovation and competitiveness. Policies to support the implementation of the knowledge economy require the collaboration of all stakeholders like scientists, investors, politicians, and the laity (Guespin-Michel, 2012). According to the World Bank Knowledge Economy Index Kenya, Uganda, and Tanzania fair well at the bottom but promising rankings of 110, 117 and 127 respectively out of 144 countries. This is indicative of a positive trajectory toward making gains by the East African Community member countries.

The youth are becoming increasingly creative. They are innovating bridges between science and policy across the globe including within East Africa. The do it yourself (DIY), innovation hubs, maker spaces continue to sprout across the globe demystifying science, availing disruptive innovations, and securing funding from both public and private purses (MACILWAIN, 2016). Makerspaces and hackerspaces are collaborative workspaces where people with common interests meet to learn, explore, and share experiences. The transparency with which these centres operate feeds right into the definition of democracy. DIY science is also important for lower-middle-income countries in improving processes and equity in science. Gustavo Batista Menezes' confocal microscope is a good example of democratised

science. Menezes and colleagues modified a US\$10,000 microscope to as low as US\$3, without compromising on the quality of outputs. This eased accessibility to scientific knowledge. Close to home in Cameroon, DIY biology through Mboalab is bridging the technological gap by providing alternative cheaper technologies for university students studying sciences thereby demystifying science and improving the quality of human capital released from universities (Ravindran, 2020). EAC is also experiencing a steady growth of innovation/tech hubs with the number currently oscillating between 40 and 50 hence contributing to sharing requisite knowledge that bolsters innovation (Afrilabs, 2020).

5. WHY EAC SHOULD EMBRACE SCIENCE

The World Bank estimates the combined population of Uganda, Kenya, and Tanzania to be over 150 million people majority of whom are below the age of 30. Similarly, the three countries share critical transboundary challenges that can be addressed by science.

It is these common challenges that informed the establishment of the East African Community creating the East African Science and Technology Commission (EASTECO) in 2007. EASTECO is mandated to conduct joint development and application of science and technology for EAC (East Africa Community, 2007). While EASTECO has registered remarkable progress, we are yet to see tangible outputs. EAC has over the years been haunted by common problems that could be jointly addressed by science in particular health, environment, agriculture and indigenous knowledge.

5.1. Health

Communicable diseases continue to distress EAC in equal measure. Malaria and HIV/AIDS have strained the already fragile health care systems to the brink of collapse. Of the over 400,000 malaria deaths worldwide, 5 per cent are reportedly from Tanzania. As of 2019, funding for malaria control and prevention stood at US\$3 billion with only US\$ 900 million (31 per cent) being contributed by endemic affected countries (WHO, 2020). HIV/AIDS is another disease burden affecting EAC's 4.7 million people. While efforts to bring down infections are commendable, the funding from the EAC member states is still paltry. Ninety-three per cent of the funding towards HIV/AIDS prevention, treatment and research in Tanzania is sourced from developed nations. Uganda's foreign funding stands at 89 per cent while in Kenya it is at 75 per cent (Avert, 2020). This is a clear sign of the regions continued reliance on foreign aid which is not sustainable in the long run.

5.2. Agriculture

Agriculture is the backbone of all EAC economies combined. It accounts for the majority of the workforce in EAC. Statistics by the International Food Policy Research Institute (IFPRI) indicate steady improvement in agriculture funding by each country. Kenya, Tanzania, and Uganda each invested 0.48, 0.17 and 0.62 per cent of GDP (IFPRI, 2018). Joint funding opportunities for agriculture research and development are yet to be realised. Kenya has repeatedly closed out agricultural produce from Uganda and Tanzania claiming it is of poor quality (Nakaweesi, 2021). Shouldn't EAC be working together in advancing agriculture as a bloc?

5.3. Environment

A grim future hovers over Lake Victoria. Scientists report it is choking on pollutants from surrounding industrial and domestic developments. Covering approximately 69,000 square kilometres, Lake Victoria is the second largest freshwater body in the World. The Lake is shared by Uganda, Kenya, and Tanzania supporting over 30 million people economically as it is the source of food, water, energy, and transport. It is also the source of the River Nile. Kampala, Kisumu, and Mwanza in Uganda, Kenya and Tanzania are all heavily populated lakeside towns, industrialising rapidly and are ever discharging untreated effluent into the lake which is an environmental and health concern (Air Water Earth Ltd, 2021). Even with the presence of the East African Community Lake Victoria Basin Commission, the lake continues to be in dire straits. This Commission was established in 1999 to ensure sustainable utilisation of Lake Victoria by all three countries (East African Community, 1999).

5.4. Indigenous knowledge

The COVID-19 Pandemic has stirred the unprecedented demand for herbal and traditional medicine across the continent in the quest for a cure to a virus so lethal. According to the World Health Organisation (WHO), 80 per cent of the world's population turn to traditional medicine as the first line of care. Upon the urging of WHO, therefore, many countries including, Kenya, Uganda, and Tanzania have since enacted laws and policies to regulate the herbal medicine industry (Government of Uganda, 2020) (Government of the United Republic of Tanzania, 2002). While traditional knowledge cuts across different facets of life it is also a cornerstone to the knowledge economy, I deliberately zeroed on herbal medicine because it is prevalent in all three countries. However, even in the face of COVID-19, EAC never united against pandemic or at least jointly funded traditional medicine research.

6. RECOMMENDATION / WAY FORWARD

Deducing from the above account the East African Community seems to be a unity of convenience. Even in the face of co-operational agreements, the bloc is yet to address the glaring similar challenges as a unified whole. There are in-country signs of progress, but despite the similar objectives and hopes of relying on science and technology to spur development cooperation at this front sounds like a farfetched dream. Nationalistic endeavours continue to undermine the spirit of togetherness.

EAC is a signatory to the sustainable development goals specifically three and eight – Good Health and well-being and Decent work and economic growth. Attaining these goals requires those in the position of power and practice to be transparent with the entire process and the intended outcomes.

Political democracy in all three countries is distinctly wanting, but joint efforts in funding scientific studies especially on transboundary concerns can be a viable start for EAC to start entrenching trust within the bloc. For example, if malaria, HIV/AIDS, and Lake Victoria pollution can be addressed jointly, EAC would be on the right trajectory to growing democracy, science and eventually attain desired development.

Funding towards science across the three countries is still below the recommended 1 per cent of GDP this is partly because the public who are the sole beneficiaries of science are not aware of the potential benefits and therefore unable to support and appreciate scientific efforts in their backyard. People support and criticise what they understand, however, if the public does not understand the intentions science is trying to attain, they will resist or criticise investment in science and innovation. But if the public understands the scientific intentions, they can influence both political will and power, thus rooting for democracy, leading to the desired development. This milestone can be attained with deliberate public engagement programmes like citizen science.

In a nutshell, just like Stephen Hawking said “Government works best of under the glare of public scrutiny. Absence of such scrutiny, abuses occur.” For democracy and development to prevail in this era science and politics need to be deliberately transparent within EAC. Modern democracies are highly dependent on science. Science thrives in a democracy. Democracy inspires desired development.

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Novel images? Artistic image creation with science and technology protocols: GANs and CRISPR-Cas9

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This article investigates two technology- and science-based methods and their potentiality and use in contemporary art, specifically in image-making traditions. Firstly, the article will briefly present digital image creation processes involving Artificial Intelligence (AI) and GANs, and secondly it will introduce a possibility for science-based image modification using a lab-based CRISPR-Cas9 system. Both methods have become available for artistic use with an increase in DIY and open science developments. These scientific methods impact the produced result aesthetically, according to the context and through associations. The question this paper focuses on is what kind of images are created with these methods? How is the meaning conveyed with these types of images? And what is the artistic point of making images with such technology-based processes?

Art. Science. Technology. GANs. CRISPR. Image making.

1. INTRODUCTION

This article must start with the basic definition of the verb *editing*. According to the Online Etymology Dictionary, the etymology of the term originates from the 1790s with a meaning derived from Latin *editus* “give out, push out, publish,” and the definition “to make revisions to a manuscript” is from 1885. The affiliation to digital tools, such as Photoshop or other similar software, meant that in the early 1990s the use of the term was adopted for computer-based work and referred to as image editing with a computer (Etyonline). Today, we also encounter the same term also within the field of genetic engineering as gene editing or genome editing. The discoveries of the 1950’s and 1960’s of DNA and its structure paved the way to today’s advances in gene editing (Synthego).

Even if it sounds like a cliché, art is always reflecting and reacting to its time and surrounding world. Concerning the connection of art to science and technology developments, the history of art presents us with various examples of works that have been impacted by

the specific era’s technological advancements and inventions. One well-known example is the invention of oil colour in tubes. In 1841 the American painter John G. Rand patented a method of packaging oil paint in flexible zinc tubes with a screw cap that could be opened and closed easily without the paint drying out. Famously, this is claimed to have enabled the Impressionists to develop a new style that took inspiration directly from the surrounding world and the natural light affecting it. The invention of the paint tube also enabled a wide range of colours to appear on artists’ palettes, including completely new ones invented by industrial chemists (Hurt 2013; Art World News 2015). Another obvious example from art history is the invention of technological reproduction methods such as photographic film and its mass production, which, for example, released painting from its reproductive function. The list of technological and scientific influences in the history of art is long and continuous. Today, computer-based image editing, digital photography, programming and 3D modelling or prototyping have become common practices for

artists. The next section briefly discusses DNA and computer code, with an aim to bring these parallel to each other.

2. CODE

The discovery of the double helical structure of DNA by James Watson and Francis Crick in 1953 led to a deciphering of the genetic code, considered one of the most important discoveries of the 20th century and the basis of molecular biology (Tamura, 2016). Francis Crick wrote about the discovery in a letter to his son in 1953:

It is like a code. If you are given one set of letters you can write down the others. ...Now we believe that the D.N.A. is a code. That is, the order of the bases (the letters) makes one gene different from another gene (just as one page of print is different from another). You can now see how Nature makes copies of the genes. Because if the two chains unwind into two separate chains, and if each chain then makes another chain come together on it, then because A always goes with T, and G with C, we shall get two copies where...

According to Lily Kay the genetic code was established in conjunction with the development of post-war era technosciences, such as cybernetics, information theory and computer science. While these areas were developing in parallel, the information discourse seemed a fitting place for thinking about the genetic code as a scientific object and scriptural technology.

No longer was biological specificity captured solely within the viscous materiality of biological pattern; now the transmitted messages were constituted through alphabetical writing, as a form of “verbal heredity.” The new discourse emerged as pure representation. (Kay, 2000, 294)

At the moment of constituting DNA as a code it also meant that the elementary unit of life became informational. The concept of life as a code based on DNA took a step towards computer science, communication theory and their concepts.

The molecular vision of life was supplemented by the information gaze and empowered by the technologies of the DNA word. (Kay, 2000, 297)

This kind of developing understanding of DNA as a code and life as information was obviously debated across scholars from philosophy, linguistics, biology, life sciences, computer science, anthropology, communication theory

and many others during the 1960s; an overview of the debate is given in Lily Kay’s book, *Who Wrote the Book of Life* (Kay, 2000, 307). These developments and their affiliation with linguistics, communication theory and computer science were also bringing to light and enforcing possibilities for genetic modification; similarly to how languages evolve and are sometimes intentionally modified, any written code can also be copied, modified and edited.



Figure 1: *Workshop in progress within the Hybrid Lab Network project*

For all of us today, it is obvious that computers and other digital devices are based on programming and code. A short look into the history of computers shows us that what is today considered as the first computer programming language was made for a mechanical computer by Ada Lovelace in the 1840s (Fuegi & Francis, 2003). Then, around 100 years later, electrically powered computers and the first high-level programming language were created in the 1940s and 1950s (Giloi, 1997). These machines can be seen as the ancestors of today’s computers. But what is especially interesting about the 1950s is that this was around the same time as DNA was thought out as a code.

Our entire lives today are interlaced with code and data, and it is no wonder that art practices and practitioners are also involved in using and manipulating digital and biological code.

The larger question is how to perceive and retrieve meaning from these types of art works that are strongly affiliated with code-based practices and scientific methods.

The next two sections describe the two processes that are the focus of this article; Generative Adversarial Nets (GAN) and the CRISPR-Cas9 system, which is introduced in more detail as it is a new development by the author and others within the Hybrid Lab Network project.¹

2.1. GANs

During recent years, many artists have taken up work with Artificial Intelligence (AI), Machine Learning (ML) and Generative Adversarial Nets (GAN). In addition, several humanities and cultural studies scholars have investigated the impact of computer-based image making (Lee, 2020; Parisi, 2013; Zylinska, 2017; among others). The recently developed GAN method specifically deals with image creation and has been used in the field of the arts in numerous experiments.

In brief, GAN is based on the idea of teaching machines to figure things out themselves. GAN consists of two deep networks; one is the generator and the other is the discriminator. The GAN network is trained, for example, with some images that are 'real' and some that are generated. The discriminator aims to distinguish between them and learns gradually what features make images 'real' (if that is the set target), and it also provides constant feedback to the generator network, which tries to generate images that look increasingly 'real'. These two deep networks are in continuous competition with each other to improve themselves. The generator aims at producing images that fool the discriminator while trying not to be fooled (Hui, 2018). GANs were invented by Ian Goodfellow and colleagues in 2010-2014 during his PhD research (Goodfellow et al., 2014). Many new variants of GANs have been developed in recent years, such as the recent VQGAN + CLIP which offers some new features (Crowson, 2021). In general, one can say that GANs have both disadvantages and potentiality in many areas.

The 2018 art auction at Christie's created a great deal of attention as on sale was *the Portrait of Edmond Belamy*, which was the first AI-generated work sold at Christie's (Vincent, 2018). Behind the generated artwork was a small group of students called Obvious. But the group was using a code that was written by

a young programmer – this issue caused a stir as the image was sold for over \$400,000.

Using a dataset of European paintings as training examples, the resulting image, produced by a generative adversarial network (GAN), appears similar to a smudged oil painting, complete with what appear to be simulated brush strokes. These are an interesting touch, as they transfer the technical qualities of painting into a medium in which they are not necessary. (Lee, 2020)



Figure 2: Style transfer experiment by the author

Experiments with images and GANs have also been focused on so-called style transfer

(styleGAN), which is a transfer of 'style' from one image to another. Popular styles have included, for example, the recognisable painting styles of well-known artists, such as van Gogh or Picasso, which can be transferred to any existing image (Pasini 2019). Below is a quick style transfer example, in which the author's self-portrait is generated using the style of the well-known Finnish artist Helene Schjerfbeck's self-portrait.²

It seems that many of these early experiments with AI and GANs have been focused on these types of approaches, such as an imitation of existing styles. One can say that the *Portrait of Edmond Belamy* followed a track of historical portraiture paintings and their style, although made with a trained network and not using the style transfer system.

GANs have entered the art scene quite quickly and as professional artists have begun using GANs, it has raised more demand for stronger concepts and meaningful experimentation. Artist Anna Ridler has trained a GAN network with images of existing tulips and generated new tulips as images in her work *Mosaic Virus 2019*.³ In her work *Bloemeneveiling*⁴ one can see short GAN-generated videoclips of possible digital tulips. Comparably, there are also examples of GAN-generated birds that look delusively 'real' but are actually new digital species that do not exist in the biological realm.

What is specifically interesting in the realm of GANs for artists is the idea of training a type of machine to generate novel images. Instead of perceiving the artist as the maker whose signature is imprinted through the hand gestures on a painting or a drawing, an artist's function here is to decide on the training material rather than finalising the end result.

A slightly different approach is found in a work by the author, *Fly Printer Extended* (Beloff, 2016). This work does not generate actual images but aims at telling us what we are looking at by its use of AI and neural networks. In the work, small fruit flies are fed with printer ink and while they produce small random dots on the paper, the neural network analyses this evolving image with dots based on a large database of images. As a result, it will predict for us what the image might depict.

2.2 CRISPR

In 1987 clustered regularly interspaced short palindromic repeats (CRISPR) were identified by Japanese researcher Yoshizumi Ishino and his team (Ishino et al., 2018; Ng, 2020). After a

few other discoveries over the next decades, such as the role of Cas proteins and understanding DNA sequencing, a group of researchers – Church, Doudna, Charpentier and Zhang – found that the so-called CRISPR-Cas9 system can be used as a cut and paste tool to modify an organism's genomes (Cohen, 2017). The method has been said to be more precise and also simpler than the methods that were used previously in genetic modification practices.



Figure 3: *Return to Dilmun (2017)* by Seyfried, van Dierendonck, Petschko and Muffatto

The idea to use a wet lab-based process using the CRISPR-Cas9 genome editing method for image creation originates from an art project by Günter Seyfried and Roland van Dierendonck. In the project titled *Return to Dilmun (2017)*⁵ Seyfried and Dierendonck developed and tested a proof of concept for image editing with the CRISPR method. In other words, the idea is to use scientific genome editing method for image modification.

In general, as the gene modification of organisms has been heavily regulated, there have not been massive amounts of art experiments done in the area. Some art works in history were made prior to the CRISPR-Cas9 system discovery and used synthetic DNA in experiments. Such an example is the transgenic artwork *Genesis (1999)* by Eduardo Kac,⁶ which converted a biblical sentence firstly into Morse code and second into DNA that was inserted into a genome of bacteria. In this work, DNA is treated as a code that is synthesised based on a literary sentence and then inserted into bacteria.

The installation – as a systematic interactive process – can also be accessed online, allowing users (with a click of the computer's mouse) to focus ultraviolet light on the display, causing mutations in both the bacteria's genome and in the coded message. Art no longer imitates life, instead, as Kac states, "art is creating life". (Stafford, 2007)

One should briefly clarify that creation of synthetic DNA is not a strictly regulated

scientific method, but it is typically synthesised in outsourced specialist labs and easily available. However, tampering with the genetics of a living organism is very strictly regulated and often artists and art-based labs do not have the licences to make this possible.

During 2020-21 a series of workshops were arranged within the EU-funded Erasmus+ project Hybrid Lab Network.⁷ Several of the workshops focused on the CRISPR-Cas9 gene-editing technology with experts from the life sciences, humanities and arts.

One of the workshops took as a starting point Seyfried and Dierendonck's idea of image editing with CRISPR-Cas9 method. The basic idea is quite simple and based on the fact that DNA is conceived as a code, as pointed out at the beginning of this article.

In brief, the principles of the developed process and protocol are as follows: the starting point is a digital image, which consists of pixels in different colours. The colour information of each pixel is transcribed to DNA code with genomic alphabets ATGC. This is done by using a (custom-built) encoder software that encodes colours into the genomic code. The code is sent further to an external company to be synthesised as DNA, which is received back in a test tube as liquid matter. This liquid is now the image. Meanwhile, the modification plan for the image editing is made on a computer – first as a visual design and afterwards also in the created DNA sequence. A specific area of the image is targeted and the corresponding section of the alphabetical code is located and edited according to the plan. The next step is to edit the actual (synthetic) DNA with the CRISPR method, which is performed in-vitro, and which involves a wet lab protocol and tools. After this is finalised, it is recommended to run a PCR test to see if the editing has been successful. If so, the edited synthetic DNA is sent to be sequenced (by an external company). The obtained sequenced DNA code is again run through the encoder software, which now translates the genomic code back into colour-pixel information. At the end, an edited version of the original image will be visible on the computer.

The CRISPR in-vitro method has benefits and also downsides; firstly, as everything is done in-vitro and in-silico, it requires no specific GMO licensing by the labs or artists. This makes it an interesting and suitable process for experimental artists interested in biotechnology and also for educational purposes. However, it is important to realise

that in-vitro performed CRISPR has many steps and is quite laborious in comparison to in-vivo performed CRISPR, which is simpler but requires the correct licences. The greatest challenge with the in-vitro method currently lies in the pricing of the synthesising and sequencing of the DNA, which is often performed by external companies. The high price of the DNA sequencing affects the artistic experiments and possibilities to create larger images with more pixel data. Nevertheless, the possibilities and new thoughts that this method opens up in relation to art, image creation and also science are worthy of consideration.

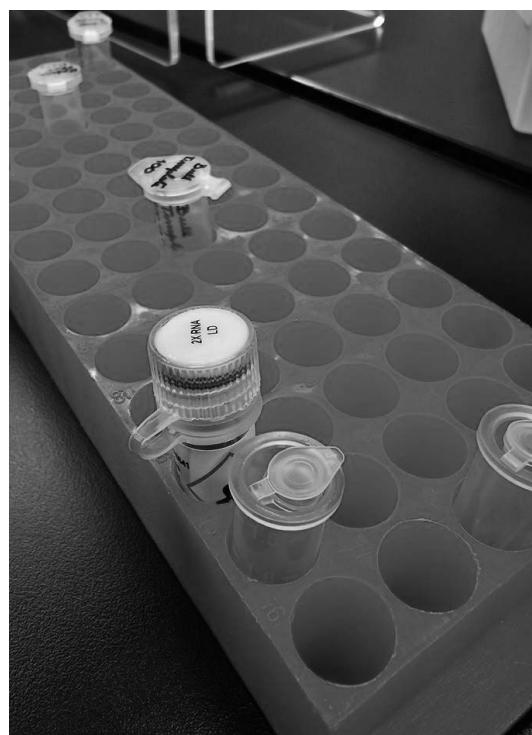


Figure 4: Wet lab-based image editing materials

3. EMBEDDED MEANING

The previous sections describe two methods of image creation that are very recent and novel. In the AI-based method with GANs the actual craft of image creation is automated to an intelligent machine capable of learning (to some extent). In the new development of creating images with the CRISPR-Cas9 system the laborious craft-based work of an artist returns, but this time it is primarily in lab-based skills and strict scientific protocols instead of the creation of, for example, unique hand gestures across a canvas.

There is one major question that concerns both of these image-making methods: how

should we (the audience) view and understand these highly technology-infused images? And also, what is the point of using GANs or CRISPR-Cas9 system for image making?

Concerning art in affiliation with AI and GANs, one of the major artists pointing criticism towards the use of AI and Machine Learning (ML) methods is Hito Steyerl. Rosemary Lee writes in relation to Hito Steyerl:

It is significant to consider the fact that although algorithmic approaches are able to produce new visual content, they do so by making conjectures from past content. This means that while they have a degree of novelty, it is restricted, effectively, to projecting the future from what has occurred in the past. (Lee, 2020,130)

This obviously references the machine learning function of neural networks, which requires training with existing 'past' images.

Barbara Maria Stafford has written about the use and significance of images at the intersection of art, science, philosophy and technology. She writes that the early modern publishing industry enabled the fusion of images that were not normally found together.

In design terms, it added value to existing, deliberately devised structures and new forms which, in turn, it helped to standardize. Ultimately, it launched new and vexing patterns into the intellectual environment that had to be rethought by the viewer and thus contributed to the remaking of the self. (Stafford, 2007, 60-61)

Types of art-based images such as GANs require the audience to learn to understand the creation process. This may be true today, as the techniques are fairly new, but there is a good chance that GANs will be standardised in the future and become just one image creation possibility alongside traditional ones. Today's GAN aesthetics quite often follow the traditions of pictorial painting or photography and the generated results are somewhat recognisable as such. This is due to the fact that the training materials are existing images (which may be selected by the artist), and in this sense GANs will always make reference to existing (or past) aesthetics. However, it is much harder for us (humans) to recognise non-representational images as being machine generated, with the network trained with existing abstract images (Elgammal et al., 2017).

However, I believe that the largest challenges and highest controversy with GANs will be in the areas of representational images which

reference concepts beyond the making of images, such as the creation of new (digital) species, as already mentioned in this article. This is one factor in today's world that blurs the traditional understanding of the concepts of the artificial and 'real' (Beloff, 2017). An example of the blurring between the artificial and biological is artist Maija Tammi's photo-series *One of Them Is a Human* (2017), which presents photographs of three human-looking robots and possibly one human.⁸

4. CONCLUSION

CRISPR-Cas9 is a newly experimented method for the creation of images that is undoubtedly a fairly expensive and laborious lab-based method with somewhat uncertain results. One could claim that this method is addressing not only the human eye but perception as a whole in the age of a technologically expanded and modified world. It is obvious, as already mentioned previously, that some of the benefits of this method lie in the educational aspects of understanding CRISPR genome editing without being a scientist. But the technique also reinforces the idea of how we (humans) can modify, edit and design anything living and biological. At the same time as a new understanding of images and their creation processes happens at the intersection of material, cultural and biological cognition, these produced images also reference the new possibilities of biotechnology.

One could state that code and digital data appear to be the basis of today's world. Artists actively, and often critically, follow societal trends and changes and experiment with the possibilities of science and technology advancements. These above-described methods (GANs and CRISPR) that have been adopted into art from the fields of science and technology are examples of how art reflects the surrounding world and also challenges audiences with new perceptions.

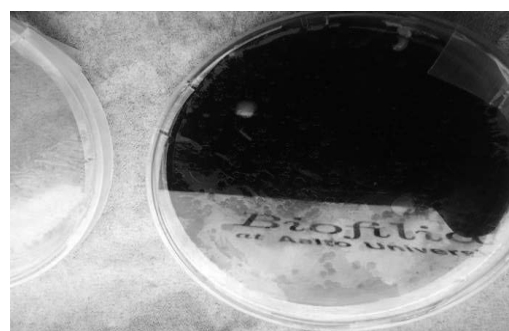


Figure 5: Biological Arts; Biofilia Lab, Aalto University

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⁵ <http://www.polycinease.com/return-to-dilmun/> (29 August 2021).

⁶ <https://www.ekac.org/geninfo.html> (29 August 2021).

⁷ <https://hybrid.i3s.up.pt> The lead of the Hybrid Lab Network project with scientific expertise is the Portuguese biotechnology institute i3s. The artistic experimentation and academic participation are provided by Aalto University in Finland, citizen science approaches with a strong public connection is represented by the Waag Society from the Netherlands and the academic humanistic contribution is provided by the Slovenian Alma Mater Europaea University.

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Simulacral Technologies and The Threefold Identity Crisis: can deepfakes effectuate a society-wide increase of imposter syndrome and feelings of inadequacy?

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Two pathologies strongly implicated with the problematic ontological status of identity are imposter syndrome and feelings of inadequacy. We will critically examine the quickly rising technology of deepfakes in relation to these two pathologies. Deepfakes may have the potential to increase the occurrences of both imposter syndrome and feelings of inadequacy due to the intimate relationship that they attain with an individual's identity. In order to make our argument, a parallel will be drawn between the technology of deepfakes and the threefold identity crisis of contemporary Western society. This threefold crisis consists in a perpetual questioning of identity, increasing identity constraint, and a growing pressure to commit to an identity through the ubiquity of simulacra. In turn, the technology of deepfakes may maintain all these three aspects due to the mechanism by which it generates its outputs.

Imposter Syndrome. Feelings of Inadequacy. Identity. Proficiency. Deepfakes. GANs.

1. INTRODUCTION

Two pathologies strongly implicated with the problematic ontological status of identity are imposter syndrome and feelings of inadequacy. We will critically examine the quickly rising technology of deepfakes in relation to these pathologies. Deepfakes may have the potential to increase occurrences of both imposter syndrome and feelings of inadequacy due to the intimate relationship that they attain with an individual's identity. Their use in the emerging field of deepfake therapy might bring this about as a side-effect of their primary goal. In order to make our argument, a parallel will be drawn between the technology of deepfakes and the threefold identity crisis of contemporary Western society, which enables a questioning of self that shows a strong similarity with the feeling of lack that is characteristic of our two pathologies. The technology of deepfakes may maintain all three aspects of that crisis due to the mechanism by which it generates its outputs and its increasing presence within contemporary society.

2. DEEFAKE THERAPY AND IDENTITY

If we are to get to grips with deepfake's investment in the ontology of identity and how this might

become problematic, we are to first get a better grasp of how deepfakes are intended to be used in therapeutic settings. The emerging deepfake therapy is intended to provide new beneficial tools to the psychotherapeutic domain and can roughly be divided into two types. On the one hand a therapeutical deepfake might be used to realistically bring to life an unavailable person, so that a patient can find closure by interacting with the deepfaked version of that person in a healing way. On the other hand – our focus here - a deepfake might be used as the better mirror of a patient to function as an illustrative example to strive towards. Yori Ettema, a Dutch artist and designer, has used deepfakes to create alternative memories for people with phobias. The purpose of this deepfake is to show a potential improved self of the patient, externally manifested in an accurate (moving) image, as an example of what the patient would be like, not affected by their phobia (2021). Stephanie Lepp has proposed a similar application for people suffering from addiction (Lepp, date unknown). Addicts should talk to their future deepfaked selves who have recovered from addiction to aid in the visualisation of such a non-addicted future. Being the mirror of a patient, and at the same time investing this mirror with ideals to be realised in the future makes these deepfakes a question of identity. In current literature, deepfake

doubles are also often referred to as 'digital twins' (Zotov et al. – 2020). Such an application of deepfakes is essentially meant as an improved manifestation technique. It can be seen as a replacement of the patient's own visualising efforts, easing that task. To investigate the relation between deepfakes and identity, we shall first outline identity's contradictory status, the current primary way in which identity is constituted, and the simulacrality of that method.

3. IDENTITY AND THE SELF

The self is an entity comprised of various feelings and mental operations that is somehow centred in the experience of an ego. The identity of that self on the other hand comes always in some linguistic form, and is therefore constituted only via a shared realm of communicable signs, shared by the people of a society. Following Theodor Adorno's negative dialectic, we assert that the two – self on the one hand, and identity as grounded in the concept, on the other - can never be in a state of complete identity. Adorno claims that the two are always in contradiction because the concept denies of any real entity both an excess and a lack. The mechanism which brings about a concept always eliminates something of the specific reality of the thing by including it in a domain of generality, while a generality suggests of a concept that it can never be entirely satisfied by the real – merely specific - entity in question (Adorno, 2014). In this way, the contradiction enables a perpetual questioning effectuated by the excess and lack that are each time excluded from whatever concept might be appealed to for the bringing about of an identity relation. Lack and excess enable the self to, a la Žižek ask each time: "Why am I what you're saying that I am?" (Žižek, date unknown). Surely, I am not the woman, academic, chess-player. At the same time, I am not merely woman, academic, chess-player. The categorical doubt that is the result of this question quickly falls on the side of the self, rather than the concept, once we realise the concealing tendency that the concept has. Concepts easily evoke a form of fetishism - says Adorno, exactly because they freeze Being in their very positivity. He would describe it as follows:

[That there is] this tendency on the part of a reified consciousness to bring all the concepts in the world to a standstill simultaneously and to fetishize them, much as happens with the headlines in advertisements, that this tendency is all the more damaging as its universal prevalence prevents people from becoming properly aware of it. (Adorno, 2014, p4)

Adorno's claim here is both a sociological and historical one. On the basis of the fact that binding uniform categories have been lost, the mind

compensates by literally fetishizing the concepts of its own devising, thereby making absolutes and ideals of everything it creates (2014). Although Adorno merely discusses concepts rather than a broader category of symbols and images, the mechanism for both seems very similar. Such cultural expressions are also engaged in a process of signification, and may also attain a reificatory status. Adorno's claims of both contradiction and reification may thus count not merely for concepts, but also for, icons, logos, images, advertisements. From this pre-ontological condition, we should draw the conclusion that positivities in general, and personal identity specifically is always a *pretended ideal*. By implicating ourselves within a culture that exchanges these positivities – something we are obliged to do in a society which only functions by means of the shared communicable realm - our self can be brought radically, and permanently into question. Simply said, it is never the symbol or image that is wrong but always one's own failure to completely actualise its idealness. The unattainability implied by the pretended ideal forces us into a permanent struggle for identity in relation to which we shall always be found either lacking or excessive, but never identical. The first fold of our threefold identity crisis is a perpetual questioning of the self.

To explain fold two, we must understand that there is a concealing cultural order of pretended ideals which people employ in order to establish an identity, as well as a determined method of employment relating to that order. Moeller and D'Ambrosio call this relation an identity technology (2019). People relate either by trying to directly satisfy those norms and semantics belonging to a given identity with its symbols, or by creating new identity expressions which are still somehow minimally related to the order. Indeed to such an extent that they can receive recognition, for it is only in the minimally shared communicable that recognition for an identity can be achieved and identity can thus be established (Luhmann, 2002). For recognition to obtain it does not suffice to merely satisfy the norms of a collection of symbols or images that together make one or multiple identities such as 'woman', or 'chess-player'. The collection should also be congruent because any cultural order of pretended ideals upholds a certain compatibility or incompatibility between its various symbols and images, stemming from its specific ordering. In this way, it might be established for example that a woman can never be also an academic, due to the way in which these identity markers relate in their significations. In contemporary society, the relation of the self to the order has drastically changed and been destabilised (Moeller and D'Ambrosio , 2019). This has necessitated a new way of relating to it for someone to constitute an identity.

Where in feudal societies, identity was easily determined through social strata which readily provided a one-dimensional identity for the individual to adopt, in contemporary society it is characterised by an endlessly divisible functional differentiation (Luhmann, 2002). Each individual has to create different identities, corresponding to different selves that fulfil various roles within a fast, multi-faceted, and thereby demanding world. For the self to secure a position within it, the display of all its different functionalities becomes a primary and never-ending task (D'Ambrosio & Moeller, 2019).

Moeller and D'Ambrosio identify three identity technologies that have alternated within societies throughout history. Where in feudal society, the identity technology of *sincerity* was important, and in modernity *authenticity* was the main identity technology, our current way of building an identity is called *proficiency*. If Luhmann's historical analysis is correct we must believe that an identity technology of current times is primarily concerned with the quick exhibition of functional identity markers. Proficiency does this by making instantly accessible a stockpile of quickly recognisable identities which can be then adaptively portrayed in different social contexts. Speed is thus of the essence. Proficiency achieves speed by putting the cultural order of pretended ideals under the efficient surveillance of the *general peer*, as D'Ambrosio and Moeller call it (2019). Achieving identity by relating to a general peer is a form of second-order observation. Esposito (2013) describes it as follows:

It is not a case of choosing those [faces] that, to the best of one's judgment, are really the prettiest, nor even those that average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligences to anticipating what average opinion expects the average opinion to be. (as cited in Moeller and D'Ambrosio, 2019, p586).

On the level of second-order observation one asks: what does the general observer, or general peer, think it is right to be under these and these conditions, and then exhibits the established identity norms for it in a summary way. Since the general peer is always some theoretical average, normalcies and commonness become the norm. They have a generalising tendency. Averages and images summarise the identity of a self in the form of a profile. Thereby, the second-order exhibitiv mechanism of proficiency leaves increasingly less room for the self to occupy a non-ideal reality. Using again our previous examples, being either the woman, or the woman and academic in a striving towards congruity is simultaneously constricted when the exhibitiv formula for being a woman becomes assiduously precise, and in its

assiduous precision is more unlikely to be compatible with the exhibitiv formula of the academic. Fold two of our threefold identity crisis is thereby one of increasing identity constraint, realised from a forced compliance to averages, normalcies, and commonness as dictated by second-order observation under the general peer.

Not only does proficiency increase identity constraints, it also signifies certain identity commitments that do not belong to it, since proficiency is a simulacral identity technology. A simulacrum is a copy, but not just any copy. Its appearance is indiscernible from those copies (that are images, symbols) of any 'real' entity which are true to an underlying ontological model. Such a distinction between copies with a model and simulacra without, is about the selection of lineages where some images or symbols are true expressions of their underlying ontological Idea (in a Platonic sense) or ideal, and some are mere pretenders (Deleuze, 1990). Thus true copies have a certain ontological depth, simulacra do not.

We should distinguish profic identities from those that belong either to the identity technologies of sincerity or authenticity, even though profic identities on their surface level may consist in the same imagery as the previous two. Sincerity and authenticity have ontological depth because they demand of the self to commit to an identity by achieving some type of correspondence between the self inside, and the identity outside; they ask the self to make true an underlying commitment that is the ontological fundament of the identity. Profic identities however, are not produced from the membership to an underlying ontology. The identities consist merely in the surface of their profile. The supposed self underneath need not actually internalise whatever identity it exhibits. This becomes problematic because proficiency is not an identity technology over and against the other two. All three technologies alternate and circulate throughout society according to the contextual needs and preferences of a person and situation (Moeller and D'Ambrosio, 2019). This means that the commitment demanded from the previous models is not abolished from society once proficiency attains the upper hand. Rather, because proficiency is the simulacral version of the previous two, individuals still find the demands of the previous two technologies exerting pressure upon them. Therefore, individuals take upon themselves the demands for commitment emanated from their simulacral versions. The point being that in a highly media- and data-driven world, where a majority of the people is constantly exposed to advertisements, social media, television, and data, the exposure to these simulacra has drastically increased. This in turn increases the exposure to the commitment demands of identity. At the same

time, the demands emanated are not merely unattainable through ubiquity, they are frauds in which no one actually participates because the dominant technology of prolificity isn't about commitment at all, it is about surface exhibition. Fold three of the threefold crisis is thus one of unattainable identity demands through an increasing exposure to simulacra.

In summary, contemporary individuals are thrown into a threefold identity crisis stemming from both the pre-ontological condition of identity, and the current identity technology that relates to a cultural order of pretended ideals in a specific way. Now that we better understand the condition of identity in contemporary society, we may get a better understanding of our two pathologies under investigation.

4. IMPOSTER SYNDROME AND FEELINGS OF INADEQUACY

Two key features of imposter syndrome and feelings of inadequacy relate to our crisis: on the one hand, to those suffering from either, the 'real' self is permanently lacking in its attempt to satisfy a pretended ideal, on the other hand, the self as already, priorly defined by some key identity markers (such as race, gender, class) is a mismatch or incongruence with that identity strived towards (Simmons, 2016). This means first of all that the self can never be *thé* woman, academic, chess-player, and second of all that the self, for example - in already being a woman - could never also be a highly performing academic because the two cannot be recognised simultaneously by the standing cultural order. The two are distinguished by the fact that feelings of inadequacy are purely the feeling of lack *vis-à-vis* a pretended ideal, while the imposter syndrome adds to this the allegation of being an imposter, always on the verge of being found out.

Whether feelings of imposter syndrome or inadequacy obtain is dependent on a precarious balancing act of proximity and distance to an ideal. Clance and Imes' definition of imposter syndrome even necessitates that the self-proclaimed imposter is actually very close to a certain identity ideal on the basis of available objective achievement measurements (1978). Feelings of inadequacy may be seen as imposter syndrome's antecedent, characterised as an obsessive focus on one's imperfections (Bravata et al., 2019). The basis of both is thus founded in a striving towards absolute identification with a certain identity ideal. A likely explanation of the additional allegation of being an imposter is a lack of confirmation of the internalised inadequacy by the relevant social context. When the imposter maintains access to a social domain

of which they themselves do not feel deserving, the only reason can be luck, or a talent for deceit. The fact that proximity is such an essential factor is of high importance to our argument as it confirms that any identity, even if backed up by supposedly objective achievement markers, can always be put into question by the ideal. When it remains unquestioned, the lack is allocated to the side of the self. All elements of the threefold crisis seem likely to effectuate a society-wide increase of imposter syndrome or feelings of inadequacy, when we understand them as pathologies that cannot deal with a lacking self. The perpetuity of questioning that sustains the lack is an unavoidable characteristic of both, enabled by the concealing pretension of ideals. Identity constraint, effectuated by the second-order exhibitiv mechanisms of prolificity, leaves increasingly less room for the self to occupy a non-ideal reality and therefore increases the prospect for an individual to be lacking in the realisation of an identity. Furthermore, an increasing demand to commit coming from the ubiquity of simulacra, increases occurrences where individuals are confronted with their lack.

5. SIMULACRAL TECHNOLOGIES

Two examples: first, neural photo-editing apps (for reference, see Perarnau et al. (2016) and Brock et al. (2017)) and deepfakes are computational systems exchanging signifiers or pretended ideals. Second, they are *ectypes*. Third, they are simulacral in their production of mere surface.

Regarding the first, the images of deepfake technology and neural photo-editing are generated by GANs, or generative adversarial networks. These AI computational systems necessarily operate within the realm of pretended ideals, since their outputs can only be generated through the computational exchange of signifiers that are exhaustive in their equations with each other (Zhang et al., 2021). However trivial this statement may seem, it strikes to the core of our first aspect of the threefold identity crisis: GANs – when directed at the identity of a self - enable the perpetual questioning of that self through their generation of pretended ideals in imagery. Once the shaping of an identity becomes delegated to the external manifestations that are these images, the excess and lack of the self are easily concealed. Whatever it may be – picture or video – they engage in a decoupling of the self from the mental in their externalisation. This is already the case with, for example, Ettema's anti-phobia deepfakes where the patient sees, as realistically as possible, themselves not being affected by their phobia, and is confronted with a pretended identity ideal. We start using deepfakes to depict identity

potentials. This is also where constraint through second-order observation starts to occur and it brings us to the second point of ectypicality.

If the GAN is to produce a deepfaked identity potential, it must draw from a reserve (that is its dataset) which is then driven towards a generalised model. This is because the very learning process of GANs functions only in this way. They are built on a formalizing statistical tradition (Zhang et al., 2021). As Zhang et al. put it, GANs find *"rules consistent with available data that apply to instances we have yet to encounter"* (2021, p107), reasoning from the past to the future. Floridi calls such a method of generation ectypical:

The word ["ectype"] comes from Greek and it has a subtle meaning that is quite useful here: an ectype is a copy, yet not any copy, but rather a copy that has a special relation with its source (the origin of its creation), the archetype. (2018, p319)

The archetype is distilled from finding the commonality of the different traits involved (2018) in the make-up of an image, much as what happens when the order of pretended ideals is put under the surveillance of the general peer. The potential identity traits inserted into the deepfake attain a generalised form that is extracted from the available data. The deepfake should be seen therefore as a prolific identity technology, of which we must be reminded that its primary function is the exhibition of functional assets. In a therapeutic setting, the desired functional assets will most likely be of a (mental) health nature. Therefore, the generation of identity potentials by deepfakes start finding themselves under the constraints of the normalcies that follow from second-order observation. It is the GANs themselves which ask *"what average opinion expects the average opinion to be"* (Esposito 2013, p4). The second aspect of the threefold crisis: identity constraint, can be perpetuated by deepfake technologies in a therapeutic setting and may thus effectuate a society-wide increase of imposter syndrome and feelings of inadequacy.

Regarding the third fold of our crisis, deepfakes are generated from computational models drawing from a reserve of ideals. Although they may accurately portray the identities belonging to that order in their external manifestation, they remain pure surface, and rely upon a prolific identity technology primed on the exhibition of functional assets to generate their images. A person being confronted with a deepfake is simultaneously confronted with these demands to exhibit functionality. Seeing that simulacra are by now ubiquitous, one feels oneself become the simulacrum when commitment is never enough and seems like the mere pretension of the 'true' commitment that is necessitated by the

unattainable pretended ideal. Enter deepfakes. They are seen in a different light in therapeutical and non-therapeutical settings alike once we understand the commitment that they demand. They are responsibilityors who request of the self an unrelenting exhibition of their functional assets.

In order to make our hypothesis probable we cannot argue from the one therapeutical or non-therapeutical deepfake in isolation. Rather, it is in an institutionalised form that these simulacral technologies may start posing dangers. Any individual is already implicated in a plethora of environments that each confront them with simulacral pretended ideals. The core of the probability of our hypothesis is in the fact that they are engaged with on multiple daily occurrences, and to a large extent even necessary to engage with by virtue of the societal structure. If deepfakes start to become this additional simulacral entity, added to environments already saturated with media and doubles, the instantiations of identity demands may only increase further. In such a way, feelings of imposterism and inadequacy may be gaining more ground in the future. As to date, little to no empirical research on this hypothesis has been done. However, Wu et al. (2021) have already proven that young Asian women who use the ZAO app to deepfake versions of themselves combined with the facial features of celebrities are prone to depreciate their self-conception. This suggests that feelings of inadequacy may occur when deepfakes are used to conceive of potential, more ideal selves.

6. CONCLUSION

We have characterised the pre-ontological condition of identity, alongside the currently prevailing identity technology of prolificity. This has led us towards the determination of a threefold crisis of the Western, contemporary individual: its identity is under perpetual question, it suffers from increasing constraint through the surveillance of the general peer, and a simulacral element may force it to commit to unattainables due to its societal ubiquity. Via this triple condition we defined imposter syndrome and feelings of inadequacy as pathologies that obtain through an impossibility to deal with the lacking side of reality *vis-à-vis* the standing order of pretended ideals. By drawing a parallel between our crisis and the mechanism necessary for the generation of deepfakes, we have argued that deepfakes have the potential to effectuate a society-wide increase of imposter syndrome and feelings of inadequacy.

If we want to prevent such a situation, fundamentally, the question becomes how to capitalise on excess and lack. A people that wants to be freed from the affective flows of imposter

syndrome and feelings of inadequacy should proceed by un-concealing. Adorno would see this done through concrete criticism (Adorno, 1997). Excess and lack may remain to allow people to occupy a non-ideal realm, not in the questioning of either 'x' or 'y', but rather in the '=' that connects them. They empower the self against the power that it is enveloped in by freeing it from unattainable identity commitments and situating it in an emergent field of power.

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ROGUE RESEARCH

Art perspectives on coevolution and biodiversity, the hybrid microbial-AI organisms of Codex Virtualis Genesis

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Codex Virtualis is an art-science research framework oriented towards the synthesis and evolution of an open-ended taxonomic collection of speculative forms of life. An aesthetic journey through an algorithmic ecosystem which seeks to enhance our understanding of the genetic, metabolic and behavioral processes present in microbial life. This paper discusses how the theoretical and algorithmic artifacts in Codex Virtualis unfold in continuous interplay with each other, rendering a scientific inquiry into the conditions for the possibility of life.

ALife. Bioart. AI. Machine vision. Microorganism. Contemporary art. GAN.

1. INTRODUCTION

Codex Virtualis is artistic practice as research stretching conventional definitions of life, experimenting with a semantic coupling of algorithms that is comparable to the mechanisms of life of microorganisms, progressively fitting novel delimitations of life. The project belongs to a cultural and artistic history of automata, humanity's age-old quest for mechanical life, and its contemporary renditions in the field of soft artificial life (ALife) as computational simulations. It also focuses on values of collaboration and exchange in the quest for diversity and survival both in algorithms as in microbial life. The project of Codex Virtualis is designed to be delivered in four phases. It begins with the phase described in this paper: Codex Virtualis_Genesis, consisting of the origin, initial classification, and multidimensional representation of these entities. The project will continue with Codex Virtualis_Habitat, establishing a relationship with a meta-environment by exposure to simulated inputs. Later, in Codex Virtualis_Emergence, inter-domain activity will be ensued by coupling in real-

time growth of living microorganisms and its evolving morphology landscapes together with AI machine learning algorithms.

In the last stage, the resilience of one of these organisms will finally be tested to be seen living virtually in Codex Virtualis_Life. This multi-phase, long-scope research strategy is a distinctive feature of previous projects of Interspecifics.

Codex Virtualis is an art-science research framework oriented towards the synthesis and evolution of an open-ended taxonomic collection of new-to-nature life forms. An aesthetic journey through an algorithmic ecosystem. The work is conceived in the form of a codex: ancestral cosmogonies of animism and catalogues of the existing and the possible as in the "Monstrorum Historia" of Ulisse Aldrovandi (1642), the "Art Forms in Nature" by Ernst Haeckel (1899) and Luigi's Serafini's "Codex Seraphinianus" (1981).



Figure 1: *Codex Virtualis Genesis* as displayed at GROUND Solyanka gallery in Moscow, Russia 2022

1.1 The Codex Virtualis Genesis Installation

The first iteration of Codex Virtualis, subtitled *Genesis*, was presented at the 2021 Ars Electronica festival in Linz, the Chronus Center in Shanghai and the GROUND Solyanka gallery in Moscow (shown in Figure 1) as an audio-visual installation featuring the live interaction and display of the elements in section 4.3.

The audio-visual installation consists of a triptych and, starting from the right, the first panel of the triptych shows the Class-B Cycles Taxonomic Navigation where a taxonomy of generated organisms, in their most simple form, is represented within a three-dimensional space. In this first screen, the AI navigates and chooses one organism which then stays in focus. From this choice, the central screen starts to display the phylogeny of the selected organism in a Class-A Cycles Grid. This second panel reveals plenty of the essential elements in Codex Virtualis Genesis going from the GAN synthesis of biological and artificial forms of life to the evolutionary dynamics of our Class-A Cycle taxonomy. The third panel displays the three-dimensional rendering of the microbial organism selected before which includes an artificially generated original taxonomic name that refers to its ancestry and segments of its own synthetic genome. For the observer, newforms of life keep emerging one by one in the taxonomy, from their specific ancestry, and as a display of a novel algorithmic micro biodiversity. All of this is wrapped by the generative bioacoustic soundscape manifesting the flows of information in our algorithmic ecosystem in closure.

This article has two parts, one on life and AI, and a second on the process of production of the work and how its processes are comparable to those of biological life. The first part will deal with the

narratives of life present in Codex Virtualis Genesis. The second part is a more technical exposure of the process of Codex Virtualis Genesis, which steps are comparable to biological functions, signifying through representational strategies and, eventually, becoming particular forms of life. Both the first part about life and the second on the use of AI as a creative media will converge in the discussion, where the political and interpretative choices to privilege exchange and collaboration will be elaborated upon.

2. ARTIFICIAL INTELLIGENCE AND FORMS OF LIFE

At the core of this codex lies the conceptual role of life in the commons as an existential concern that should not be limited to a survey of its realized states or what is known, but rather unfold an active engagement with its possible realizabilities. We find that usual definitions of life grounded on thermodynamics, metabolism, evolution and self-organized complexity all fail to achieve the conceptual task in particular ways. In fact, definitional approaches to explicating life are unlikely to be scientifically fruitful precisely because operational definitions cannot provide compelling answers to 'what is' questions about natural categories (Cleland, 2019). So this work seeks to challenge definitions of life by framing the dynamics and processes that emerge in Codex Virtualis' algorithmic ecosystem.

The processes that are researched and integrated into generative mechanisms within Codex Virtualis Genesis embody characteristic elements to more than one of the contending definitions of life in biology. The design and assembly of our system's semantic layers pushes forward valuable insights

into the fundamental intertwining of definitions that convey evolution and self-organized complexity. A combination of Darwinian evolution and Lynn Margulis' symbiogenesis is represented by mechanisms which perform continuity over a historical lineage, genetic variation, horizontal transfer and natural selection; self-organized complexity is represented both, in the integration of cellular automata—which has been characterised as producing autopoietic behaviour in the ALife literature (Beer, 2015) – into the genetic pool of biological organisms, and is also represented by the meticulous, yet loose, coupling of random generative processes with the capability to produce a perceptively infinite amount of variation. This is an exemplar activity of the codex (perhaps encyclopaedic) nature of this scientific and artistic research program, one that promotes new ways of thinking about the possibilities of life at the intersection of microbiology, astrobiology and soft artificial life –the branch of artificial life that studies replication of the abstract, functional, underlying processes to life in computational terms.

Codex Virtualis is rooted in a field of analogies that symbolically compares levels of genetic expression with probabilistic data distributions, and transfer learning with horizontal gene transfer to materialize a generative morphogenesis source in a virtual environment. The two main inputs fed into and orchestrated by our artificial generative system are microscopy and cellular automata images. A dynamic feature transfer between biotic Naro, Agua and model organism datasets along with a dataset consisting of continuous cellular automata solitons simulated using Bert Chan's Lenia (Chan, 2018). In this sense, within the core of this project lies the exploration of life and life-simulation morphological interplay. A space from which a biosphere emerges within the technosphere.

The symbiotic narrative of evolution is for Codex Virtualis a conceptual ground to speculate on different levels of fusion and metamorphosis. In the first level, a selection of resilient model organisms: *Chroococcidiopsis*, *Deinococcus radiodurans*, *Bacillus subtilis*, and *Xanthoria Elegans*, constitute the initial line of kinship from which a series of morphological symbioses will take place. The cooperative nature of an algorithmic ecosystem in the second level and the human-machine intentionality enactment is the third level of symbiotic relationships embedded in this project.

As an art-science artistic research framework, Codex Virtualis is an ideal platform that, when rested on the intersection of science fiction and documentary art, promotes valuable challenges to the referenced scientific theories. When it comes to the field of Artificial Intelligence (AI), the integration of neural networks, computer vision mechanisms and traditional machine learning algorithms into a

semantic coupling that seeks to represent symbiotic relationships proposes an animist conception which antagonizes the widespread mechanistic conception of AI that imitates –and somehow preserves– the alienated mechanization of human labour in capitalist society. This animist conception considers that, through a repositioning of distributed agency and of subjectivity, we can picture

“AI as freed from an assumed intelligence based on a human measure as well as seeing machine intelligence as an agentic entity of another order, capable of a subjectivity other than that of humans. [...] AI is envisioned by [the Interspecifics collective] artists to explore a cosmopolitically conscious ecology and the posthuman prospects of symbiosis and of collective commons.” (Zhang, 2021)

3. NARRATIVES OF ARTIFICIAL LIFE

If popular culture represents extra-terrestrial life as anthropomorphic, with bipeds with different mutations, a more realistic expectation of life in space is microbial, taking into consideration for example abundance, distribution and diversity of microbial organisms on Earth, as well the probability of occurrence of a form of chemical organization. Codex Virtualis portrays life in space as microbial life, in close proximity and exchange of the characteristics necessary for survival. Microorganisms are the minimal expression of life, the minimal requirements to what we consider living and hence the best model organism to start experimenting with the borders of what it means to be alive.

The project joins a cultural and artistic contemporary praxis inquiring around the concept of life through codex that recount ancestral cosmogonies, mechanical representations, computational simulations, and mechanisms of life. Building an epistemic bridge between microbiological knowledge and the artificial intelligence connectivism approach, Codex Virtualis imagines ways of living together by transforming our perception of microorganisms from pathogens and utilitarian items into subjects, as inspiration for change as models of forms of living, of deep interspecific relations that may enhance our possibilities of survival.

3.1. Artificial Life as a Field and its Archaeology in Automata

To better understand the quest for (re)producing life, one must visit the stories and visual representations of "artificial creatures". The project joins a tradition of cultural and artistic projects inquiring into the conceptual apparatuses of life and its genealogies. This tradition of mechanical representations and emulations of life through the

centuries has been recounted for many authors such as Wood (2002), and Cave and Dihal (2018) that present numerous examples of attempts that confirm a long and constant desire to generate living beings. Probably intertwined with the creation of these automata is the question of whether by imitating life we can improve our understanding of what it is that gives life to the living (we can for instance think about Descartes' clock analogy). As early as 1951, von Neumann's interest in understanding some fundamental properties of living things, and in particular their capacity for self-replication, led him to devise the concept of the cellular automaton, considered the first formal model of soft artificial life. In resonance with this research, cybernetics also became interested in describing certain phenomena in terms of their behaviour rather than their substrate, so that certain principles could be generalized to both animals and machines. Thus Langton, father of AI and creator of self-replicating loops, suggested that life should be studied as a property of form rather than of matter (Langton, 1989).

Codex Virtualis lies within this broad history of synthesis of life, an essence that is often left behind all the techno-scientific haze for it conveys a more mystical than a strictly rational epistemology. Codex Virtualis remains a compendium of strokes, liquids and forms laid out so that someone in their own way, like the Nahuatl poet of verse, can interpret it:

I sing the paintings in the book,
I unfold them,
I am like a flowery papagay,
I make the codices speak,
inside the house of paintings
(Manuscrito de Cantares Mexicanos, 1904)

Thus, Codex Virtualis is an artificial life artistic research project that seeks to achieve a better understanding of the genetic, metabolic and behavioural processes of life by means of carefully

articulating a display of scientific theories represented by a multi-layered ecosystem of interconnected, collaborative computer simulation strategies. As such, it is concerned with a bottom-up scientific study of the fundamental principles of life that honours computer scientist Chris Langton's quote "Artificial life can contribute to theoretical biology by locating life-as-we-know-it within the larger picture of life-as-it-could-be" (Langton, 1989).

4. BUILDING AN ALGORITHMIC ECOSYSTEM

For the first iteration of Codex Virtualis, subtitled *Genesis*, the technical processes are conceptualized into three main layers

- 1) synthesis of biological and artificial forms of life,
- 2) exploration and operation of the synthesis layer
- 3) assemble a display of outputs produced in layers 1) and 2).

The limiting boundaries among these layers blur as we approach their coupling and interaction—which are devised to perform.

4.1. Life-Form Synthesis

One of the fundamental processes adopted is the training of StyleGAN2 generative adversarial networks. Two different training processes are performed in this conceptual layer which are: training a network starting *from scratch* (on one of the image databases) and training a network starting *from a previously trained checkpoint*—or transfer learning. These two are procedurally equivalent but manifest distinct representational characteristics.

In artificial genetic modelling, symbiotic evolution is often described by genetic fusion operators within a genotype representation level. In our GAN architectures specifically, coevolution is

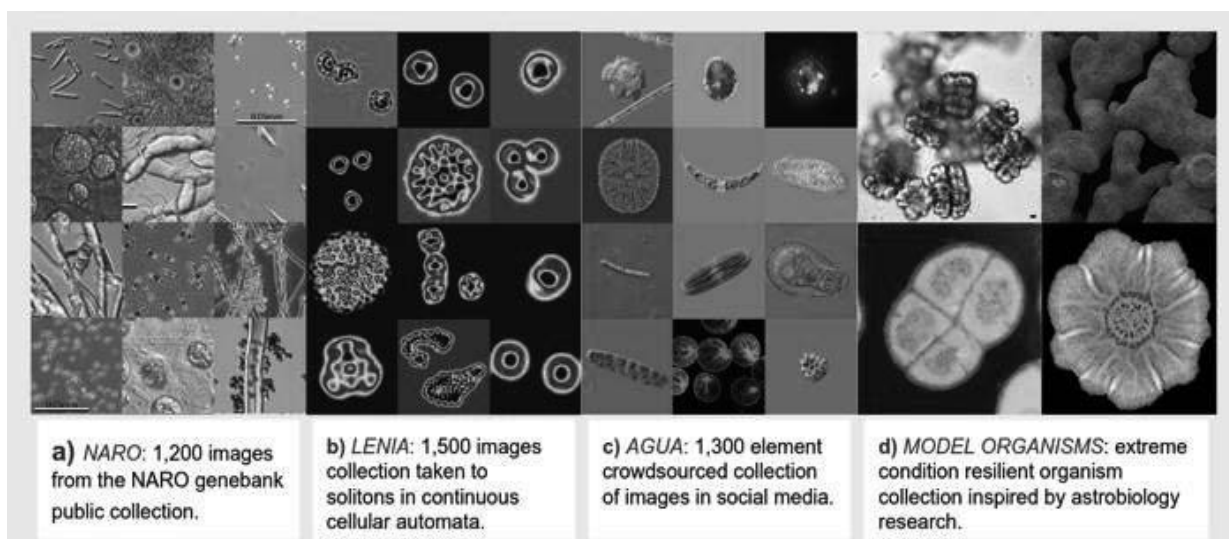


Figure 2: Image databases used to train our StyleGAN2 networks.

implemented via the GAN's discriminator versus generator game-theoretical interplay through which –at a phenotype level– information exchange, imitation and deception constitute a primordial set of inner interactions that lead to a divergent, continuously evolving, representation of visual forms. Based on visual properties of the organisms, this approach invites to think of life beyond a gene-centric vision, in which the environmental specificities and other epigenetic factors contribute to the actual biological reality, but also in which not only the chemical composition, but the three-dimensional structure of the elements is part of the identity, such as in the case of the way proteins are folded in specific 3D structures.

For the specific case of the transfer learning process, two qualitatively different datasets merge using domain adaptation strategies in machine learning, leading to the emergence of novel visual features. Such a bimodal synthesis strategy allows us to explicitly represent information transfer between domains, analogous to the horizontal gene transfer mechanisms in biology. The latter being an increasingly acknowledged relevant source of evolutionary novelty due to genome acquisition, mutualistic interactions, and synergy between organisms.

4.2 Exploration and Procedural Synthesis Operators

To extend the generative possibilities of our trained GANs, in this layer we are concerned with the manipulation, exploration and control of image

generating procedures. Unsupervised representation and autonomous exploration are conformed by the integration of computer vision, statistical dimensionality reduction and machine learning algorithms. The result is an *in silico* evolutionary architecture that explores different algorithmic recipes under which the biological concepts of variation, heredity, fusion, and cooperation can aesthetically manifest themselves and lead to de novo hybrid morphological profiles.

Latent space exploration and disentanglement becomes a crucial step to enact the synthesized morphological features in the first layer. The various GAN neural networks resulting from the previous layer are conceptually inherited in this layer by the functional role of GAN's generator γ which, given an input vector in the latent space of dimension d (with $d=512$ in our case), produces an RGB tensor (of dimension $512 \times 512 \times 3$) that is a 512×512 pixel image. Taking the *latent space as a genetic encoding* that maps into various phenotype expressions through γ projects the analogy that changes in the gene pool of a population (genotype expression) produce a continuous stream of novel organisms (phenotype expression). In this step, an exploration of vectorial properties—such as relative position, direction and magnitude—of the latent space through γ is meant to identify and represent relationships between image attributes and the latent space region that generates them. This allows us to first, get a grasp of the variety of forms represented in the latent space and second, to assemble mechanisms that take autonomous

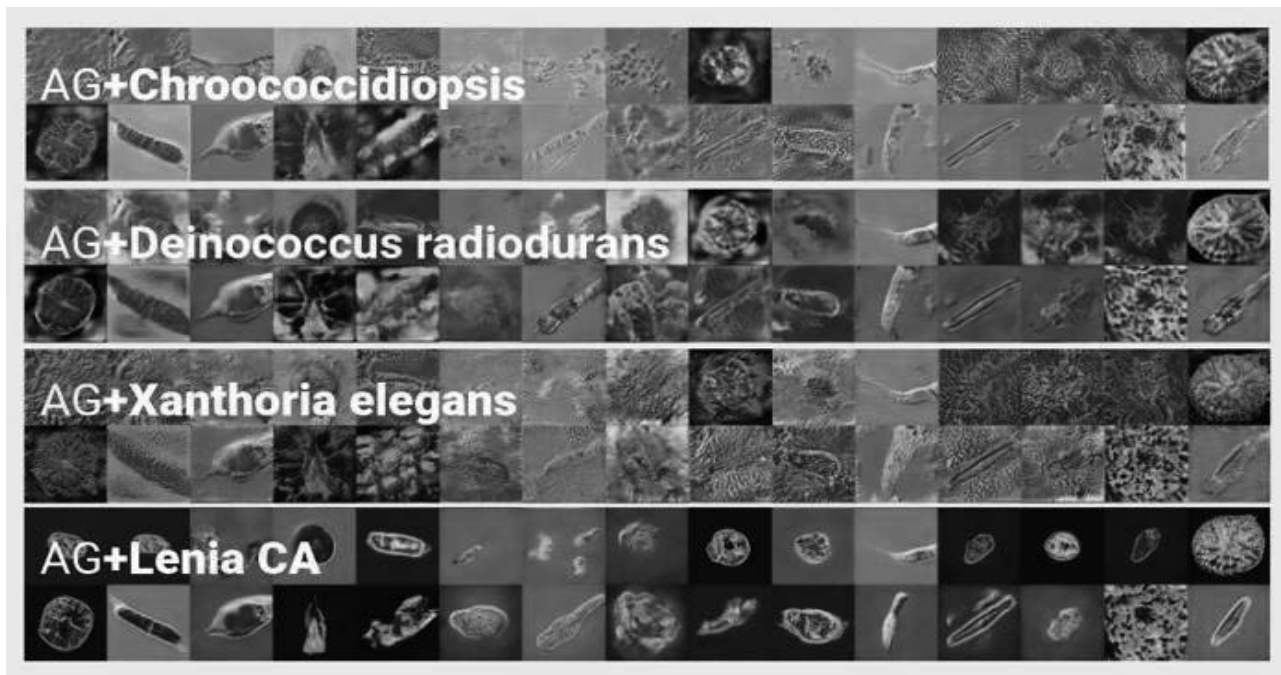


Figure 3: Images generated on four GANs which were trained on samples for model organisms *Chroococidiopsis*, *Deinococcus Radiodurans*, *Xanthoria Elegans* and cellular automata solitons after being trained for a fixed amount of epochs on the AGUA dataset

control of the generation of images into artificial forms of life.

4.2.1. Augmenting representation

To better understand the morphological features that are represented within our GAN's latent space we define a set of positive integers seeds $S = \{s_1, \dots, s_n\}$, then for each seed we generate a latent vector w_n using a random number generator G set with seed s_n , next we produce the image $\gamma(w_n) = i_n$ and encode this image through an encoding function E as $E(i_n) = e_n$. For an encoding function E , we use the VGG16 neural network which is pre-trained on image classification in the imagenet dataset. By excluding the last two layers which perform a multi class probabilistic assignment the resulting encoding is a vector of dimension 4006 which summarizes visual features of i_n captured by an architecture of convolutional and pooling layers. Finally, e_n is reduced in dimensionality through a statistical dimension reduction algorithm $R_a(e_n) = r_n$ where R_a is the spectral value decomposition and R_b is the principal component analysis.

4.2.2. Taxonomic classification of the latent space

A taxonomic classification of the latent space is done by training either a k-means (with k estimated through silhouette score maximization) or an Agglomerative Clustering algorithm. Each clustering algorithm assigns each image i_n family a taxon id or label t_m (m is one of the possible clusters for a given model which vary for every GAN), where organisms in the same taxon share visual characteristics such as shape, contour, color, and texture. Through the combination of latent vectors and t_m , we come to formulate a map of regions in the latent space where configurations of similar visual features are

maintained through γ . The resulting taxonomy serves a twofold purpose first, it allows us to get a grasp of the diversity of forms that are both synthesized and emerge from interpolation of our GANs' learning to represent and generate the training image instances; second, it induces an augmented representation of morphological features that other algorithmic processes can integrate into generative procedures.

4.2.3. Operating synthesis through augmented representation

Here we propose two distinct mechanisms to generate video clips of trajectories in the latent space—that we call cycles—which take as input the set of 2-tuples that consist of latent vectors and their assigned cluster or taxon. A cycle refers to a video where a newly generated organism shows an organized, uniform, and continuous behaviour.

4.2.4. Class-A cycles

Class-A cycle sequences of images are produced by following the trajectory of a given set of points in the latent space, interpolating the intermediate ones, and inferring a frame for each of them. Class-A cycles are generated automatically by selecting an ordered cluster tuple of some specified length l —which represents a family—, then sampling a vector within each individual cluster's convex hull and tracing the trajectory between them. This generative procedure can autonomously generate a practically infinite number of distinct cycles for a fixed family—with the number of distinct families being the number of permutations of length l . The set of cycles for a given family is taken to encode some sort of shared ancestry while, at the same time, expressing peculiar forms of adaptive variation.

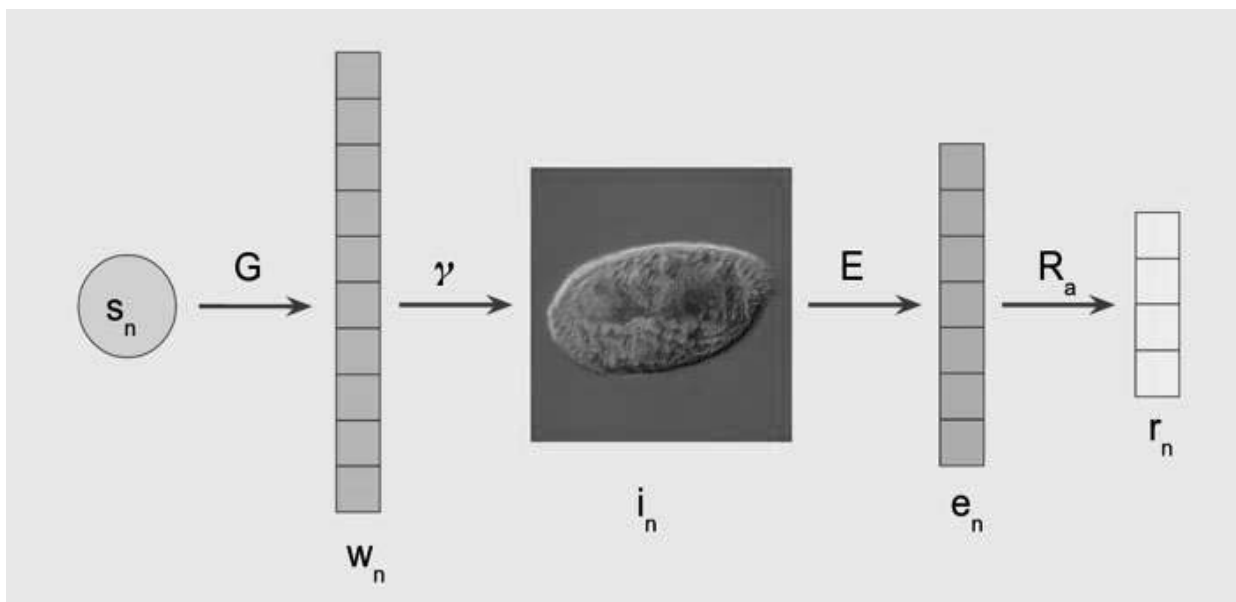


Figure 4: Diagram representing the distinct objects and compositional structure of representation for a single organism image I_n

4.2.5. Class-B cycles

This class of cycles is generated through a human-machine collaborative algorithm in which we take the input tuples consisting of latent vector and assigned cluster through a user interface that allows a human operator to visualize and navigate through regions of the latent space and the visual features these generate—through γ . After visualizing vectors in the latent space, the human operator manually selects groups of vectors to visit through in a latent walk to generate class-B cycles. The purpose of this manual choice is to find the most suitable individuals that will constitute our genetic pool to form a new generation. Selecting for organized, uniform and continuous behaviour, the manual selection criterion acts as a fitness function, allowing to merge features of organisms and targeted mutations.

4.2.6. Machine perception and artificial selection as an evolutionary framework

With the aim of including an evolutionary framework within the project, we make use of certain ideas and attributes from artificial selection and directed evolution studies in biology. In that sense, once we have an origin, representation and classification of our set of hybrid organisms that come out from our system, we add upon it a layer that enables the system to be fully generative and allows a re-enactment of some evolutionary features which in our case are fulfilled by an evolutionary algorithmic architecture.

Two of the main properties that a system must possess in order to direct an artificial selection upon it are: first, a trait variation within a collection of organisms and second, that those traits can be passed and inherited to the offspring generations (Sánchez et al., 2021). As means to extract a quantifiable metric from a particular trait of interest, we make use of a collection of computer vision algorithms, which depending on our scope could encompass colour histograms, segmentation, skeletonization and edge detection amongst others (Van der Walt et al., 2014). Once a specific metric has been extracted from our set of organisms, we can generate a ranking, so the ones that have a superior index value are the ones that are selected and feedbacked into the GAN architecture, therefore this one can be retrained in the next iteration.

This evolutionary algorithmic architecture serves as a metaheuristic optimization algorithm that tackles some biological features such as reproduction, mutation, recombination and selection. The first one is accomplished within the GAN architecture in the interplay of the generator and discriminator neural network systems, which continuously generate novel organisms. Mutation concept can be represented in our system by the generator network, which adds noise to the training set of images creating data distributions that differ slightly from the original ones. Recombination manifests

itself within the cross-domain dataset fed into the system along different time stamps during the GAN training process. Finally, selection is accomplished by means of the visual feature extraction and metric ranking during the computer vision perceptive stage as explained before.

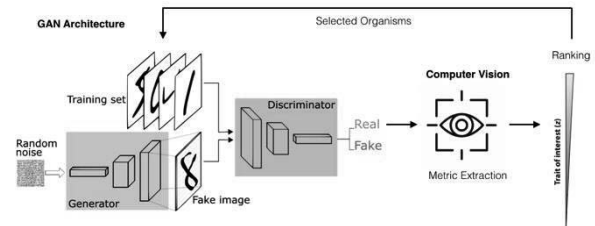


Figure 5: Diagram of computer vision process.

To sum it all up, as we can see in the diagram above, the overall perceptive layer can be used in order to put evolution into play within our artificial system. The directed selection of a specific morphological feature allows us to explore and to lay down in an explicit manner what can be conceptualized as a fitness landscape, which is configured along the different iterations of the system in analogy to the evolutionary timescales in biological evolution.

4.3 Assembly of Display

4.3.1. Rendering three-dimensional bodies

Seeking to transcend the two-dimensional space of the StyleGAN2 output in a way that will open the possibilities for organism models to process environmental inputs to control the shape of its body, we modelled a three-dimensional outer membrane or 'soft shield'. This is done by drawing points in a 3D environment using videos as procedural textures. The process consists of taking the x/y position of a pixel, drawing two equidistant points to the base plane in opposite directions, and using the pixel's RGB colour values as a heightmap of positive and negative values. This process is also projected to an opposite plane that gives the generated body a spherical shape.

4.3.2. Class-A Cycles Grid

An exploration into the expressions of possibility and coevolution in the Class-A Cycle generative process are displayed in the form of a grid. In this grid, iterations through the families of organisms which are continuously evolving in our algorithmic ecosystem are framed in a side-by-side comparison at scale.

4.3.3. Class-B Cycles Taxonomic Navigation

The agglomerative clustering in 2.2 provides a hierarchy of similarity between vectors or regions in the latent space. The taxonomic navigator integrates this hierarchical organization into a 3D visualization. In this navigator, each node is an organism

connected to others in the same group by the proximity of a set of generated images' encoding 'r' (which consist of vectors of dimension 3 in this case) from 2.1.

4.3.4. Synthetic Genome

This process generates a synthetic genome by taking 16s and 18s ribosomal RNA sequences which were collected for the model organisms in the NARO gene bank dataset. It integrates the use of a language model GPT-NEO (Black et. al. 2021) along with heuristics that select segments from the DNA sequences database to generate hybrids between biotic and the generative DNA segments. Language models like GPT-NEO are estimators of the probability distribution of tokens co-occurring in a sequence which learn in a semi-supervised fashion by 'reading' very large corpus of text, so it is the case that the target distribution is the linguistic structure manifested by years of written human interactions on the internet.

4.3.5. Generative soundscape

A bioacoustic print is generated and rendered to signify the multidimensional flow of information which manifests vitality in this computational ecosystem. Scale, position and momentum across the assembly of visual outputs (in the Class-B Cycles taxonomic navigator, Class-A Cycles grid, Three-dimensional Bodies visualizer, and synthetic genome) are engaged in the modulation and control of granular synthesis which leads to a bioacoustic print resembling that of a lively rainforest—through the appropriate reinterpretation in the context of Codex Virtualis' synthesis of the living.

5. DISCUSSION AND FINAL REMARKS

Codex Virtualis is part of the diverse materiality of outputs such as audio-visual installations, workshops, libraries of open-source code and written work that explore cybernetic animism and picture a cosmology in terms of social, technological, aesthetic, and biological machines. In this work, the concept of symbiosis permeates every sphere of a transdisciplinary artistic research program —engaging with the conditions of possibility in forms of life—, and this meets the animist de-centring of subjectivity, one gets a sublime choreography of poietic machines.

In Codex Virtualis, an autonomous algorithmic ecosystem is brought to life through the enactment and embodiment of information processing mechanisms that reflect on those of biological systems. Codex Virtualis can be understood as a readymade of technological and theoretical frameworks that seek to sharpen our perception of the creative function in machine terms, and question conventional definitions of life, experimenting with algorithmic behaviours that progressively become

novel lifeforms in themselves. In the synthesis layer, this is reflected by the encoding of the gene-to-phenotype expression relations as latent-space-to-visual features or the horizontal gene transfer as transfer learning. Next, the integration of neural networks, machine learning, and statistical heuristics within layer 2 encode analogies about the role of exploration in scientific discovery and hints towards human-computer collaboration in the production of knowledge while at the same time representing biological analogies about heredity and adaptation. Finally, through the display of scientific names, 3D bodies, synthetic genome, acoustic bioprint, and the navigation through the wide array of possible forms of life in previous layers, layer 3 orchestrates an immersive foray through the codex.

Both microbiological and artificial intelligence follow a connectivist approach, of collaboration and exchange. Codex Virtualis imagines ways of living together, of deep interspecific relations that may enhance our possibilities of survival. Identities in flux, becoming the other, exchanging genes. Some of the key themes to consider is the animistic view of the algorithm and the materiality of the electronics that sustain it, as part of a dialogue on expanded notions of life. The concept of cooperation amongst organisms instantiated as "becoming by living together" instead of "becoming by competing between with each other's" as the drive of alternative ways that evolution manifests itself.

5.1. Animistic and Expanded Notions of Life

Anselm Franke (2010) argues that the distinction between life and non-life is central to the modern divide. Modern definitions of life are centred on institutional science, life as a biological concept that is never fully defined. A form to resist this dualism of the living and non-living, is animism, a 19th-century concept originally from colonial anthropology to describe the mistake of the "primitive" attribution of life to objects. Nevertheless, there are more recent ways to understand animism as in its indigenous appropriation with the recognition of subjectivities. These more recent interpretations are closer to posthuman, post-anthropocentric philosophies and to the kind of animism that Codex Virtualis embodies.

Detaching from the modern life science restrictive understanding of what can be considered alive, Codex Virtualis_Genesis emphasizes the life-like qualities and the life characteristics of its digital and physical components. For instance, the cellular automata that feed its training, the algorithms, the Neural networks choosing, the electronic matter and energy that materialize these algorithms, and most importantly the organisms emerging from the iterative process. Life, in this case, becomes a performative action rather than a fixed property, and in this form, life is performed by the emerging organisms of Codex Virtualis_Genesis.

The choice for an animistic approach can be interpreted from a contemporary perspective in the new materialist post dualism or as non-western animism in the pre-colonial traditions, for which living and non-living are not opposed possibilities but extremes of a spectrum. Within these perspectives, the elements of Codex Virtualis oscillate at different positions, in which by experiencing and relating to the emerging organisms, these gain subjectivity and livelihood in our encounter.

Besides the subjectivity attributed to the organisms emerging from the algorithms to the algorithms, and to the electronic matter and energy that materialize them, Codex Virtualis also presents an analogy of image synthesis to horizontal gene transfer, and with this parallel, it underscores the idea of cooperation as a drive for evolution displacing competition as the central force. This model to interpret the drive of evolution and biodiversity would require a much more careful consideration than what can be granted in this context, nevertheless, it needs to be said that collaboration, mutualistic symbiosis and symbiogenesis are central to the way Codex Virtualis performs life.

Codex Virtualis experiments with novel conceptualizations of life and of the relationships established among species, looking into the technical processes that are comparable to biological functions by enabling the generation of microbial forms as a way to present the role of exchange and cooperation as a source for survival and biodiversity. The project belongs to a cultural and artistic history of automata, humanity's age-old quest for mechanical life, and its contemporary renditions in the field of soft artificial life (Alife) as computational simulations. It also focuses on values of collaboration and exchange in the quest for diversity and survival both in algorithms as in microbial life. Codex Virtualis imagines ways of living together by transforming our perception of microorganisms from pathogens and utilitarian items into subjects, as inspiration for change as models of forms of living, of deep interspecific relations that may enhance our possibilities of survival.

In the end, this work is an exploration of Algorithmic Life, stretching conventional definitions of life, experimenting with algorithmic behaviours comparable to the mechanisms of life of microorganisms, progressively fitting novel definitions of what it means to be living.

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Existence Beyond Transhumanism – Context-based Research-creation for Critical Art Making

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Already before the pandemic, environmental pollution, societal inequalities and religious struggles were worrying us. The consequences of global market forces and the exponential growth of production and consumption have provoked us to ponder about the flaws in current-day humanity. Artists and researchers are more than ever probing ways and methods to interact with and care of what matters in the realms of our era. Combining the practice of Research-creation with the concept of Critical Making, and applying a systemic perspective, can help to develop encouraging ideas and alternatives for the near future. To illustrate the model of the artist as a mediator for structural change, the creation of a feature clip 'Existence Beyond Transhumanism', inspired by the ongoing discussion on Transhumanism serves as case study for explaining the approach. Whereas the debate around Transhumanism mainly focuses on body enhancement and lifespan extension through technology, the artistic intervention creates meaningful ideas for stimulating multiple new connections between the real and the imaginary, the human and non-human. Artistic agency using machines and non-human intelligence for co-creation can act as interpreter, connecting the outcomes into sound-, visual-, language- und performance-based artworks that make the future emotionally experienceable for a larger audience.

Post-/Transhumanism, AI-supported creativity, Non-human lifeforms, Research Creation, Critical Art Making

1. INTRODUCING TIME FOR A CHANGE

Imagine that in 10000 BC, in the 12th century or in 2421 you are thinking about the future. Depending on your epoch, you might hope for a fire to warm your cave, or constant good harvests and less wars, or a longer lifespan, better updates, or settling on a new planet in an ever increasingly complex life. At minimum, you would prefer to have some certainty about the future and survival guaranteed for you and your offspring.

Today, the homo sapiens are reflecting and questioning existence and evolution, and showing preoccupation with the 'Future' (Harari 2015, 42). For current humanity, thinking about the future revolves around complex challenges such as how to tackle the threat of environmental changes on Earth, how to fight the current pandemic and its aftermath, but also how to rebalance the abusive financial market effects of extended capitalism alongside with the ongoing digitalisation of society and culture. In parallel, the quest for meaning and purpose in a secular, capitalism-driven world is gaining in intensity (see also Frey 2019).

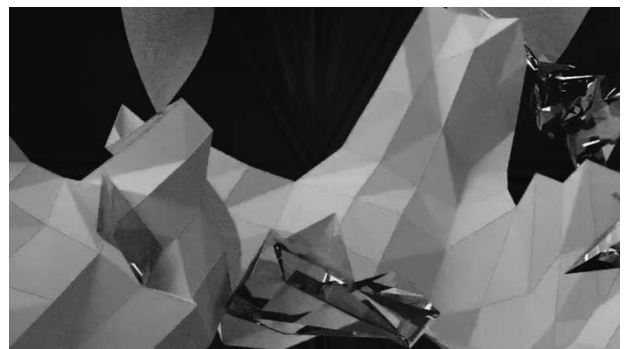


Figure 1: Illustration of emergence of 'digital self-awareness' (video still).

And we are concerned with the emergence of 'digital self-awareness', which may extend too far and advance too fast for our current biological mind-body-system to be able to keep up at all.

In essence 'desirable futures' have always been important for humans but in our era the scope and scale of the reflection are wider due to the growing knowledge of the universe and the connectedness of its elements in every aspect (Stiegler 2018, 51-54).

2. NEXT LEVEL OF CRITICAL ART MAKING

From a system-theoretical point of view, human activities and processes occur in a self-referential manner (see e.g. Roth & Schwegler 1990, 61). Consequently, a social system establishes for its proper functioning a reference line or 'normality' which, through underlying beliefs, helps in maintaining stability from an inside perspective whilst also marking the frontier to the outside world. An element/member of a system will stay in the intra-system-quasi-objective context in order not to be sanctioned or excluded, but also for maintaining a higher level of stability.

During extended moments of crisis this 'normality' is increasingly under scrutiny, yet a system will always maintain its reference unless a radical change of boundary conditions induces a pattern shift. Besides radical changes, establishing a 'meta-system' is another approach for inducing systemic changes.



Figure 2: Illustration of connected worlds through a Meta-System (video still).

Here artists, through their transversal nature and transgressive interest, can play a crucial role in stimulating or setting up such kinds of meta-systems. It is important to add that these 'artists' do not necessarily need to have an accomplished artistic education, and can equally be scientists, social workers, technology entrepreneurs or philosophers, to cite but a few. And, in an era where clear definitions about what comprises an artist or artwork have become obsolete, it is potentially better to talk about artistic agency. This translates into a person or group being independent, playful, open to change perceptions, connecting the dots, generous and interested in creating meaning (see also Schnugg 2019, 55-72).

Part of the necessary approach has already been formalised under the heading of 'Research-creation', as experimental practice at the complex intersection of art, theoretical concepts, and research (Truman & Springgay 2016). This approach is trans-disciplinary and incorporates hybrid forms of artistic practice between the arts and science, or social science research. As Research-creation is focusing on processes rather than the communication of outputs or products, it is

proposed to combine it with the concept of 'Critical Making'. This approach explores how hands-on making can supplement and extend a critical reflection on technology and society (Hertz 2012).



Figure 3: Illustration of 'Critical Making', connecting heterogenous spheres (video still).

The notion of Critical Making potentially encompasses any practice that combines making with criticality (Cramer et al. 2018). And combining art and critical thinking skills – 'Critical Art Making' – can be very effective in improving the quality of life for individuals and societies (see O'Donnell 2019). Part of the 'art' is to establish a meta-system for interactions between closed systems through the research-based creative process and to work on forming outcomes and objects which include a critical reflection on technology and society. It goes without saying that the approach to Critical Art Making proposed here does not exclude the established art-market system with its own rules and beliefs.

3. THE ARTIST AS A MEDIATOR FOR STRUCTURAL CHANGE

Coming back to the challenges discussed at the beginning, engaging critical artistic energy in hybrid territories between perceived and underlying, and between factual and postulated has a potential for inducing structural change. Artists as agents of change can be part of development processes and help promote human values and user agency.

Although technologies developed by humans are in their conception epistemologically bound to human intelligence, it can be speculated whether the implementation of Artificial Intelligence will not lead to the emergence of new results and ontologies that escape their original, human conception.

Whereas this could be seen as negative, it is proposed to consider precisely these new results as an opportunity for humans to enlarge their current self-referential perspective. Beyond existing settings and conventions, machines can help us to develop ideas, representing another 'perception' of the world and thinking (Miller 2019, 343-345); e.g. machines could complement human brain capacities instead of

making humans passive and dull through turn-key provision of all kinds of services.



Figure 4: Illustration of a posthuman conception (video still).

Another possibility is to stimulate and reconnect our intellect with the sensory environment in which humans and their ancestors evolved within complex, land-based cultures (Yunkaporta 2020, 6-10). Instead of generating more and more complex abstractions of the world, we and other lifeforms would benefit from exploring the fact that we are actually the world (Weber 2017, 110-139).

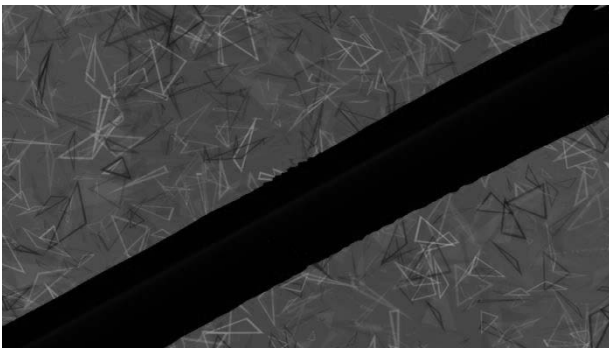


Figure 5: Illustration for reconnecting our intellect with the sensory environment (video still, source function by <https://infinitygames.xyz/>).

Integrating these possibilities, it is therefore proposed that artists could go beyond visualising complex data, crafting sculptures based on quantum phenomena or exploiting sound effects linked to nano structures. The hereof resulting art works and interventions all have their merits, often demonstrating a stunning visual beauty, and should by no means be discredited. The solemn question is nevertheless: given that structural changes and systemic shifts are necessary and recognising the potential that exists in Critical Art Making, is it not more appropriate to convene a deeper research-creation that enables artists to go further in their work?

Again, from a systemic perspective, the creation of alternatives and new patterns is crucial for stimulating change (see also Morin 2020, 68-98). The variants can be architectural forms, visuals, shapes of bodies and faces, animations, poems,

code, sounds and music, statements and arguments, movements and spatial expressions.

By generating variants with often surprising results, the artist can benefit both from the support of technology, and conceptually incorporate artificial system behaviour as ontological being in a future world for co-existence (Peterfriess 2021). In a larger scope, this approach is theoretically not limited to humans and technology, and may include any kind of lifeform, starting from those on Earth and ranging to future forms of existence as yet unknown to us.

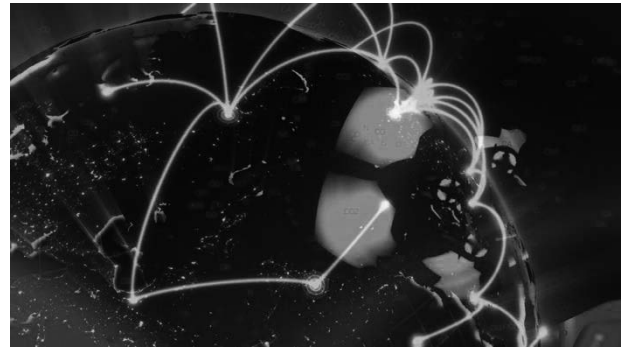


Figure 6: Illustration of a positive, forward-looking sense (video still).

Whereas the variants generated can be as rich as possible in expression, the next step is then to interpret them in an iterative and intuitive way, and to transform them into artworks. By recombining elements, creating stories, inviting for participation and considering perception patterns of today, the results can stimulate a positive, forward-looking sense and open up avenues for engagement.

In this respect the artist(s) invite(s) the audience to experience near futures, to experiment between different paths and to nourish an informed opinion beyond mainstream arguments, beliefs and promises. In essence, the artist acts as a mediator between present and future, stretching the boundaries of perception, and encouraging co-creators and audience to get involved in different or new patterns.

4. CASE STUDY: EXISTENCE BEYOND TRANSHUMANISM

4.1 Contextualisation & Reflection

In order to illustrate the approach described above, the ongoing discussion about Transhumanism, driven by actors from brain sciences and technologies, body enhancement and cryogenic life-extension, serves as a case study. The concept – or even philosophy – of Transhumanism offers undoubtedly encouraging possibilities. However, if we speak about brain uploading, augmented humans, cloning and drastically extended lifespan,

it touches heavily on the essence of human existence and corresponding ethical questions.

For contextualising the subject, Transhumanism is the intriguing idea that present limitations and frustrations of our existence could be overcome (Huxley 1957). This concept has been extended to the conception that humans surpass their current natural state and perceived limitations through the use of technology, so as to mitigate aging and to extend human lifespan, even beyond a biological state. (Vita-More 2020). It appears that Genetic Engineering, Advanced Pharmacology, Advanced Computing & Artificial Intelligence and Cyborg Technology could accomplish, in a matter of years, what biological processes and environmental challenges would take thousands of millennia to achieve.



Figure 7: Illustration of hidden code lines powering a transhuman (video still).

Whereas Transhumanists embrace self-directed evolution, bio-conservatives, in contrast, advocate strongly against those advances, despite the fact that any global ban on person-engineering technologies would be exceedingly difficult (Walker 2021). Sceptics argue further that the complexity of our embodiment will make it unlikely to download soon our brains to a computer (Brooks 2002, 197-208). Finally, if we anticipate the 'Homo Stellaris' (Johnson and Hampson 2019, 18-25), a change of human physiology and mind, linked to high radiation intensity and different gravity levels compared to Earth, are likely to occur or even become a prerogative for human evolution. It can also be speculated how far Transhumanism is in particular linked with Western societies and their concept of self-improvement with the help of technologies. In Confucianism, Buddhism and Taoism, the key is authenticity – a kind of 'change' phenomenon, where human nature in the world is not related to properties of Body and Mind, and thus without temporal limitations such as life or death (Lee, Hyun-Jung 2018).

So, what makes Transhumanism an interesting case study for Critical Art Making? Transhumanism is in the first place not driven by direct needs, but rather by commercial interests and the more englobing idea of extended territories (Bratton

2016). Transhumanism appears as a kind of 'techno-anthropocentrism' in which the protagonists often neglect the complexity in an era of advanced capitalism (Thomas 2017). Our highly competitive social environment does not lend itself to developing a variety of solutions, let alone the co-existence of a multitude of solutions. Here artists cannot only reveal all invisible and underlying trends, but also stimulate emotional experiences around potential variants of the future.

4.2 Methodology of Work

The methodological procedure focused on the development of variants as a set of prototypes that served as epistemic objects for stimulating emotional revelation. Having started with several lines of iterative research on subjects linked to Transhumanism, the following key topics were identified for the project:

- Physicality
- Self-optimisation
- Biohacking
- Brain-uploading
- Human condition
- Lifeforms
- Multiverse
- Eternal life
- Transhumanism itself

This list is certainly not exhaustive, but has proved to be highly relevant as input for the creative process. Around these topics, the generation of new variants and patterns of shapes, forms, sounds, movements and statements, questioning societal and ethical issues such as identity and gender bias was applied from two viewpoints: using machines (algorithms and weak AI) as a tool on one hand, and on the other understanding them as an independent ontological representation, with their own 'reasoning' and aesthetics, for proposing hybrid and (for humans) new forms around, and even beyond Transhumanism. The results were then interpreted by a human artist with regard to:

- a) novelty,
- b) inspirational capacity and
- c) critical perspective.

This led to the preselection of various images, video-clips, text passages and sound elements for artistic exploration. Following the approach of the artist as a mediator between present and future along the lines of today's perception patterns, a decision was made to develop an immersive feature clip as a game-like journey around various aspects of Transhumanism,

Throughout the journey the characters of the plot directly address the audience, while the narration draws inspiration from Chinese mythology and

Western philosophical traditions, as these two main strands have, for a long time, questioned in various ways the idea and concept of existence. Together with an immersive sound ambiance, the video clip makes near and far futures accessible for the audience, and opens a path for reflection on the future of humanity and Transhumanism.

4.3 Implementation of the Feature Clip

The generation of variants was carried out in several steps. Starting from the identified key topics around Transhumanism, a first research axis focused on creating natural language-based statements, revealing unusual sentence patterns. This was achieved by using OpenAI's Generative Pre-trained Transformer 2 (GPT-2) version and the Megatron-11b unidirectional language model (<https://inferencekit.com/>).

This led not only to unexpected semantic patterns, but also to quasi-poetic statements e.g. concerning eternal life. The results were critically reviewed by the artist as input for the design of the feature clip and the overall storytelling.

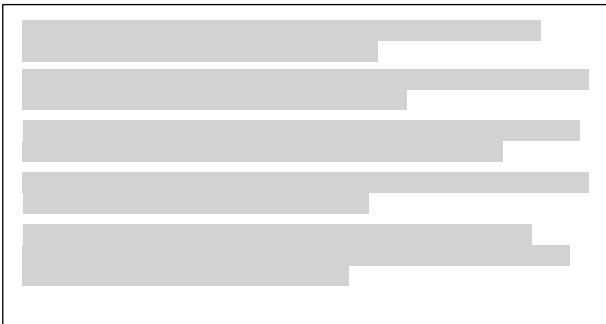


Figure 8: Case study: examples of GPT-2 based text generation (screen shot).

For the research on visual hybrids, variants were generated using Generative Adversarial Networks (GAN), in particular BigGAN and StyleGAN models (<https://artbreeder.com/>), as methods of exploring highly complex spaces. Uploaded images from a separate creative process, linking back to the key topics mentioned earlier, were fed into the models.



Figure 9: Case study: GAN animated lifeforms in a future world (video still).

By crossing/blending and 'cross-breeding' genres, gender, colour, race, moods, dressing styles and human/non-human lifeforms, new hybrids were created in the forms as images and short video sequences. Through a facial animation software, part of the images was further transformed using the results from the OpenAI GPT-2 process.

A third field of work concerned the exploration and creation of sound and acoustic ambiances. Using a novel algorithmic Quad Note Generator (<https://reasonstudios.com/>), and drawing inspiration from the key topics around Transhumanism, specifically developed additive and modular synthesizer patches (melodic and rhythmic patterns) were activated based on algorithmic aleatory modulation of pitch, velocity and note intervals.

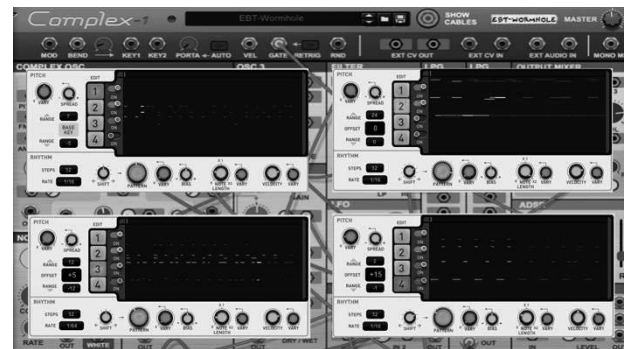


Figure 10: Case study: examples for algorithm-based sound pattern variations (screen shot).

For the final overall video creation, the gaming context and corresponding retro-futuristic aesthetics were considered appropriate for making future life situations around Transhumanism experienceable (see also Zhan 2013). When deemed necessary, additional variants were produced for the concluding touch. The final artwork, in its first iteration is presented as a feature clip where all input sources are carefully arranged.



Figure 11: Case study: game like animation of a transhumanist character (video still).

4.4 Analysis of Results

In general terms, the creative process effectuated made it possible to generate a set of variants where the inventive exercise was not focused on the concrete artwork as a distinct objective at first. Technology was used as a tool, but the artist's critical thinking was crucial for reflecting on how to make choices between variants, and how to integrate them so as to obtain a meaningful and accessible result.

When applying critical thinking skills, the artist floats over the variants from all angles and all viewpoints. Due to the variety of approaches, strategies, and problems from diverse inputs and standpoints, this process allows for interaction with different stimuli and situations. Learning to negotiate and navigate between the variants generated and viewpoints about the final artwork significantly improved the end result, and contributed to the overall intention of a different view on Transhumanism.

As a next step, the intention is to develop the setting into an AI-based generation of living spheres between design fiction and critical planning, yet with focus on developing an advanced vision on Transhumanism. In contrast to other visions in the field which point, for example, towards 'hyper-density' (Young 2021), here the future of humanity is sought as a process of opening up points of areal density and reconnecting with the planetary environment(s) rather than a continued dissociation from it – so, to quote: "beyond Transhumanism is only movement and change, all is circular, fluid and endless."

5. CONCLUDING - YOU HAVE REACHED THE NEXT LEVEL

In conclusion, the case study represents a novel approach for connecting digital animation, gaming, digital poetics, philosophy and sound art. In addition to the GAN and GPT-2 approaches used, generic neural networks could be exploited for the visual creation of new life situations and any forms of communication. In an extended approach this could be developed and transformed into a hybrid game including virtual worlds and physical objects.

Thinking about the future and possible implications of Transhumanism via generative art creation and algorithmic aesthetics provides a valuable way forward to reflect on what matters, and to express it through critical and yet accessible art. And making the future emotionally experienceable for larger audiences is a promising empirical way and practice for Critical Art Making, and merits further exploitation.

The artist, in the wider sense as it is defined here, can act as a mediator between the present and the future, asking pertinent, research-based questions around the human condition. The artist can further pave the way for co-existence with non-human lifeforms and explore alternative design methods for impactful technologies – ultimately for reconnecting our intellect with the sensory environment in which humans evolved and continue to evolve. This could also contribute to a reflection on the role of art and artists now, and in the future (see for example Peterfriess & Rojina 2021).

The potential for experimenting 'beyond Transhumanism' is endless, yet it can answer questions on how we could, or should today reciprocally redesign ourselves and the perceived or imagined worlds around us in order to address the current challenges for humanity. It can serve as a stimulus to overcome our Anthropocentric thinking where, in the future, humanity is reconnected with planetary environment(s) and non-human Lifeforms rather than advancing on a continued dissociation. We might not be talented enough to help much the latter very much, but they might certainly be able to help us.

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About Becoming a Cybernetic Organism: An Approach from the Sound of Perception

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From a personal exploration of listening, the author seeks to understand, from cybernetic theoretical concepts, the impact of technology on the perception of reality through sound from her disability condition. Suffering from single side deafness or, in other terms, having lost the eighty percent of her hearing in the left ear, the author struggles to understand her position in the world from her work as a sound designer for cinema and the social and political impact of sound, which situates us as inhabitants of spaces, coexisting with other beings and with machines in a modern society that embraces technology as a mechanism to potentiate our human performance.

This document seeks to highlight practices such as discrimination and gender differentiation as meaningless and absurd practices. We are becoming cyborgs: beings without categories, non-binary and without specificities but with capabilities. This analysis based on personal experience brings some hypotheses about what the process of becoming a cyborg organism will be: new forms of cybernetic organisms, new ways of perceiving the world, networking, and interacting in it through science.

Cyborg. Disabilities. Reality. Perception. Listening. Body. Prothesis.

1. INTRODUCTION

The definition of identity depends, varies, and evolves according to the way we perceive the world. We experience the world through the senses, and this defines the way we interact with other humans, other beings, nature, spaces, and ourselves. We learn by this experience how to sense the world, we develop sensibility to acknowledge otherness and, indirectly, we are told how to understand, control, and behave through senses. Hence, we also learn structures of power established by society via the way we should manage our senses. Perception of the world, then, becomes a fixed way of sense and that defines our position within the social structures, such as family, friends, work, neighbourhoods, our city, and our country. The perception of the world forces us to identify ourselves among these power structures and, by default, our behaviour: the way we navigate around people, beings, nature, machines, and spaces. All these social interactions define who we are and our identity.

This journey of experiencing the world is directly related to how we hear, how we sound and how we are in silence. Humans are visual beings, we focus our attention according to what we see and what we look at, but to comprehend objects visually, we

should take distance, move far enough and then we acknowledge and confirm the existence of things. As Salome Voegelin affirms about visual perception:

Vision, by its very nature, assumes a distance from the object, which it receives in its monumentality. Seeing always happens in a meta-position, away from the seen, however close. And this distance enables a detachment and objectivity that presents itself as truth. Seeing is believing. (Voeglin, 2013)

On the contrary, listening is to be immersed, to be surrounded, to be touched by sound. We are constantly in the centre of an acoustic sphere; our hearing system is omnidirectional, and the ears are always open. It requires a conscious action to block it, but we are unconsciously getting sound information all the time. We are hearing what is not seen, we get information of action, movement, situations, natural activities, social configurations, among other things through sound. We learn to ignore, maybe as a survival instinct, and to pay attention through sound; a lot of information is coming in and out of our ears. Having said the above, it is possible to affirm that the sense of listening continually defines our identity, our position in the world and who we are.

This text explores, through personal experience, the sound perception of the world as someone who has a hearing disability and who, despite my condition, has spent the last twelve years designing sound for cinema. After twenty-four years of half-deafness, I decided to face my disability and give myself the opportunity to regain hearing through a cochlear implant. The process of becoming a cyborg raises questions related to the meaning of disability established by society, the impact of technology as a tool to improve human capacities and the changes in perception of reality. These repercussions lead to the redefinition of identity and re-position of the autonomous person within a society.

2. EMBRACING, UNDERSTANDING AND REDEFINING DISABILITIES

The first process faced to become a cyborg was the questioning of disabilities. Being born as a normal person which in the simplest concept means without disabilities, body disfigurements, or mental handicap; and then developing deep left sensorineural hearing loss at early childhood was a very confusing event in my life. I just realized about my new condition when a doctor told me; that is how unconscious we are about our hearing. I thought I was a kid like the others at school and I did not know that I was missing half of my hearing system. There were two consequences that are worth mentioning because they defined my behaviour for the next twenty-four years. First, it was the way my family decided to make the subject (issue) a taboo and practically cancel it from any conversation or analysis which forced me to the second, refusing to accept myself as I was.

Being hearing impaired is a disability that is not visible, therefore it is easy to hide and easy to learn to lie perfectly about it. Denial reaches the point that in many moments you forget that you are indeed different. I never considered myself as disabled and because disability is usually related to a visible impairment, I was never treated like one, I never told anyone about it, and no one ever asked me if I really was. However, I lived with fear, I disabled myself in social, work, and personal situations in which I isolated myself. I did not give myself the opportunity to belong to an acoustic world because I imagined that this was not possible for me. Being aware that I could not hear in one ear terrified me, not because of the lack of hearing, but because I had learned that being disabled was something to be ashamed of, it was wrong and had left me in a position of vulnerability that, together with the fact of being recognized as a woman, would simply close my opportunities of being an autonomous person within a society. In school I was not taught to be conscious about diversity, handicaps, otherness; I was told to fit the norm. Disability was an idea created by that erroneous

collective thinking regarding being able in a different way, which led me to deny my condition as a survival mechanism. Fear became the guidance to deal with myself. Lennard J. Davis affirms that to discuss disabilities the intake must be changed:

So, the first task at hand is to understand and theorize the discourse of disability, to see that the object of disability studies is not the person using the wheelchair or the deaf person, but the set of social, historical, economic, and cultural processes that regulate and control the way we think about and think through the body. (Davis, 2016, 28)

This regulation of the body created the concept of it as a tool that must be productive. The implementation of statistics in the body allowed the development of its normativity by subscribing this to eugenics. The need to enhance the body and improve the race to reach perfection, automatically forced the creation of guidelines or rules of what should be considered as the approved and normal body. A range of physical dimensions, specific capabilities and mental conditions were stipulated mainly to ensure productivity. Consequently, the capitalization of the human body arises which by default creates the abnormal, the atypical, the aberrant, a perverted perspective of the body (Davis, 2016, 67). With this economic value granted to the human being, other kinds of corporeality are eliminated from the system. The useless and the incapable become what must be suppressed, hidden, transformed, fixed, or improved. Specific ways of working and relating to the world force us to seek the perfection of that corporality and, on many occasions, this search only leads us to cancel ourselves if one is considered different.

3. LOOKING FOR THE NORM OF LISTENING

Human beings are not binary in terms of sound. Sound is not something that we turn on and off, even if we block our ears, we still get sound from our inner selves. On the other hand, most of the time we are not communicating through a yes or no answer. There is not just loud or soft sounds and there are not just high or low frequencies, there are many possibilities in between. To understand sound, we need time. We use words to understand, we like to hear sentences to tell stories, to develop social communication, to belong to an acoustic environment. To experience a space, we must recognize sounds and propagation of sound. Sometimes, we hear sounds of actions; sometimes, we pay attention to the sound of places and, other times, we appreciate the sound of other beings or nature, or maybe, one day, we find all sounds disturbing. A space is not sounding the same, movements and actions are performed differently

every time and, therefore, our way of perceiving and appreciating sound is constantly changing. Hence, a specific way of listening cannot be imposed as a norm, and no idea of the correct listening can be established since we process sound information in such different ways. There are so many variables in a psychological, physical, environmental, situational, geographical among other levels, that our perception of reality through sound varies even when we listen to the same sounds. The meaning, the context, the information, and the feeling provoked by sounds depend on the combination of these levels. Sound is always different and therefore, disabling a person because her or his hearing system is different is wrong, unfair.

Despite my hearing impairment, I decided to become a sound engineer, a sound designer and a teacher who talks about sound. I was looking to survive without letting people know about my condition and I was trying to fit in and pretending to have the perfect productive body just to be part of society, but I knew I was lying to myself. Evaluating the way of listening is difficult, because if you do not know how to properly listen, you do not know what you are missing or what is exactly wrong, you just know that is wrong. I wanted to fix it, but I did not know how it would feel to fix it. I never questioned whether I wanted to solve it or not. I was able to have a social, professional, and working life in which being disabled did not seem to be a problem. I wanted to do it out of the need to not feel ashamed, to take away my fear, to not have to lie.

At the same time, despite the impairment I developed different strategies to understand sound: Through vibrations, I felt sound in my body. With technology, I learned to visualize, manipulate, process, and perceive sound objectively. Experience, other senses, and social relationships allowed me to communicate, work and relate to the world through sound. Courage and stubbornness had to be embraced to unsubscribe to the preconceptions of disabilities and comprehend that there are infinite ways to perceive, to experiment, to produce and to be. I realized that my hearing system just worked differently.

Understanding that differently abled people conceive and experience the world in a non-traditional way and that this brings the opportunity to break paradigms of social structures, labour processes and agency of the self within a society is important to provide free development and definition of identity. Therefore, the idea of searching for the perfect body, or the establishment of the healthy or appropriate body, lacks sense. The decision was clear afterwards. I wanted to experience a change in my life. I decided to take advantage of technology, I accepted my condition, and I gave myself the opportunity of experiencing the world in a different way. I would not have a

normal body; I would have a machine attached to my head and it would be visible. I would listen through a machine. Merging my brain with a robotic device would allow me to reposition myself in the acoustic space, to localize sound, to play with sound. I will not find the perfect ear, but I will have the chance to change, to declare myself as vulnerable and to take responsibility for the desire of updating myself.

4. BECOMING CYBORG

Establish communication between two beings who do not know about each other. Other materiality, one is flesh, warm, organic, and sticky, and the other one is cold, hard, artificial. Each one speaking different languages, there is no understanding, no common ground. That is what the cochlear implant is. I recovered acoustic stimuli in the left ear, but there is no understanding of the world. Reality from that side is misunderstood, blurred, distorted. I hear a synthesizer talking to me, but the brain does not know how to translate it. Sensibility, desire, and emotion is needed to make sense of the prosthesis, a recognition of vulnerability and the possibilities of technology, a merge of the machine and the human. Otherwise, there is just noise and frustration. As Shildrick states in her article of re-imagining embodiment,

taking a phenomenologically based approach, it is clear that to rely on a prosthesis is not a matter of a self-using an exterior and impartial technology, but of incorporation, of becoming embodied as hybrid...

and then continues saying that this

indicates how the prosthetic experience may entail also a complex and unsettling contestation not only of the relation between self and other, but of any subjective sense of self. (Shildrick, 2013, 27)

A conscious mindset that allows me to remember why I allowed a robot to inhabit my body and accept that we are coexisting together; the robot is alive through my body and my left hearing system is a fact because of the robot. None of us could be functioning without the other.

Sound will start slowly to make sense; we¹ are in a collaborative construction of reality. Sound is coming to my understanding in terms of simple and long tones that vary its volume. Acoustic information from the world is shaping these tones so they become something that I understand. After experiencing daily life, I find patterns and learn words, actions, movements, relationships that are encoded somehow by my brain and finally correctly translated as information². Because sound is undoubtedly related to time, I need time to decipher

meaning. To find meaning, I need desire and sensibility to acknowledge the existence of people, spaces, beings, actions through sound. The real human-machine amalgamation consists of a mental transformation of myself being and allowing the robot to be us, to recognize together the existence of otherness. The success of the implantation of an extraneous object into my head will be not only the clinical measurements of my listening, but also my ability to re-identify myself together with the machine.

The problematic aspect of the cyborg, as stated by different authors³, is the economic force and the implied militarized industrialization of technology (Harrasser, 2017, 16), which at the same time contributes to the idea of the productive body and the negative impact of cybernetics within the social structures. Accessibility to the modification of the body through technology is most of the times granted to the ones with privileges, purposes of the cyborgs can easily support fascist and discriminatory practices, destruction of the organic, the nature and the human itself and radical surveillance and control.

Nonetheless, and besides the negative impact of the accelerated evolution of technology, prostheses create the possibility of what was considered impossible before. It inevitably changes the way we act; we adapt and how we evolve. Hereafter, it is in our power to decide what to do with it, we must take responsibility. I defend the contingency of change required by a human being to define the self and find a position in the world. The implantation of technology in our lives and bodies must be clear, transparent, and the person subjected to these procedures has to know the difficulties of the processes. I wanted to determine my position through sound as a sound designer, as a teacher and as a person who cares about others. I wanted to recognize the world from a different listening standpoint. The option I found to understand my condition was becoming a cyborg and despite the risks I was taking, I decided to do it because it is just fair that people have the opportunity. Therefore, technology becomes a tool for free development of a person who demands agency within a community and a society. As Donna Haraway affirms in different texts and lectures, all of us are already cyborgs who implement technology as an extension of our bodies to experience life: Computers, mobile phones, watches and even pills, became a way to modify our experience daily. Is our choice to decide which purposes we are reaching with it. In my case, sound and listening was the way to understand life.

Every sound in the world is taken by the machine and translated by my brain as the same, there is no discrimination or priority of specific sounds. Humans automatically focus and selectively direct

listening to what interests us or what is worthwhile. We give importance to certain things based on our judgments and preferences. In some way, we acoustically cancel out certain beings, situations, or actions that we do not want to hear or that are not interesting for us. Even when the cochlear implant is a device composed by binary programming, my listening is not binary. I do not listen or hear selectively as the regular hearing human system does. I cannot recognize, I cannot react to certain sounds. All beings, objects, spaces, movements, and situations sound the same to me. I do not pay attention to what I find interesting. Suddenly, every single sound has the same importance to me because I cannot control it. My reality completely changed. I give importance to any sound that comes to me: the sound of a mosquito excites me the same as the sound of a person talking to me, I am aware of the existence of all beings. The wind is a constant sound that reminds me that we live in constant movement, that there is nothing but situations. I like all sounds now. I'm looking for more sounds, more stimulation through the vibration of particles that touch the robot who talks to me. My listening is inclusive and non-discriminatory, all sounds are welcome, and it is through sound that I acknowledge life. Donna Haraway states about machines:

But basically, machines were not self-moving, self-designing, autonomous. They could not achieve man's dream, only mock it. They were not man, an author to himself, but only a caricature of that masculinist reproductive dream. To think they were otherwise was paranoid. Now we are not sure. Late twentieth-century machines have made thoroughly ambiguous the difference between natural and artificial, mind and body, self-developing and externally designed, and many other distinctions that used to apply to organisms and machines. Our machines are disturbingly lively, and we ourselves are frighteningly inert. (Haraway, 2017, 11)

My perception of reality is updated every two months with a new programming. I am constantly changing the acoustic world around me. From now on, I have the choice to rebuild it, to shape it. I expected the world to come back to me as I knew it, and I found a strange combination of synthetic tones created by the organic and analogue sound sources that surround me. I became a cyborg to be more robotic, more productive, more efficient, but the machine made me more human: technology is allowing me to embrace pain, to be confused and to update myself until I find and define the acoustic world that I want for myself, in which I want to be and of which I want to be a part. The collaborative construction of a machine-organic organism lets me think, conceive and perceive the world where the otherness has a sound, where I can recognize the position of others in my world and, at the same time, I am slowly

defining my identity through the constant change and upgrading the process of listening. To become inert beings because of technology makes no sense. Technology, when implemented responsibly in our bodies and in daily life, is a powerful tool to empower what is vulnerable and to recognize what is completely ignored.

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¹ The robot and I.

² e.g. words, sound of animals, objects collapsing, etc.

³ e.g. Karin Harrasser, Donna Haraway and Sadie Plant.

Botanycaring: Rethinking Human-Plant-Relationships through Caring Sensory Interfaces

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Humans-plants relationship is known since ancient times. Nevertheless, our relationship with nature is everything but “natural” and it is an artificial construct derivative in dynamics of control focused on human well-being, such as food, medicine, contemplation, and even company. Botanycaring starts from a personal inquiring about our affective and intimate relationship with plants. Thus, it draws a design approach inspired by Michael Pollan’s concept about the “dance of domestication”. Botanycaring proposes speculative design inspired by Pollan’s Botany of Desire’s chapters: sweetness, beauty, intoxication, and control. These are used as interfaces concepts for proposing human body-plants rituals that re-think caring interactions between them. Botanycaring discusses the need to design artifacts – meaning artificial - to re-think our relationship with plants by changing its dynamics of power. Also, it looks forward to provoking questions and design explorations that ask about how we can design nature within ecologies of care, integrating the feminist perspective of care in techno-science thinking proposed by María Puig de la Bellacasa as an essential aspect in the process of thinking and knowing the otherness: thinking with and thinking to, as ways of building worlds with and for others. Furthermore, Botanycaring explores what happens if home plants dynamics are based upon and driven by human body resources, intimate gestures, and rituals, designing the above for more-than-human worlds and skins.

Humans-plant relationship. Care. Intimacy. Interfaces. Senses. Design. Post-Humanities.

1. INTRODUCTION

Possession – property – is about reciprocity and rights to access.

If I have a dog plant, my dog plant has a human.
- Donna Haraway

Humans-plants relationship is known since ancient times. Nevertheless, our relationship with nature is everything but “natural” and it is an artificial construct derivative in dynamics of control focused on human well-being, such as food, medicine, contemplation, and even company.

We have been for some time in a juncture where we have shifted from climate change to climate emergency. In this so-called sixth extinction, we humans have had a clear tendency to preserve or to save living beings that are the most similar to us. In that sense, plants as captivating and strange they could be to us, have been relegated. “Scientists at the Royal Botanic Gardens, Kew, and Stockholm University found that 571 plant species had disappeared in the last two and a half centuries, a number that is more than twice the number of birds,

mammals, and amphibians recorded as extinct (a combined total of 217 species).”

This data suggests plant extinction is happening as much as 500 times faster than what would be expected normally if humans weren’t around. “This study is the first time we have an overview of what plants have already become extinct, where they have disappeared from, and how quickly this is happening,” as said by Dr. Aelys Humphrey.

Botanycaring looks to rethink our role as caretakers in an altered and broken nature as well as the notion of humans- nature as separated beings, rather that the intersubjectivity of that connection, of that relationship.

In Enlivenment, philosopher Andreas Weber presents an alternative understanding aside of the definition of Antropocene. In such he argues that “not that human control nature but that humans and nature exist in a commons of mutual transformation.” Then the dualism of nature-human does not exists, because the fundamental dimension of existence is shared in what he calls “aliveness”. In that sense, “Self is self through

other. Seeing all beings in a common household of matter, desire, and imagination.” (Weber, 2019, 22)

What Weber calls “mutual transformation” is also stated maybe from a different point of view by Michael Pollan in *The botany of desire* but as “the dance of domestication”, (Pollan, 2010) in where contrary to the extended belief that humans have mastered the control of nature for centuries, is nature that has evolved to seduce and control us, to satisfy our most basic yearnings.

2. RITUALS OF CARE IN MORE THAN HUMAN WORLDS AND SKINS

Botanycaring was born from an inquire that join rethinking our relationship of power towards nature to transform it into a caring one, enveloping this in a context of climate emergency and extinction taking into account how our embodied emotions and affections modify or not the way these caring moments unfold, and finally how this leads our rituals of intimacy and care to happen in more than human worlds (Figure 2).

Botanycaring is then defined as the speculative care scenario in which

- (i) the caring rituals we have with our own body are extended to non-human bodies (plants)
- (ii) using our body living resources to sustain such external bodies while
- (iii) c. sharing human notions of grief, care and belong to sustain rituals around extinction and/or co-survival between humans and non-humans – ideally- fuzzing this frontier.

Care, as proposed by Maria Puig de la Bellacasa on the most general level, “can be viewed as a species activity that includes everything that we do to maintain, continue and repair our ‘world’ so that we can live in it as well as possible. That world includes our bodies, ourselves, and our environment, all of which we seek to interweave in a complex, life-sustaining web.” (Puig de la Bellacasa, 2012, 198). The project then, reinforce and weaves scenarios in where the body is not only the vehicle we perform care with, but carries the actual vital sources from where the caring act is fed, it carries its vitality within.

2.1 Caring Co-Survival and Caring Co-Extinction

If according to Paola Antonelli’s words: “We don’t have the power to stop our extinction, but we have the power to make it count”, this project provokes scenarios where we, as designers and artists can frame a more caring co-survival and caring co extinction that involves other worlds that are not human. In such, natural emotions that emerge in

grief, emotions related to lost and farewell are invited and performed, as well as rituals based on reciprocity and belonging that state: we are still here, we are present, even as we inevitably fade.

But what does it mean to care? “Is it an affection? A moral obligation? Work? A burden?”. “Can we think of care as an obligation that traverses the nature/culture bifurcation without simply reinstating the binaries and moralism of anthropocentric ethics? How can engaging with care help us to think of ethical “obligations” in human-decentered cosmologies?” (Puig de la Bellacasa, 2019)

Botanycaring provokes scenarios in which the dynamic of power with nature is inverted. If we have built entire life support systems for our benefit, namely respirators, cardiac intensive care units, dialysis machines, and in general all sort of devices to assist, extend and replace our body in order to live, what could happen if we human bodies become life support system for non-human bodies, in this case plants. If we rely on nature to sustain us, what happens if nature relies literally on our bodies to sustain itself, and if that happens could we be more present in the act of taking care of nature?



Figure 1: Cardiac intensive care units

In that sense, Botanycaring units invert the dynamic of plants as healing herbariums, to create ones of human’s bodies that are healing units for plants. Our human bodies as gardeners as speculative ethics of co extinction and co surviving. “Can we think of care as an obligation that traverses the nature/culture bifurcation without simply reinstating the binaries and moralism of anthropocentric ethics? How can engaging with care help us to think of ethical “obligations” in human-decentered cosmologies?” (Puig de la Bellacasa, 2017)

In this spirit, an exploration of substances and the human body–plants sensory artifacts were proposed exploring the concepts of vitality, belonging, nourishment, reciprocity, synchronicity, bonding, vulnerability, nostalgia and grief. The mentioned concepts were explored through a series of object/rituals such as a hybrid skin cream, a human perfume that benefits plants, a human body-plant watering artifact among others. If the

project seeks humans to be menders are caretakers of nature and own brokenness, why do we deny an even reject the nourishing and healing source our own body has to offer? Namely our blood, tears, urine, etc.

3. RITUALS OF BIPOETIC ENLIVENMENT AND THE SENTIENT WORLD

Why rituals? Because “the ritual is based on repetition. Not in the repetition of a gesture but in the repetition of a symbol. “The symbol, a word that comes from the Greek *symbolon*, originally meant a sign of recognition or a “password”.” (Byung-Chul, 2019, 9)

Botanycaring rituals are proposed in domestic spaces in which care and intimacy occurs naturally, as ideal resistance places for these rituals to happen continuously. Thus, private rituals sustained consistently in time will become – hopefully - into collective acts of care. “Repetition is the essential feature of rituals. It is distinguished from the routine by its ability to generate intensity”. (Byung-Chul, 2019, 11) Rituals interrupt the inertia of time. “Time today lacks a firm framework. It is not a house, but an inconsistent flow. It disintegrates into the mere succession of a punctual present. It rushes without interruption. Nothing offers it *hold*. The time that rushes without interruption is not *habitable*” (Byung-Chul, 2019, 13)

All these artifacts are rooted in the idea of caring better and how this care can be *enacted* as well as *embodied* not just felt as an intention. These, understanding care as a “vital affective state, and ethical obligation, and act of love and a practical labor” meaning that care is something we do. “It is always specific; it cannot be enacted by a priori moral disposition.” (Puig de la Bellacasa, 2017)

“Rituals are symbolic actions. They transmit and represent those values and orders that keep a community cohesive. They generate a *community without communication*, while what prevails today is *communication without community*.”

Through this enacting moments, Botanycaring seeks to create a physical bridge between bodies sharing living sources to create moments of vital states of care that are not only seen but felt, physical but spiritual and at the same time metaphors of connection to feel connected and reciprocated and cared for, aiming to articulate, in each artifact/ritual culminating in an idea that a precise description of the world could be possibly given only “in a language of poetry, a language of love. This language automatically includes other beings as referents for emotions and metaphorically self-understanding” (Weber, 2019, 148)

“To maintain our connection to this living world, we need to respect its basic principles of fertility and mutual exchange, which are already structuring the unconscious workings of our bodies, namely our metabolism and our emotions. Enlivenment means unfolding as a living part in a vibrant household of energy flows and meanings. It means recreating any relationship of reciprocity in an honest and fertile way. It means striving for freedom by giving in to necessity.” (Weber, 2019, 89).

3.1.1 Watering Tears: Crying and weeping is a recognizable sign for sadness, also a natural response when someone dies. This piece is built to open the feelings of vulnerability, nostalgia, and grief while performing the act of collecting human tears for a plant’s sake. It is built to do it slowly as it respects and preserves the timing of a mourning.

Formally, it is a face mask that collects human tears to water and clean plants. The mask can be used directly to water small plants through a serum cable or it can be stored in a perfume bottle with a spray dispenser. All in this object is tiny and resembles perfumery to re-enact something that is scarce and precious, not replaceable. Beyond the form, it looks for a moment of connection between interspecies emotions as well as reframing how we said goodbye to non-humans.

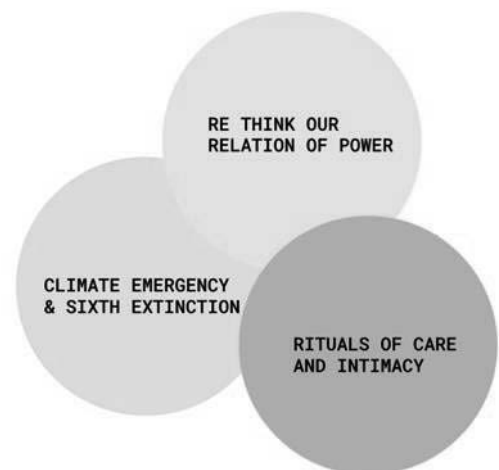


Figure 2: Botanycaring Topics





Figures 3 and 4: *Watering Tears Mask*

3.1.2 Kidney Garden: This piece is based upon the concept of the Human Body as a gardener, and in that sense around the idea of nourishment and reciprocity. This device is an artificial exo-kidney that collects human urine and processes it into water to nitrogenate domestic plants. It is made of two plastic containers that resemble kidneys and a serum cable. Urine is full of nitrogen, potassium, and phosphorus, which are the nutrients plants need to thrive—and the main ingredients in common mineral fertilizers. “Plants are nature’s alchemists, expert at transforming water, soil, and sunlight into an array of precious substances, many of them beyond the ability of human beings to conceive,” (Pollan, 2001) If we invert that dynamic, can human bodies be a mean for nature conservation? If so, how can we do it carefully?



Figure 5: *Kidney Garden*

3.1.3 Moon seeding ritual & My life will be yours.: Synchronicity, bonding, and reciprocity. An artifact that allows you to sync your menstrual cycle with the growing cycle of a plant and use menstrual blood as fertilizer in daily entourages. This one is still in progress.



Figure 6: *Seeding moon ritual*



Figure 7: *My life will be yours*

3.1.4 More-than-human skincare: Flesh, touch, protection. Open vulnerability, vulnerability as openness. Our skins protect us from the world and exposes us to it. In an approach to explore how to share this between human and non-humans, a “serum” for plants made of human urine was created. This urine serum contains nitrogen, potassium, phosphorus, and zinc) diluted in human tears, this is packed in a glass bottle with a dropper. As seen, the forever known practice of using plants blood, -namely all their properties - is inverted, in where is our human vital sources that are used to take care of plant skins. It explores how individuality can be challenged and pushed through this brief but meaningful encounters, encounters of individualities that can be permeated. In that sense, “‘phenomena’ are not shoved aside as mere illusions but that they convey a poetic knowledge through which the world expresses itself. Romanticism is fairly modest concerning the human ability to understand the cosmos as being something separate. The world’s interior is forever ungraspable as totality. But it can be approached and embrace it as individuality. Its interior permeates the uncountable permutations of the surface of things, which in turn become the sensitive skin of a vulnerable flesh. This flesh vibrates with a continuous desire to be touched, to touch, and to make itself feel. The world is sentience because it is matter”. (Weber, 2019, 149)



Figure 8: *Watering tears mask*



Figure 9: *More than human skincare*

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Duelling Epistemologies. How Artists Hack Laboratories and Alter the Futures of Science

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Donna Haraway's 'Situated Knowledge' can be understood as feminist critique of scientific 'objectivity,' but there are additional factors to critically challenge knowledge production – from the perspectives of race, gender and class, as well as contemporary economic ideologies. Looking specifically at the interaction of Hybrid Arts and the life sciences in the late 20th and early 21st century science we would like to formulate two lines of critical approach: 1) How can Hybrid Art, and specifically artistic research - in lab – critique the effect that the market has on determining what is researched and what is not. Funding can also be seen as a means of directing and disciplining scientific research and knowledge, to make sure it follows the desires of the market. Can cross-disciplinary exchange between scientist and artists be a catalyst for liberation? 2) What are the effects of 'engineering' as ideology on both science and Hybrid Art? Especially in the case of the life sciences, where the money and the attention are focussed on bioengineering, the ideal of efficiency creates an obstacle in the pursuit of knowledge. Efficiency, mandated by the market plays a major role in engineering. But this is in contradiction to nature and life, where complexity and redundancy play a very important role in evolutionary success. Additionally, we live in an era where 'hype' of biotechnology, creates a platonic mirage of the actual state of science. We propose, for example, that CRISPR is not going to radically change nature as we know it and sustainable biomaterials are unlikely to replace plastics. Are both artists and scientists capable of sifting the hype from their research and practice, and if so, how?

We see a small group of (mostly women and nonbinary) hybrid artists challenging the epistemology of natural sciences, without breaking from scientific method or 'doctoring' the results of their inquiry. As opposed to the artist as visionary, here is the artist as deep critic: Špela Petrič, Kat Austen, Mary Maggic, Tarsh Bates to name only a few. They bring in questions of epistemology, ontology, ethics and politics, yet remain true to the science. Instead of a 'pure research' which, despite its pretension for purity, in reality exists to provide marketable products, their hybrid artistic research seeks to place both knowledge and our species, back within a planetary ecology. In a long-term sense (as opposed to market economy short-term profit goals) the approach of these artists asks questions about the survival of *Homo sapiens*. Also, their engagement with a diverse public, through their work but also new forms of media such as DIY science workshops, talks and inter-species performance broadens both knowledge and debate, as well as offering lay persons tools and knowledge for scientific literacy, within a broader ethical, ontological, epistemological and political framework.

Epistemology. Hybrid Art. Art Science. Bioengineering. Science and capitalism

1. INTRODUCTION

In her 1988 essay *Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective* Donna Haraway places natural science's claim toward 'objectivity' under a wider scope of investigation. She notes that historically science has been carried out in tandem with militarism, capitalism, colonialism, and male supremacy (Haraway, 1988: 581). While the purpose of Haraway's essay was to propose a 'feminist science' which would acknowledge and locate its bias, we think the power of the essay

itself is in this initial questioning of the possibility of an objective science, and the locating of this so called 'objectivity' within the realm of power – gender power, racial power, and above all economic power. The point here is not to overturn 'science' as some sort of belief system, but indeed to create a stronger, more accurate science, by examining and acknowledging the innate biases that are part of every action. In fact, it might be better to define science from the get-go as 'scientific method', or as a verb 'to science' – or 'do science', or carry out research by scientific method

– rather than as a noun which, in the public imagination at least, occupies territory.

That said, doing science still takes place within a world controlled and regulated by political and economic powers, whose desires support, hinder and shape what research actually takes place. Funding is probably the most important determinant of what is actually researched – or on the contrary, what knowledge is left undiscovered. There is no simple formula here though, but rather a complex set of constantly re-aligning currents that determine what resources go where. In the last three decades since Haraway wrote her essay there has been an additional point of input into this complex system: calls for inter- and transdisciplinary practice, first within academia, and more recently from several generations of artists who have sought access to laboratories and research institutions with the goal of following their own hybrid practice.

While the numbers of artists actually participating in research in scientific institutions and their influence upon these institutions is rather small – perhaps minuscule – we think it is interesting to ask here what role they might play, now or in the future, in challenging existing biases in the science, as well as opening up currently closed avenues of inquiry. But first we want to explore some of the biases in our current world that determine what is researched and how that research is carried out.

Looking specifically into late 20th and early 21st century science we would like to formulate two lines of critical approach:

- i) How does scientific research take neoliberalism as fact instead of ideology? Not only taking this questionable economic theory as fact, but how funding and 'ambition for success' determine what is researched, but negate outcomes that might contradict capitalism. And how is funding used to discipline science into following the desires of the market?
- ii) Understanding engineering as ideology: This is especially the case in life sciences, where the money and the attention are on bio engineering. The ideal of efficiency plays a major role in engineering – and in capitalism. This is often in contradiction to living systems, where complexity and redundancy play a very important role in evolutionary success. Given the limited space allowed here, we will only briefly touch on a few points.

2. HOW NEOLIBERALISM FORMS RESEARCH

Often bias in research is finessed through the framing of the research: which questions are asked, how comparisons are made. For instance, research on the effect of perchlorates on thyroid iodine uptake differed markedly when carried out

by a National Academy of Sciences panel as opposed to researchers working for companies that had the responsibility to clean up perchlorates (Michaels, 2008). All too often "tricks of the trade" are used, for example in comparison studies, such as drug trials, where "testing your drug against too low or too high a dose of the comparison drug because this will make your drug appear more effective or less toxic" (Michaels, 2008) or in a systematic review of pharmaceutical industry sponsorship where "inappropriate comparators to the product being investigated" was a major factor in outcomes favouring the sponsor (Lexchin, 2003).

Bioethicist David B. Resnick states from the start that scientific research is a form of business: "The business of science is to produce new discoveries and innovations that advance human knowledge and society." He also notes that scientists and their sponsors and institutions have financial interests related to the outcome of research. Additionally, decisions outside the scope of research (such as those made by journal editors) also influence what research is published and indirectly influence both what is researched and the outcomes of that research (Resnick, 2014).

Beyond these direct influences from the capitalist system in which scientific research is embedded, there are also a number of issues, intrinsic to the practice of scientific research such as depending on existing structures and paradigms, that influence and constrain scientists' thinking; some of these are also forms of bias. In *Philosophy of Biology: Philosophical bias is the one bias that science cannot avoid* Fredrik Andersen, Rani Lill Anjum, and Elena Rocca mention, as an example, a default position in molecular biology that entities (such as proteins) are more fundamental than processes. They also point out recent research that takes the opposite approach, and explore the tension between these two ontological positions. Even more interestingly they place this tension within the idea of paradigms and paradigm shifts as discussed by Thomas Kuhn in *The Structure of Scientific Revolutions* who had called this phase 'normal science', and argued that "the role of the scientist was to fill in the gaps in our knowledge within the paradigm. Therefore, in times of normal science, there is little need for or interest in philosophical discussions on the foundations of a subject. However, according to Kuhn, when scientists start engaging in philosophical debates about their subject, a paradigm shift might be imminent (Kuhn, 1962)." (Anderson, Anjum, Rocca, 2019).

Certainly, the radical changes within the life sciences in the last 50 years have led to a number of paradigm changes, it will be interesting to see if more interaction between biologists and practitioners from outside discipline, such as hybrid artists, will encourage and accelerate paradigm changes. This

interaction can also take place within institutions – such as the existence of SymbioticA, a biological laboratory for hybrid artists, that is itself part of the University of Western Australia's School of Anatomy and Human Biology. It can also be found in the extraordinary transdisciplinary practice of individuals such as biologist and artist Brandon Ballengée, microbiologist and artist François-Joseph Lapointe (Lapointe, 2012) or Špela Petrič and Kat Austen (both of which have PhDs, in Biochemistry and Chemistry respectively) who we will discuss later.

Capitalism has especially encouraged a fusion of biological research and engineering bringing about the biotechnological revolution of the last half century. But this marriage of disciplines also means an intermingling of ideological positions. Engineering implies the practice of changing the world to suit human needs and goals. It also emphasises the importance of simplicity and efficiency as both the 'proper way of doing things', and a form of maximising profit, the latter being a key goal of the markets. But this is in contradiction to nature and life, where complexity and redundancy play a very important role in evolutionary success. On a ground-eye level Chemist Derek Lowe has a noteworthy blog post *Engineering Biology, For Real?* that critiques the engineering view prevalent in some sectors of the life sciences. Riffing on the biotechnologists' metaphor of 'building blocks' of proteins and enzymes:

So when you casually say "Once we identify the Legos in biology" you're actually asking for a great deal, and by disguising it in terms of similarly-sized little building blocks, you actually are confusing the issue. Let's say that the Lego blocks in this case are the five major nucleotides in DNA and RNA. We've identified them. Does that mean that we understand their systems well enough to mix and match them? Well, crudely, yes – we can go in and change a genomic sequence. But do we know what happens when we do that, and why? Not so often, not at all. (Loew, 2018)

Here one can argue that the ideal of efficiency creates an obstacle in the pursuit of knowledge. Efficiency, mandated by the market, plays a major role in engineering. But this is often in contradiction to nature and life, where complexity and redundancy play a very important role in evolutionary success. Beyond the confines of research and 'pure science' the waters become murkier. Important knowledge and developments are 'packaged for consumption' by audiences outside of science (Kolker, 2016). Here science becomes not so much an approach towards seeking out and verifying the world around us, as playing a part in some grand human narrative (and often this narrative is adapted towards dominant ideologies). The farther you get from scientific publications, and into more and more

general publications, new developments like CRISPR-CAS9 are framed according to the desires of the medium and its audience. While CRISPR-CAS9 is certainly an improvement on previous forms of genetic modification scientific studies also show problems with unintended deletions of genetic materials and other issues.

Similarly, the recent hype on bioplastics attempts to offer a simple feel-good narrative to a very complex problem (Galla, 2021). Certainly, continued plastic production and the waste it produces is a major problem which will plague both our species and the planet for a very long time. But none of the 'sustainable' replacements on offer can really replace the manifold strength, versatility and current low cost of plastics. Some bioplastics present their own issues with degradability and sustainability (Zimmermann, 2020). There is no simple answer here. Some bioplastics become realisable option, but only IF governments find ways to limit competition from fossil fuel-based plastics – for instance, by substantially raising their costs. But this is probably more a matter of doing without some very convenient items (such as plastic bags, synthetic textiles, laminate furniture) and making do with plastics when we absolutely must. But it is more likely that plastic production will continue to increase well into the future (International Energy Agency (2018) because it not only enables convenience for consumers (with a probable high cost in the future) but because its production is vital to fossil fuel companies and their political and economic allies.

If doing science depends on a point of objectivity – that in turn is only a Platonic ideal – then certainly this point is situated in a maelstrom. But most scientists remain true to scientific method and adjust the state of science according to the knowledge at hand. Still, Haraway's situated knowledges presents a more honest approach to the ideal of objectivity, one that may better serve both the natural sciences and society in a troubled future. Into this situation we now look into the introduction of outside players. But unlike previous collaborators from the humanities, philosophers proposing scientific ethics, or historians of science, or science journalists, the interesting thing about hybrid artist is that they also practice science. Bioethicists are rarely 'lab-ready', bio artists, almost by definition, are. And yet they bring with them a bag of tools (the tradition of 20th century aesthetics, the discourse of relevant fields of humanities such as science and technology studies, posthumanism, anthropology, a working knowledge of electronic media) that not only compliments 'doing science', but can be of aid in locating 'situated knowledge.'

3. HOW ARTISTS HACK LABORATORIES AND ALTER THE FUTURES OF SCIENCE

We see a small group of (mostly women or non-binary) hybrid artists challenging the epistemology

of natural sciences, without breaking from scientific method or 'doctoring' the results of their inquiry. As opposed to the artist as visionary, here is the artist as deep critic: Tarsh Bates, Špela Petrič, Mary Maggic, and Kat Austen – to name only a few.

3.1 Hacking Heteropatriarchal Medical Practices



Figure 1: Tarsh Bates: *Surface dynamics of adhesion*, 2016, exhibition view Art Laboratory Berlin, photo: Tim Deussen



Figure 2: Tarsh Bates: *Surface dynamics of adhesion*, 2016, detail, photo: Tim Deussen

Artist and researcher **Tarsh Bates** is interested in the aesthetics of interspecies relationships and the human as a multispecies ecology. Her educational training comes from both the science and the arts: After doing a Bachelor of science in Biotechnology (environmental biology), she has been part for many years as a researcher at SymbioticA, based at The University of Western Australia (Many noteworthy artists received essential experience through their residencies at SymbioticA. Canadian artist WhiteFeather Hunter, for instance, is currently realizing her PhD at SymbioticA. She dedicates her biotechnological art practice to the topics of postcolonial ecofeminism, witchcraft, microbiology and cellular biology with performance, new media and craft, Hunter, 2020). There Bates shaped her artistic paths and realized both her Master thesis and her PhD. The latter is titled *The Unsettling Eros*

of Contact Zones. Queering evolution in the CandidaHomo ecology (Bates, 2013). Her collaborator, co-partner and subject of artistic attention is the micro-organism *Candida albicans*, who she is particularly enamoured with. "I am particularly interested in the microbiopolitical 'response-ability' of *CandidaHomo* ecologies because the infections attributed to *C. albicans* are almost exclusively human induced", Bates remarks. "What we do to our bodies – antibiotics, prosthetics, feminine hygiene products, dietary choices, hormone adjustment, immune suppression, biomedicalisation, latex and silicon sex toys, prophylactics, biomedical devices – encourages *C. albicans* proliferation." (Bates, 2019)

While challenging hetero patriarchal medical approaches of *Candida albicans*, she has centred this yeast in her artistic works. One of her outstanding art projects is **Surface dynamics of adhesion**, that Bates created for the exhibition *The Other Selves. On the Phenomenon of the Microbiome* at Art Laboratory Berlin in 2016 (Rapp, de Lutz, 2016). This work puts the living candida in both cultural, social, and psychological context. At the same time, it reveals essential microbiological aspects of *Candida albicans* (Rapp, de Lutz, 2016).

In this installation, for which Bates prepared the living artwork at Deutsches Herzzentrum Berlin Charité, there is a red-brown frieze on the wall is similar to a model of flocked wallpaper. "The living *Candida parapsylosis*, which is applied in five acrylic plates on agar with the blood of the artist, grows in a pattern very similar to the first drawings of its relative *Candida albicans* by the biologist Charles Philippe Robin from 1853. The formal aesthetic combination of microbiological knowledge and social-historical decoration is fascinating. Especially in the Victorian era, the awareness of hygiene increased rapidly. Thus, Bates marks a historical connection in the mid-19th century in several respects." (Rapp, 2019)

3.2 Exploring human-plant relationships





Figures 3 and 4: Špela Petrič: *Phytoteratology*, 2020, installation view Art Laboratory Berlin, photo: Tim Deussen

Being a hybrid artist with a PhD in biochemistry, internationally renowned artist **Špela Petrič** very consciously follows her dual epistemological approaches: Her work is dedicated to the Plant Kingdom as part of a multi-species collaboration exploring the ontologies, methodologies, ethics and practices of care involved in our relationship to the vegetal. The green kingdom, a central point of interest for the artist, functions on a radically different biological basis from humans: seemingly inert, literally vegetative and endowed with unexplored forms of intelligence. Yet science reveals an intricate world of mysterious chemical conversations, interspecies networks and non-centralised operations alien from our own existence. Through her radically transdisciplinary artistic research Petrič “proposes novel modes of human-plant communication, intercognition and exchange.” (Rapp, de Lutz, 2018)

An excellent example is the installation *Phytoteratology* based around thale cress, *Arabidopsis thaliana*, which Petrič lets grow from embryo form in a bath of chemicals from her own urine. The resulting plants are by consequence partially biochemical chimeras with the artist as a hormonal – but not genetic! – co-mother (Petrič, 2018). “In *Phytoteratology* blood kinship and genetic lineages give way to subtler streams of radical trans-species intermingling and category mongrelisation” the artist says. “The project embodies my desire to conceive and mother a trans-plant, to conjoin the gentle green alien, metaphysically dubbed the most primal of life forms, the barest of bare life.” (Petrič, 2016)

The artist Špela Petrič critically questions the approach of genetics. Her work can be understood as a challenge to the biotechnological canon,

whereas she proposes a biochemical inheritance instead of the genetic, which can be understood as masculine, coded and connected to patrimony and ownership. The hormonal and biochemical is fluid and therefore harder to define, crossing boundaries.

3.3 Hacking the River and Molecular Fluids



Figure 5: Mary Maggic: *Milik Bersama Rekombinan (Recombinant Commons)*, 2020, installation view Art Laboratory Berlin, photo: Tim Deussen



Figure 6: Mary Maggic: *Milik Bersama Rekombinan (Recombinant Commons)*, 2020, installation view Art Laboratory Berlin, photo: Tim Deussen

Artist and biohacker **Mary Maggic** works at the intersection of biotechnology and cultural discourse, having studied Biological Sciences and Art at Carnegie Mellon University as well as Media Arts and Sciences at MIT Media Lab. Their artistic work spans documentary filmmaking, DIY science, and public intervention and has been exhibited intensely and internationally. Their refreshing radical artistic research is essentially based on civil disobedience and uses Workshopology, DIWO and Hacking to collectively gain transdisciplinary

knowledge (Maggic, 2021; Maggic, 2018; Rapp, de Lutz, 2019).

A good example of Maggic's artistic research approach based on open science is the work *Milik Bersama Rekombinan (Recombinant Commons)*, for which the artist spent one year researching in Yogyakarta, Indonesia as Fulbright scholar (2018/19). They explored the surreal landscape of an urban Indonesian river, Code ("cho-deh") in Yogyakarta, colonized by plastic, with toxic implications for nearby inhabitants. "While water is the medium that connects us all, it is also the primary carrier of harmful industrial molecules that 'queer' both the river and the bodies of its inhabitants," states Maggic about their art project. Maggic points out the multi-faceted and complex root of the problem – poverty, lack of infrastructure, and pollution as colonialism – the artist sees an urgency to rethink toxic conditions with empathy, care, and collective survival (Rapp, de Lutz, 2020).

Maggic considers the assumption that science was 'neutral' as a cultural myth, as scientists constantly take sides. "The tools and apparatuses used in the lab are especially not neutral because they supposedly produce 'truths' while making biased cuts in the deep web of entanglements", Maggic remarks by referring to Karen Barad. The artist considers these truths rather "as fictions in order to challenge the authority of science, and show that we don't have to be scientists to construct our own fictions. That's why so much of my work and research is in do-it-together science—to see how we can produce our own tools and knowledge, and ways of seeing." (Maggic, 2018).

3.4 Watery Ecologies and Artistic Research



Figure 7: Kat Austen: *The Matter of the Soul* (2017 – ongoing), exhibition view Art Laboratory Berlin, photo: Tim Deussen



Figure 8: Kat Austen during the workshop *DIY Hack the Panke: Microplastics*, Art Laboratory Berlin, 2018, photo: ALB

Berlin based artist **Kat Austen**, who holds a PhD in Chemistry and has a background in science journalism, combines scientific knowledge, hacked equipment, and ethnographic research. Central to the artist, who is one of the founding members of *DIY Hack the Panke* (Rapp, de Lutz, 2021), is the experience of living in a time of dramatic climate change, such as the melting of the Arctic ice shield. Climate change is the most essential aspect she evolves her approach and artistic research around – and with this she is keen on finding and creating empathy for a planet in crisis. In her project *The Matter of the Soul* (2017 – ongoing), which we had exhibited in our exhibition project *Watery Ecologies* at Art Laboratory Berlin in 2019, she examines the impact of climate change in the Canadian High Arctic through a multimedia sound work, sculpture, and performance (Austen, 2021). Here Austen combines scientific knowledge, hacked equipment and ethnographic research with a strong aesthetic approach. Crucial to the work is the lived experience of being in a time of melting in the Arctic (Austen, 2021).

During the last few years Kat Austen has also been working on the subject of microplastics in the wild, first in sea life, then in urban waterways, and more recently in trees. An important part of her artistic research and practice has been an evolving series of workshops in collaboration with scientists, artists, and DIY science practitioners (Austen, MacLean, Rapp, de Lutz, 2018). In context of *DIY Hack the Panke*, together with microbiologist Joana MacLean she realized the workshop *(Un)Real Ecologies and Microplastics* several times (between 2018 and 2020). In the workshops Austen and MacLean, together with participants, examined the 'plastisphere' of the river Panke (in Berlin Mitte) and observed how organisms interact with plastic, including a closer observation of the collected particles using microscopes to get a closer look at plastics and living creatures.

In the online event *Microplastics and Coexistence* with Austen and MacLean, we discover their art and science research on microplastics and become aware of the potential of open format DIY/DIWO approaches mediated by Workshopology: “[They] allow us to rediscover our agency in the world, the ability to research and make sense of the world is to have agency within it,” remarked Kat Austen, “and when you are aware of your agency you are more able to and likely to act, and to act in a constructive way that will change the problem you are looking at. And so, for me, the development of these DIY techniques is a political act.” (Austen, MacLean, Rapp, de Lutz, 2020). This is only one of numerous examples we could give to show that workshops can be understood as an artistic performative medium for the 21st century – not only interactive but also participatory.

4. FINAL NOTE

As we have shown in this short paper, hybrid artists propose current and essential questions of epistemology, ontology, ethics and politics, refreshingly transgressing the political borders of research – yet in their practice they remain true to science. Instead of a 'pure research' which, despite its pretension for purity, in reality exists to provide marketable products, hybrid artistic research seeks to place both knowledge and our species, back within the context of planetary ecology. In a long-term sense the approach of these artists asks vital questions about the survival of *Homo sapiens*.

Be it challenging hetero-patriarchal medical practices (Bates, critically exploring human-plant relationships (Petrič) as a means of discussing the epistemologies of science, hacking the river and molecular fluids (Maggic) or providing research on watery ecologies (Austen) – artistic research shows an impressively versatile approach to 'doing science' beyond the arena of short-term economic interest. Additionally, their engagement with a diverse public, through both their artwork and new forms of media such as DIY/DIWO science workshops, talks and inter-species performances broaden both knowledge and debate. The workshop as artistic performative medium for the 21st century radically broadens the borders of knowledge production. These new formats also offer the lay person tools, structures and impetus for scientific literacy, within a broader ethical, ontological, epistemological and political framework.

Finally, a strong awareness of discourse enables hybrid artists to situate their own knowledge (which includes relevant fields of the humanities and posthumanities) in a way that not only compliments 'doing science', but can also aid in building an awareness of issues of 'objectivity' and 'situated knowledge' in the natural sciences.

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Content Aware and Other Case Studies: Museum of Synthetic History

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With the rise of artificial intelligence and related computational tools in everyday dealings with knowledge organisation, production, and distribution, incl. for example archives and history-related applications, we're concerned whether these computational methods 'colonize' and fundamentally change our common approaches to what constitutes studying and knowing a subject matter. We will unpack upon these concerns, looking at phenomena such as a lack of completion and categorisation in biodiversity archives, or new methods of creating artificial fossils as ways of filling gaps within historical datasets and potentially narratives. We also call back into how ontological architectures of computer science have emerged and how they defined ways in which knowledge is accessed. Via the examples of various case studies and thought experiments, the paper tries to examine the initial concern and predict its potential consequences, building upon the question as to what degree machine-learning-based approaches can augment our methods of analysis not just in history but in cultural behaviours.

In other words, how might computational models of ontology be producing an epistemological shift within the quality of knowing by imposing a knowledge system of references, linked nodes, hashtags, and databases that are never entirely complete in representing subjects they are set to define. Thus, asking if we shall hold on to our approaches of comprehension of things and their emergence or instead succumb to the generative, on-demand, a click away, always-at-your-fingertips forms of knowing and comprehending?

Domain Ontology. Computer Science. Meta-Archaeology. AI.

1. INTRODUCTION

"The whole age of computer has made it where nobody knows exactly what is going on",- President-Elect Donald Trump on the 28th of December 2016.

In a room of the National Archaeological Museum in Athens, people walk alongside stone sculptures showing scars of their excavations; Stones, earth, clay, metals all illuminated by blue light, stored in glass vitrines. At the back of the exhibit, broken into small fragments lie calcified pieces of such metal and stone. A circular structure discoloured by seagrass, eaten to pieces by time and dismantled by humans so eager to preserve it in the name of knowledge. The Antikythera Mechanism, put in place after its discovery in 1901, dragged from the bottom of the sea to be displayed to audiences seeking to understand the past. We lean on this display of objects ripped out of time, as our crutch of engaging with history. Once we find them, they become proof of historical occurrences and on them, we mould our new understandings. The discovery of the Antikythera Mechanism introduced

new timelines of the origin of mechanical operation structures, while its concrete purpose still remains unknown. Our 'history' as a notion of understanding the past and the current seems to be object-based on documentational 'proof' which separates 'truth' from 'speculation'. However, what if the creation of these objects were no longer a process of seeking blindly? What if the unknown was to be fulfilled by an analysis of the known?

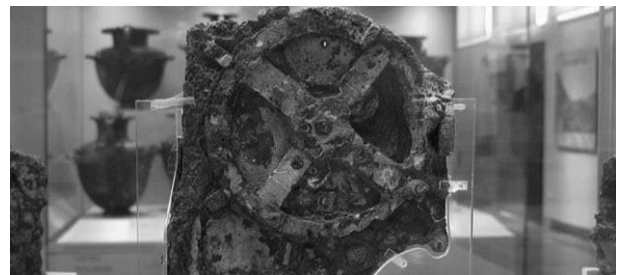


Figure 1: *The Antikythera Mechanism is in the collection of the National Archaeological Museum in Athens, Greece. Tilehamos Efthimiadis, Wikimedia Commons / CC by 2.0*

In this text, we are suggesting that there is an epistemological shift in how machine accelerated logistics of information affect the formation of knowledge, archive, and historical record. There are many various ontological theories within the science of being, although not all of them have become so increasingly and forcefully imposed on designing our infrastructures of knowing, learning, and doing, as a set of ontologies upon which computer science was initially set and continues to operate today. Taking this argument further we find it interesting to ask whether the following holds true: a set of ontologies that emerged in computer science colonise other ontologies and render previously established ones obsolete by introducing computationally accelerated ontological structuring and logistics of meaning. Computational ontologies are interdependent with the properties of computational systems, such as scalability, accessibility, interoperability, and others. What are the effects of these properties on how we structure, record, and acquire knowledge? We find it important to look into what issues they may project in relation to studying subjects through their representations in a form of data accessed and delivered via the means of computational networks, i.e. outputs derived by machine learning systems or simply web search queries.

Many of the modern machine learning developments were designed as means for automation of information processing while some of them also became means of knowledge production on their own. As opposed to the conventional ideas of knowledge such AI models hold a peculiar quality that can be described with a somewhat capacious word: **programmability**. These precisely programmable systems can generate information upon demand and thus can be seen as forms of programmable knowledge on their own.

What seems ontologically challenging can be inquired via the following question: in which context does the difference hold importance between, let's say, 'a **stone image**' generated by a GAN model (General Adversarial Network) capable of generating thousands-a-second of hyper-realistic images of subjects it was trained on, or between a random image delivered via Google search query with the "**stone**" keyword, or a notion of a **stone** within our collective or individual memories. And can any of these derivatives be less ontologically corrupt and thus more "real" than the others? A question similar to the one asked by Joseph Kosuth in his 1965 iconic piece "One and Three Chairs" (Kosuth 1965). He conceptually challenged forms of subject representation. And we believe that a few radically new ones have emerged since the 1960s.



Figure 2: Larry Aldrich Foundation Fund © 2022 Joseph Kosuth / Artists Rights Society (ARS), New York, Courtesy of the artist and Sean Kelly Gallery, New York

2. ONTOLOGICAL TAKEOVER

Ontology seeks the classification and explanation of entities, as a branch of philosophy, it deals with questions of origin and existence, but the term has found a modern purpose within the context of AI. Containing the idea of a shared vocabulary, definitions of concepts, and the relationships between them, ontology facilitates an understanding of the architecture of AI systems. Tom Gruber, an American computer scientist recognised for foundational work in ontology engineering in the context of AI, in his 1993 paper "A *Translation Approach to Portable Ontology Specifications*" says, "For knowledge-based systems, what "exists" is exactly that which can be represented." (Gruber, 1993). In other words, in a knowledge-based program, vocabulary **represents** knowledge itself. Computational ontology functions as a database, a structure of information organisation, it is not only the definition for a branch of philosophical discipline but an actual architecture, that largely governs logistics of knowledge and meaning. Computer system ontologies rely on entities such as hypertext, hyperlinks, hashtags, metadata, ascending and descending orders, hierarchies of access, file systems, variables and extensions, executables and more, they are devices and elements of the architecture of knowledge-organisation systems through which they deliver, extract, produce and engage with knowledge itself. Do such developments also bring a change in how we as communities' access and engage with historical knowledge? The answer seems, inevitably, yes.

A reasonable concern to follow, would be how this might change us in return? Some studies suggest an effect of a feedback loop in which the use and implementation of tools create a change in human behaviour. Research at Emory University provides an example of a feedback loop that is intrinsically epistemic: it shows that neural circuits of the brain underwent changes to adapt to Palaeolithic toolmaking, thus playing a key role in primitive forms of communication (Stout 2016, 28-35). Projecting these dynamics onto various forms of computational accelerated forms of engagement with knowledge,

we may observe a peculiar relationship in which human interactions with knowledge change to develop structure patterns similar to those of computational ontologies, i.e. hashtags, hypertexts and such. If concerns around the philosophy of language helped us to better learn the correlation between the language, meaning, knowledge, perception, and the world, we may suggest that we will soon need the study to see how computational semantics and generative models affect them too.

Following this thought, the introduction of a network-based knowledge access model can be traced to have brought a database approach to learning behaviours. This could be attributed to both the introduction of the mere accessibility of the vast pool of information and knowledge provided by the internet as well as the methodology through which we have learned to navigate this pool. With knowledge at our fingertips have we been adapting Machine-derived behaviours, like navigating architectures of knowledge through keywords, hashtags, and reference ontologies rather than internalising it in ways our evolutionary biology suggests? The way information is distributed is defined by the current state of logistics of information technologies. So, what might it mean for attitudes towards information processing and engagement with historical objects when we regard knowledge as something to reference rather than to learn? The focus then lies rather in the development of the quickest architecture for navigation of information rather than infrastructures of passing down knowledge. In this context of a high-speed information highway architecture, we want to look at the process of computational analysis of data and information in particular, historical data, and the growing use of AI investigation tools applied to historical archives, which are described in this text, and these machine-learning outputs of artefacts of the natural sciences as objects of knowledge in this altered state information classification.

So rather than considering how our human interactions with knowledge have adapted in isolation, we consider how our interactions have adapted due to the inclusion of AI mechanisms which in turn rely on ontological knowledge models. AI as an algorithm is a perpetual learning machine, everything else that is gained from it is secondary-its primary function is to learn. Seeking knowledge for seeking's sake.

It must be noted that there are many types of classified AI categories, including Machine learning, Deep learning, Natural language processing, Computer vision, Explainable AI, reactive, limited memory, theory of mind and others. Some of them are ontology-based, while others are self-learning systems. For example, machine learning-based systems use statistical classification of patterns to compare what they have learned from training sets

to new data, to determine whether it fits a pattern. Whereas ontological architectures of AI are very different, "Ontology-based AI allows the system to make inferences based on content and relationships, and therefore emulates human performance." (Earley 2020). Considering such ontological dynamics, we must turn a critical eye towards archives and databases, and the biases that are already embedded in them, as well as towards the motivations and intentions behind the applications of computational knowledge production. The 'Museum of Synthetic History' presents a case study of such critical interventions.

3. MUSEUM OF SYNTHETIC HISTORY

To display the consequences and explore the possibilities of an epistemological shift in machine-lead information architectures, we engage with the 'Museum of Synthetic History', which is an artistic research project led by Egor Kraft and forms the continuation of the existing project CAS, as a thought experiment, looking at biodiversity and archaeological practices surrounding fossils. We speculate on the role of AI in the analysis and creation of archive data and highlight the concerns which ought to be regarded when using AI for nature-science research. The 'Museum of Synthetic History' as a research project becomes a visual, spatial, and archival output of this investigation, as both: metaphorical imaginations of a museum space filled with synthetic pieces of history created by AI-palaeontologists and real collection and archive of such outputs to further the investigation into the consequences and the biases of the implementation of contemporary problematics in biodiversity and natural science fields.

3.1 On Biodiversity

The Earth's estimated biodiversity is in the order of 10 million species, from which only 10–20% are currently known to science, while the rest still lacks a name, a description, and basic knowledge of its biology. (Krishtalka and Humphrey 2000; Wilson 2003; Costello et al. 2015; Sampaio et al., 2019) The biodiversity extinction crisis is an alarming trend across related fields of science. The rate of biodiversity loss is accelerating, leading to a tendency for "Big Data" production on species observation-based occurrences instead of specimen-based occurrences as a way to map and protect biodiversity (Troudet et al. 2018). During 300 years of biodiversity exploration, many organisms were collected, catalogued, identified, and stored under a systematic order (Sampaio et al., 2019). However, many samples there are, we're barely reaching a quarter of well-documented observable species on Earth, which form the basis of this data-driven research. The consequence of a lack of this knowledge is the loss of irreplaceable sources of

high-quality biodiversity data and the proliferation of misidentified records with poor or no corresponding data. All of which, in turn, results in a doubtful source of knowledge for future generations. (Troudet et al. 2018; Sampaio et al., 2019) In other words, in writing the history of life on earth we're currently limiting ourselves to recycling only the existing data in a feedback loop machine of widely available and trending computational methods, such as data-driven and AI-powered research technics. This is an alarming trend in varying fields and within any application of AI since a dataset will never be truly complete.

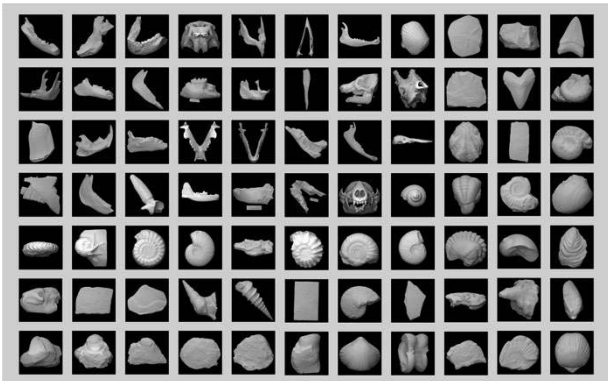


Figure 3: Fragments of a custom-produced dataset of 3D scans of paleontological findings, including fossils, corals & other biogenic items

3.2 Artificial Fossilisation

the University of Bristol, under the supervision of Jakob Vinther, Evan Saitta and their team have been conducting research into artificial fossilisation. The aim of their developed methodology is to aid in the process of finding fossils in order to continue the aim of completing our archives of biodiversity and understanding of paleontological history by reverse engineering fossils.

Their published experimental protocol may indeed change the way fossilisation is studied as they've unlocked methods to manipulate time, not the least force behind the creation of a fossil. Through specially developed technics directed to produce artificial fossils, the research group managed to synthetically compress millions of years of natural processes into a single day in the lab. Those artificial fossils are synthetic by origin, yet visually indistinguishable from the genuine ones, and as material analysis reveals structurally very similar according to the claims in their paper published in 2018 (Saitta, Kaye and Vinther, 2018). 'Artificial maturation', is an approach where high heat and pressure accelerate the chemical degradation reactions that normally occur over millennia when a fossil is buried deep and exposed to geothermal heat and pressure from overlying sediment. Maturation has been a staple of organic geochemists who study the formation of fossil fuels

and is similar to the more intense experimental conditions that produce synthetic diamonds.

"The approach we use to simulate fossilisation saves us from having to run a seventy-million-year-long experiment," reported Saitta, "We were absolutely thrilled. We kept arguing over who would get to split open the tablets to reveal the specimens. They looked like real fossils - there were dark films of skin and scales, the bones became browned. Even by eye, they looked right." (Starr 2018; Field Museum, 2018)

In their own words they nick-name the procedure 'Easy-Bake fossils', gamifying objects of history as their purpose becomes another one entirely, specifically that of a tool. They describe the possibilities of their approach as ones of reverse engineering. "Our experimental method is like a cheat sheet. If we use this to find out what kinds of biomolecules can withstand the pressure and heat of fossilisation, then we know what to look for in real fossils."(Field Museum, 2018).



Figure 4: Artificial Fossil. Photo courtesy: Saita et al./*Palaeontology*, 62(1), pp.135–150 (2018)

In this case, archaeological practice becomes a matter of knowing what to look for as opposed to trying to find the undiscovered. From Saitta's statement we understand that in order to combat such problematics like the biodiversity crisis and similar problematics in the paleontological field they intend to attempt to work backwards; To take an organism or marker which is currently in existence, create an artificial fossil of it and review what remains after over a millennium of ageing processes. The remaining markers then become guidelines of what to search for and if found become a new string of the historical narrative of this planet.

Peculiarly we are now faced with a type of 'reversed archaeology', where history is predetermined in a lab and fieldwork becomes a matter of finding the piece which fits the artificially created template. A painting-by-numbers type of paleontological puzzle, which leads to yet another type of recycling of knowledge as opposed to random discovery through seeking; Similar to the

problematics which occur when attempting to expand biodiversity data using AI technics on an existing dataset. The consequence of machine-learning knowledge production is that AI approaches questions with the intention of solving them, no matter how much force it must apply to mould the existing data into a solution to the set task. How big is the gap between a DeepDream plate of spaghetti and meatballs morphing into a hellscape of dogs as AI constructs the hallucination with brute force, to archaeologists creating 'easy-bake' versions of fossils and scouring the earth for their counterparts potentially blind to the unknown and undiscovered data around them?



Figure 5: DEEP DREAM IMAGE; Artist unknown:
<https://www.stichtingopen.nl/does-android-dream-of-electric-dogs-does-google-deep-dream-reveal-anything-about-psychedelical-hallucinations/>

3.3 Synthetic Objects

The 'Museum of Synthetic History' builds on these ideas. Preoccupied with the issues of biases in AI-driven research practices today, the 'Museum of Synthetic History' challenges previously established AI-based methodologies, against data from prehistoric and geologic time archives including first stone tools, writing systems, paleontological archives of fossilised plants, organisms, and other biogenic data. How different would an AI-composed or, ontologically speaking, - synthetic plant fossil seem as opposed to an actual sample from prehistoric floras? Or will AI-manufactured proposals of newly rendered specimens be distinguishable from the remaining millions of actually existing species that never made it to get scientifically catalogued? And, finally, what would that mean to actually produce such objects involving artificial fossilisation technics in terms of philosophical concerns around ontology, agency, and materiality of organic and inorganic subjects? Or what would bone remnants of prehistoric species look like if they were algorithmically composed and then 3d-printed in calcium phosphate? Such engineered bone tissues or artificially matured stone imprints may come across as indistinguishable from genuine paleontological findings.

What new domains of natural sciences will emerge when the history and ontology of floras, faunas,

single-celled organisms, yeasts, moulds, rocks, minerals and those of unearthly origin, is studied by algorithmic forms of knowing? In other words, we can even go so far as to say that the project 'Museum of Synthetic History' is a thought-object experiment into simulating a situation in which the agents of artificial, automated reasoning committed to the conceptualisation of their own emergence and production of their own history and artefacts.

4. GENERATIVE HISTORY

What artificial maturation experiments, biodiversity problematics, and thought experiments into a 'Museum of Synthetic History' have in common is that they look into the ways data can be produced to fill in what we may define as blank spots in the 'dataset' of our entire history, attempting to create a more 'complete' picture of a subject matter. We are confronted with two radically different ontologies: one archive-based, documental vs. a generative one, the latter intends to produce outputs on demand, whereas the former is rather static and linear. The former is perhaps how history is meant to be, isn't it?

Let's for a second imagine a present that is in constant shift and flux, shaken by earthquakes of change that occur with every newly artificial fossil, created as an algorithm runs a dataset based on the existing documented nature-history archives. A generative historical ontology suggests that its expansion of knowledge of itself occurs through an analysis of itself. Instead of the unknown- we are presented with an ever-shifting 'known', which duplicates into grotesque copies of itself, barely recognisable yet copies all the same. In other words, throughout this text, we have confronted ourselves with structures of how an understanding of paleontological and nature-history sciences operate and how these methodologies are being augmented through the incorporation of computer sciences. There is nothing speculative about the incorporation of these new methodologies. However, they lend themselves to the imaginings described above. Does a generative history position us inside of a generative present, and would such a present look like one described above? We do not know, however imagining such scenarios allows us to visualise the biases and problematics as critical thought when engaging with computational knowledge-producing agents in natural science and historical data analysis.

In concluding thoughts, at the beginning of this paper, we posed the possibility that the very manner in which one interacts with knowledge has shifted or whether our access to history itself has changed. The case studies and experiments explored above primarily deal with historical archives. When looking at generatively created

objects we are looking at a history created in the present. When such methods are being used within a historical investigation, we are rendering archives of the past in real-time. This paradox could be well observed within the case study of the 'Museum of Synthetic History' experiments in which archaeological findings are produced by AI systems which are then artificially matured via physical manipulations. Such objects turn out to be not only illustrations but also case studies of described above problematics. We might also go further and introduce a term - **'post-archaeological object'**, an object which is by all of its measurable material qualities stands for an archival object, but in reality, has been generated only to match these measurable material and symbolic qualities. We can think about the "Ship of Theseus" and whether an object replicated down to its molecular structure it could still be considered the same? Or we might be tempted to revisit thoughts and ideas on such notions as genuineness, authenticity or even Benjamin's aura, as he argued that the trace of an aura and history of an object may only be brought to light by the chemical analysis (Benjamin, 2003). A criteria which the artificial fossil fulfils, creating the conundrum of this explorations. However, this was not the aim of this text. Instead, here we wanted to highlight the urgency to understand the epidemical nature of somewhat forcefully imposed computational ontologies and their effects on our relationships with the past.

These imaginations are neither dystopian nor utopian; They in no way intend to devalue the richness and incredible applicability of various domains of computer science; however, we suggest that at least some of this criticism and reflections are kept in mind when designing new tools and methods for computational utilities in natural sciences and historical analysis. The 'Museum of Synthetic History' may be seen as a device for critical thinking towards a future in which the past, as in history, is generative, synthetic and merely a-click-away computational output.

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Rogue Things, Biotechnical Thresholds, and Post-cybernetic Museums: A Critique

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In this paper, I will propose that if we begin to understand museums as mediation-technologies then they could be seen as producers of thresholds that may navigate between anthropological problems and biotechnological umwelt. The question is: who navigates the archive of thresholds? A question which leads to the framing and naming of the post-cybernetic museum.

Rogue Things, Asperitas Clouds, Biotechnical Thresholds, Post-cybernetic Museums, Zero Dimensions, Lightning Museums.

1. INTRODUCTION

This paper is departing from an on-going research collaboration together with a collective of artists, curators and theoreticians focused on the topic and problem of evidencing post humanity. It is from here my investigation of and critical reflection on rogue things and biotechnical thresholds, as well as the notion of the post-cybernetic museum, begins and is made operational. The issue in general is the how to navigate a blurred field of research into invisible and intangible nonhuman 'phenomenon' (in want of a better word) through a limited and faulty 'psychology of intuition' as well as evermore neo-rational and over-hyped 'ideals of science'.

In the following, I will operate a soft version of the method of the French philosopher Michel Serres. This method oscillates the writing and presentations of a problem 'between the ideals of science and the temptations of literature'. He uses metaphors and other poetic figures to reveal what Serres terms as 'the third element', the overlooked and invisible element of communication – and indeed, communication itself – which is what renders boundaries and thresholds permeable. It is through the appropriation of Michel Serres' method of revealing thresholds by poetic narrations I will be framing and investigating 'rogue things' and what they (possibly) do (or do not) do specifically in the context of museums as (metaphors and symbols of) kaleidoscopic architectures and spaces of communication of knowledge and histories about art and cultural/natural heritage.

Building on the most recent writings by the French philosopher Michel Serres, I propose that it would

be possible to see alternative prospects for the museum where it operates beyond the technological media reveal (and beyond being a 'visualization technology' (Whitehead, 2012) and toward a strategy of para-curating. Here, I argue, inventive and moral obligations of the posthuman crisis threatening our planet may generate alternative histories of biotechnological ideas and experience enabling museums to 'operationalize' archives of rogue things and the biotechnical thresholds they operate.

2. BIOTECHNICAL THRESHOLDS?

Paradoxically, we are facing dealing with, on the one hand, a rationally detected problem, climate change, created by rational societal dynamics - oppositional energy systems and economic philosophies, cold and hot wars - which have failed; and on the other hand, a circumstance where the solutions are not the 'neo-rationalism' which currently is dominating the rhetorics of Western democracies. How and what is framing our judgments will also be that which controls our systems of perception, structures, and temporal imaginaries?

In the Wood Museum (2018), Christian Yde Frostholm writes the trees into a new kind of cultural history in the absolute periphery of the human radius of attention. In the Lightning Museum (1982), Per Højholt lets the museum as momentary memory event arise and destroy itself as weather events, humanity exposed by biotechnological imaginations

Operating in a transforming topological space, the museum as medium is oscillating between para- and epi-genetic tendencies of bio-technical memories,

histories, and catastrophes. Para-curatorial methods are needed to operate and navigate the externalized objects and the structural epi-topology of the digital culture of zero dimensions.

In 2019, Christopher Whitehead, English theoretician of museums, found himself in southern Spain, invited by the Spanish National Museum to work on a sound walk about the remains from the Califate culture in the region. While working on the project, several boats with refugees arrived at the shores, and he witnessed the chaotic and dramatic situation which ensued – boats full of people being turned back or, if shored, rounded up and placed into camps. While this was happening, the Museum project aimed at informing about European cultural heritage of human rights, freedom of speech etc. continued regardless. This made Whitehead reflect on the status of boundaries and bias in the idea of European cultural heritage – and what constitutes the museum as a fundamentally European construction?

The Austrian art mediator and curator Nora Sternfeld has suggested the formation of *para-museums*, which should serve as spaces for de-learning and re-appropriation of existing modes and conditions of knowledge; spaces that would enable the visitor to renegotiate his/her understanding of the world, art, history, and the future. According to Sternfeld, one can speak of a crisis of representation in Western museums¹ where heroic tales of the (primarily national and colonial) pasts are still constructing the temporal visit and visualization technologies of the exhibitions. She emphasizes the importance of learning one's own strong narratives and patterns of interpretation to make room for new, curious encounters:

What if the museum were not defined by collecting, preserving, researching, and mediating (and thus by the national, institutional colonial project of Western Enlightenment), but on the transgenerational handing-down of knowledge - knowledge of, with, and through objects and matter? What if the museum was a 'space of remembrance', a 'contact zone', or a 'third space' in which to share narratives and history? (Nora Sternfeld, 2016, 158)

Michel Serres proposes there is hope in the face of posthuman crisis. According to Serres, we are 'condemned' to become more inventive, intelligent, and transparent because we all share the 'new universalizing' mobile screen. Therefore, he proclaims that the days of repetitive work are over and ends a talk with...

...a catastrophic word: new technologies have condemned us to become intelligent. Since we have the knowledge and the technologies before us, we are doomed to become inventive, intelligent, transparent. Inventiveness is all we have left. The news is catastrophic for the

grumpy, but it is exciting for the new generations because the intellectual work is obliged to be intelligent and not repetitive as it has been until now. (Serres, 2007, 138)

In-between Nora Sternfeld's idea of a para-museum and Michel Serres' ambiguous catastrophic word the contour of a post-cybernetic museum emerges. It is through the exteriorization of our consciousness in technology and media and our participation in media ecologies that our very experience of temporality arises in the first place (Stiegler, 1998; Lund 2019). The museum should be seen as playing an essential role in refining that experience, as well as revealing it as a 'biotechnical' threshold. With the increasing presence of network technologies and infrastructures, the need for critical methods of reflecting the experience of biotechnological life has only intensified and accelerated. I would claim that there is a need for attending to the 'boundaries' of memory, temporality and screens, and what conditions those boundaries as biotechnical thresholds. Post-cybernetic methods are needed to negotiate between the catastrophes of the past, and those of today, that are structuring our lives and modes of knowing.

3. THRESHOLDS, BORDERS, BOUNDARIES...

In April 1986, I was living in France. Phoning home from a phone booth, I found my parents very distraught: there had been an accident on a nuclear power plant in a city in Soviet Ukraine, discovered only because the radiation was measurable in Scandinavia. In France, there was no trace of that story – and in the days following this and other phone calls, the French authorities were seemingly attempting to ignore that anything had happened maybe hoping it would 'blow over'. However, after several days, and the accident in Chernobyl could no longer be ignored, they announced that people in France should not worry because the radiation had not crossed the French borders... and that nuclear power plants, of which there were and are many in France, were 'absolutely safe'. A message that, even back then, made me pause and question the status of borders and boundaries in the face of invisible nonhuman forces.

What is the status of such 'rogue things' and events and what condition them as biotechnical thresholds in a cultural context?

How could the museum become a medium of the experiences of posthuman crisis? Is it possible to see the focus of the museum shift towards an innovative mode of possible better futures for the world in the face of accelerating and enframing technological mediation (Heidegger, Zizek, Kittler, Stiegler)? Or, alternatively, would it be possible to see the invention of a museum emerge based on a different view of technology? One, in which human

agency and embodiment (Hansen, 2004, 589) (Serres, 2007) is in play in new and alternative ways?

What are the connections between the idea of posthumanity seen as essentially a biotechnical lifeform (Hayles, 2010, 24; Mitchell & Hansen, 2010), and the museum understood as medium and 'visualization technology' (Whitehead, 2012) 'revealing' historical things and ideas in anthropological, structural, and phenomenological ways (Heidegger, 1946; Allen, 2019)?

According to media theory (Kittler, 1999; Flusser, 2011; Stiegler, 1998; Hansen, 2004), because we organize our social enterprise by using technologies and media it is possible to assume a fundamental connection exists between our use of technologies and media which is conditioning our ability to relate to the nonhuman world and our experience of posthuman crisis.

Cape Canaveral, 1986: The Challenger accident. According to Michel Serres (1986) accidents and disasters transform the imaginings of machines and humans and what conditions their relations and existence. Machines and humans are somehow equalized without the possibility of (full) control of external nonhuman events and processes.

Thus, it is relevant to ask how the state of technological mediation, and biotechnical lifeforms, through the increasing proliferation of network technologies that frame and affect our experiences of the world, each other, and ourselves... how, in short, all these things affect and challenge the museum as medium of posthuman crisis? Is it possible to envision a paradigmatic turn in the way museums operate with history and cultural remembrance? And how would that turn look like?

4. ROGUE THINGS?

There are three main ways in which 'things' have been traditionally understood across the ages of information-gathering in museums:

- i) things as a gathering of properties ('bearers of traits') (anthropological)
- ii) things as unities of a sensory manifolds / multiplicities (phenomenological)
- iii) things as syntheses of matter and (rational) form (structuralist)

Each of these approaches delineated the character of things within a certain paradigmatic conception of the human-world relationship, and hence of the role of the museum (and archive).

Famously, Heidegger criticizes these traditional understandings and look instead at, what he then calls, things in themselves, tools, and works of art. Things in themselves (dt. 'Dinge an sich') are those material entities that have not been subjected to

human intervention (a stone or a tree). In contrast to this, tools and works of art are akin because they are crafted by human hands and, thus, all artists are, in a sense, artisans.

Every work has a 'thingly character' (Heidegger, 1977, 3). Yet there is something in the work of art that makes it irreducible to a mere artefact (such as a hammer), and that puts it 'over and above its thingliness' (ibid.). One of the effects of the appearance of the work of art (we are still with Heidegger) is the disturbance of everything around the work. The work estranges us from the immediate circle of beings in which we believe ourselves to be at home. We think that things are familiar, reliable, and ordinary. Yet, the work of art shows us that 'the ordinary is not ordinary, it is extraordinary, uncanny' (Op.cit., 31). 'What presents itself to us as natural (...) is merely the familiarity of a long-established habit which has forgotten the unfamiliarity from which it arose' (Ibid, 7).

In more recent years, the critique of the traditional positions has gradually been revisited under the impression (and pressure) of an accelerating presence of, and constantly transforming, media technologies and their infrastructures. However, the basic theoretical positions of the key-institutions of information gathering, sensing, and synthesizing have not co-evolved – they are very much still harboring a conditioned selection of anthropological, phenomenological, and structuralist positions². The mediated threshold of things and information in museums remain largely unreflected despite the radical transformation of conditions and ideas of culture and society surrounding the museum as medium – not only as a communication apparatus (Benjamin) and a constructed 'milieu' and 'transducer' of subjects, things, and information (Stiegler). But more acutely as the medium of posthuman things and (the experience of) posthumanity. In this way, it is possible to make the claim that works of art are not alone in revealing the unfamiliar in the familiar; nonhuman processes and events are increasingly uncanny, to an extent that it is possible to see art works becoming 'something else' (in the techno-cultural entanglement of capital and power) whereas 'something else', then, is communicating the unfamiliar in the familiar in nonhuman processes and events.

An example could be what we normally would regard as the familiarity of looking out at the sky in the morning during coffee, or in the evening when driving home from work. But the familiar clouds reveal unfamiliar nonhuman processes. Here, in the dramatic shape of a 'new cloud' in the sky, in my country spotted for the first time over Copenhagen on 25 August 2021. In 2017, this new cloud was first seen over the plains of the prairie in Mid-western USA and subsequently named 'Asperitas' clouds by Meteorologists. The name

translates approximately as 'rogue' or 'roughness', or as it were, we could name them rogue thermodynamic things. The clouds are closely related to 'undulatus clouds', but it is yet unclear to rational science³ more specifically how and why they even appeared.⁴ They seem to be weather and climate change phenomena, out of the range of rational science as well as beyond our capabilities of interpreting and understanding. Such rogue things, uncategorized clouds, produce a threshold between scientific categorization and literary imaginings.

What we sometimes seem to be left with are attempts to solve anthropological problems in a biotechnical cultural setting, but this is not enough if we are to grasp the real ontological challenges of art and technology according to Mexican philosopher Maria Antonia Valeria Gonzales (Gonzales, 2019).

Comparing Nietzsche and Ortega Y Gasset, Valeria Gonzales claims that there is a move from troubled self-understanding and -exploration towards machine visions in the perspective of art and technology. Ortega: understanding technology is a condition of what is human. Mapping out how technology was and is being used; and how technology itself is being produced, and what it is in turn producing. Thus, technology should not be reduced to its machines, Valeria Gonzales claims, but we should look at technology from where it produces its thresholds.

I would like to further this notion and turn it into a para-curatorial question: how did museums as medium produce certain kinds of thresholds? One way to approach this would be to look at the genealogy of thresholds produced by technical images.

In 'The universe of technical images', the media philosopher Villém Flusser outlined a differentiated scheme of embodied mediations of shifts in topological space that have in turn dominated evolutionary history of human culture and thus also the forms of sensory perception that have been possible in certain 'dispositive' periods. This Flusser presents as a countdown of the reduction of spatial dimensions that have been available to humans' experience of the world: 4, 3, 2, 1, 0. At the first four-dimensional level, human is not really human yet because he is completely immersed with his whole body into his environment. The next three-dimensional level is dominated by her hands that grab things and change them, like an evolutionary sculptor. This is followed by an image phase in human culture in which two-dimensional images dominate, and human sight is primary. Then follows an evolutionary dispositive of linear one-dimensional texts and the work of primarily human fingers. And finally, in the zero-dimensional world of calculated and computer-generated technical images, a secret black box world of discrete numbers, dots, bits and

pixels, we are operating the embodied biotechnical dispositive at our fingertips. (Flusser, 2011).

Flusser's sketch of the historical changes of the dispositive conditioning of human's biotechnical sensory perception covers several thousand years. His critical description of the historical being of man in the world could be seen as the description of a movement from not influencing or producing anything at all in the phase of four dimensions, to a (current) historical point degree zero, where man herself creates everything s/he experiences and thus finds herself in a dimension-deprived experience-universe. A world in which humans are both the sender and the recipient of their own myths and constructions.

In continuation of this notion, it would be possible to ask critical questions about the status of the contemporary museum as a medium of experiencing the history of biotechnical lifeforms (and the history of experience as biotechnics through transforming diapositives of technical images). What constitutes a museum of zero dimensions?

Returning to Michel Serres, this notion of accelerated evolution of sensory perception of zero dimensions resonates with, I would claim, what he calls 'a technical exo-Darwinism':

Writing and printing were memories, and today you have better memories than your predecessors. Indeed, we have lost our memory subjectively, but it has externalized objectively. I call this phenomenon 'technical exo-Darwinism'. There is externalization of objects, and these objects evolve in place of our bodies. You see that what you once took for a cognitive faculty, memory, is not a given and permanent cognitive faculty, but that it depends on the medium. (Serres, 2007, 133)

Thus, it could be proposed that, following the different topological setting of knowledge and human existential expression, is conditioned by the bio-technical externalization of objects, as rogue things.

But how might a museum operate this condition? And how, if at all, might the post-cybernetic museum operate with a different kind of technical memory (of externalized objects⁵) in-between the neo-rational ideals of science and the temptations of literary imaginings?

5. POST-CYBERNETIC PROPOSITIONS

Where 'classic' cybernetics turned the attention towards feedback (and the automated (self)control of systems), post-cybernetics, I would claim, restages the feedback as evidence of post humanity – bringing an acute sense of navigating mediated time and non-human temporality. This narrative already has a history in media theory: In

his essay on Art in the Age of Mechanical Reproduction, Walter Benjamin describes the technological conditions that shape the conditions of possibility for aesthetic expressions:

Within great historical periods, the nature and character of their sensory perception also changes in step with the overall form of existence of human collectives. The nature and way in which human sensory perception is organized - the medium in which it takes place - is not only natural but also historically conditioned. (Benjamin, 2010, 19)

However, what we today would call *medium* does not occur very often in Benjamin's writings. Instead, he used terms such as 'apparatus' and 'mittel' (German for 'middle') (Benjamin, 2010).

Nevertheless, it is possible to establish that Walter Benjamin's 'medium' is the all-encompassing force field that connects the human sensory with the world by being an interplay between natural (physiological, physical) and historical (social, technological, aesthetic) factors (Wilke, 2010, 40).

The German media theorist Friedrich A. Kittler is interested in the history of media and technologies. His method is to examine what can be said and thought within a given period. The premise for this, according to Kittler, is determined by the development of new media and technologies. (Kittler, 1999, 23)

In his influential article on *Media Theory*, the American media theorist Mark B. N Hansen describes how Kittler's media theory establishes a split between two types of approaches to media: one that examines the *experiential dimensions* of media (including digital media), and one another that, in a media archeological way, digs out the *technical logics* of the media - logics that, according to Kittler, are only sporadically related to human perception. It was, Hansen believes, primarily the latter that interested Kittler (Hansen 2006, 297). However, Hansen criticizes Kittler's view that media can be autonomously dissected out of the embodied human context, and emphasizes instead...

...the irreducible bodily or analog basis of experience which, we must add, has always been conditioned by a technical dimension and has always occurred as a co-functioning of embodiment with technics. (Hansen, 2006, 8-9)

Mark B. Hansen further substantiates his way of thinking with the help of the notion of transducing and the concept of prosthesis. man is essentially technical, and it is part of his very essence to make use of prostheses in sensemaking. As such, as Mitchell and Hansen propose in their introduction of Critical Terms for Media Studies, we are all leading a biotechnical form of life:

What the emergence of the collective singular media betokens is the operation of a deep technoanthropological universal that has structured the history of humanity from its very origin (the tool-using and inventing primate). In addition to naming individual mediums at concrete points within that history, 'media,' in our view, also names a technical form or formal technics, indeed a general mediality that is constitutive of the human as a 'biotechnical' form of life. (Mitchell and Hansen, 2010)

It is possible to arrive at a general media concept understanding humanity as a biotechnological form of life and that our very sensory perception is conditioned by the history of its mediation.

Secondly, the museum as medium of biotechnical life is configuring a topological space different from the Euclidian/Cartesian. Here, not only distance has to be redefined but also the overall conditions for the production and experience of objects, subjectivity, and the way cultural memory is constructed:

Stop saying that new technologies have shortened distances. They actually transported us from one space to another, from a Euclidean, Cartesian space to a topological space where distance has to be redefined. (Serres, 2007, 130)

This perspective on feedback on a topological scale that Serres brings speaks to a paradigmatic shift in the way the systems of knowledge production is understood from the thresholds that technology produces.

The post-cybernetic position is addressing what I (inspired by Serres excluded 'third parties', those making communication possible – imagined in figures such as Hermes, angels etc) term the 'third machines', those thresholds between humans and machines we cannot control and will never control: the geopsychological and thermohistorical machines. The counter-evolutionary and biotechnical thresholds.

Finally, the post-cybernetic position raises questions about temporality and scalability of our ability to operate judgmental faculties in a techno-mediated culture and how this in turn may empower a para-curatorial strategy. How do we navigate, what do we tell our children, where should we find the stories that narrate a bias about a possible and sustainable future? Sustainable for whom and what?

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¹ I am referring here to museums and cultural archives based partly on my own experience as curator at an art museum 1998-2008, partly on recent discourses of museum professionals i.e. at the National Danish Art Gallery SMK.

² A postcolonial perspective: Heroic tales of the colonial era and exotic, primitive depictions of the colonized populations still appear.

³ The Met Office.

<https://www.metoffice.gov.uk/weather/learn-about/weather/types-of-weather/clouds/other-clouds/asperitas> (6 September 2021)

⁴ Asperitas (formerly known as *Undulatus asperatus*) is a cloud formation first popularized and proposed as a type of cloud in 2009 by Gavin Pretor-Pinney of the Cloud Appreciation Society. Added to the International Cloud Atlas as a supplementary feature in March 2017, it is the first cloud formation added since *cirrus intortus* in 1951. Source: Wikipedia. Accessed 6 September 2021.

⁵ Like post-colonial objects, Anthropocene 'memories', geopolitical crisis etc.

'No Culture No Future': Virtuality and Its Discontents Reinvented

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When Lithuania, along with much of the rest of the world, went into a nationwide lockdown amid the second wave of the COVID-19 pandemic in the late 2020, the situation for the country's culture and arts sector seemed to be worse than during the first quarantine. Although there was already substantial know-how necessary for mitigating the negative effects of the closure of physical spaces and live events by transferring cultural content online, there was a growing sentiment that it was not enough. With institutional plans halted and most events streamed on the Internet, it gradually became clear that the 'digital culture' niche which had been in the making for several decades was perceived by the cultural mainstream largely as a supplementary layer for the conventional offline, face-to-face, 'real' cultural life, rather than as equivalent to the latter.

While artists, institutions, and cultural producers were exploring mediated formats of reaching the audience and (re)discovering the potential of digital media, symptoms of a 'digital fatigue' were becoming increasingly evident. Several months into the quarantine, the Lithuanian culture community adopted the slogan 'No Culture No Future' and called for opening up the cultural sector for live, unmediated activity despite of the difficult epidemiological situation. The professed reasons for this were not so much economical but instead quasi-spiritual, based on the idea that it was precisely culture and art that ensured the society's mental well-being (and thus resilience against major crisis like a viral outbreak), to the point of being prescribed as a kind of 'medication' in some countries.

This situation prompts some important questions. What are the implications for the longstanding fascination with the ideas of telepresence and online creative practice in at least some milieus like media art or net art? Has the sudden compulsory virtualisation of all cultural activity rendered these earlier fantasies completely irrelevant and even inappropriate? Or is it a case of cultural ignorance/amnesia that points to the still obscure status of the practices and discourses of art and technology, new media art, network art and digital art within the larger context of contemporary culture? Looking at some conflicting notions of virtuality in the different art worlds and periods, the article seeks to critically reflect on the related value systems and provide some thoughts on whether the international digital culture movement of the 1990s–2010s has any legacy that is widely recognised as legitimate and influential.

COVID-19 pandemic. Mediation. Digital culture. Telematics. Art on the Internet. Digital fatigue.

1. INTRODUCTION

The sudden outbreak of the COVID-19 pandemic in late 2019 and the ensuing repeated lockdowns in 2020-2021 left few spheres of human activity unaffected worldwide. Due to their substantial dependence on live experience and immediate interaction, art and culture are among the spheres to have been hit particularly heavily, with most cultural institutions and venues shut down for the entire quarantine periods. This unforeseen situation and the need to sustain at least some part of the usual activities prompted the majority of art and

culture institutions as well as individual artists to turn to various forms of remote online communication with their audiences and dissemination of creative content in digital form, which they may not have employed before.

Over time the reaction of both the cultural producers and the audiences to such forced confinement to 'innovative media' ranged from initial enthusiasm and eagerness to learn new skills or explore new forms of outreach to eventual 'digital fatigue', feeling overwhelmed with the surge in available online content, lacking face-to-face interaction with other members of the cultural

community, and lamenting the precarious and disadvantaged status of cultural workers during involuntary and indefinite downtime. The plea for a lifting of the restrictions for the arts and culture sector found its expression in the slogan 'No Culture No Future', with which cultural workers and institutions in Lithuania in particular as well as some other countries adorned their social media profile pages or, as in the emblematic case of the French actress Corinne Masiero at the 2021 Les Césars film awards, their own body.¹ The evident message behind this motto is that accessible cultural experiences and services are crucial to human well-being and the survival of society at large in the long run. Moreover, the rhetoric that surrounds it also signals that art and culture have not only aesthetic, intellectual or economic but also spiritual or therapeutic value that can mitigate the deteriorating effect of the pandemic on the public emotional and mental health.²

While the artists' collective outcry about their (as well as the public's) worsening financial and psychological condition caused by the inaccessibility of cultural activities is understandable, some of the elements of the aforementioned rhetoric seem genuinely puzzling. Particularly so to anyone who is at least tangentially acquainted with the fairly long history of experiments in digital art and culture of the 1990s and 2000s (and to some extent into the 2010s) that sought, among other things, to radically democratise and decentralise the production and consumption of culture, using emerging technological tools to promote inclusion, collaboration and open circulation of creative content. What such emancipatory initiatives (mostly falling into the categories of net art or new media art) aimed to achieve was precisely a new kind of culture that could break away from the rigid and exclusive system of art institutions and the art market itself, providing greater involvement without limitations imposed by geography or level of artistic proficiency and cultural erudition. The recurring motif of the pandemic-era grievances, however, is that only 'live' culture can achieve the desired therapeutic effect, while culture confined to telepresence and online mediation or documentation is essentially neutralised or even detrimental.³

Yet even if one focuses on the optimistic responses to the opportunities offered by the pandemic situation, there is a surprising common element to them: the pervasive emphasis on the supposed radical novelty of art and culture going online. Particularly in the case of art scenes and communities that previously relied on digital communication technology in the spheres of advertising, public relations and documentation rather than actual creative practice, the need to transfer virtually all their activities to the internet for

the period of the lockdown seems to have opened a new, hitherto unfamiliar space of creation and dissemination of art. This points to a vast awareness gap between the more traditional art forms dependent on the live presence of the audience and the pioneering art movements of the recent decades that sought to promote art and culture enabled by and engaging with emerging telematic technology, namely the Internet and related tools such as webcasting and videoconferencing.

There is already some research on certain aspects of the use of technology during lockdown in the arts and culture sector such as the impact of the pandemic on the activities of cultural institutions and individual artists, changes in the level of arts engagement during the pandemic, forms of virtual exhibitions and other forms of online artistic content, or the phenomenon of 'digital fatigue' or 'Zoom fatigue'.⁴ What seems to be lacking is a consideration of the (ir)relevance of earlier experience and know-how of the net art and new media art communities to the current situation, as well as the implications of the lockdown-induced massive disaffection with digital technology and remote communication (to put it somewhat simplistically, virtuality in general) for the development and reception of technology-based or technology-related art. Thus, this paper attempts to overview how the digital culture precursors of the last three decades seem to be omitted from the present-day popular discourse on art in virtual space – with a particular focus on the case of Lithuania in an international context. Rather than formulating a definition of networked art or art on the net, which has been done many times in various texts by artists and theorists such as Josephine Bosma, Andreas Beckmann, David Ross, Rachel Greene, and Geert Lovink, or providing a typology of virtual and hybrid environments in which art and culture can reside, the aim is to expose and emphasize the current discursive inconsistencies and blind spots that reflect the more general underacknowledgement of digital and telematic arts as a field with its own rich history.

2. A BRIEF PREHISTORY OF ART ON (AND AFTER) THE INTERNET

Contrary to what many art producers and consumers as well as administrators seem to believe in the era of the COVID-19 pandemic⁵, art had ventured into virtual space long before this landmark event – more importantly, it was not just physical art objects that were exhibited online as images, but art that was made specifically for and on the internet. Since the arrival of the World Wide Web in 1994 and the documented birth of net art in 1996, a specific international group of closely

associated artists interested in the merging of art, technology and science, who came to form the new media art scene in the late 1990s and 2000s, sought to develop an online art world of their own outside of the conventional institutional art system (Paul 2010). Their chief aim was not to use technology for its own sake, but rather to deploy it for critical and experimental purposes (Tribe et al., 2006, 6). The history and development of this specific 'network culture' is extensively covered in major publications written and edited by prominent new media art researchers and theorists, including Mark Tribe (2006), Christiane Paul (2016) and Lauren Cornell and Ed Halter (2015).

Some other theorists like Domenico Quaranta or Geert Lovink, however, have been more sceptical about the long-term success and relevance of new media art within the broader art system, claiming that the former is not really an art movement or a niche of contemporary art, but rather an art world unto itself that is ignored by the contemporary art milieu and in turn refuses to be a part of it (Quaranta, 2013), or even a 'self-referential ghetto dominated by techno-fetishism' (Lovink, 2007). The controversial article 'Digital Divide: Contemporary Art and New Media' by the renowned art critic Claire Bishop, in which she criticises the paradoxical lack of engagement with themes related to the digital revolution on the part of contemporary artists while simultaneously dismissing the entire new media art scene as 'a specialized field of its own' that 'rarely overlaps with the mainstream art world' (Bishop 2012), also suggests a lack of mutual awareness and communication between the worlds of NMA (New Media Art) and MCA (Mainstream Contemporary Art).⁶

The historical marginalisation of new media art in relation to the mainstream art system may also provide an explanation as to why its legacy of relocating art production, dissemination and reception to the Internet and other telematic platforms has remained for the most part unacknowledged when the volume of online creative content surged during the lockdown. A possible reason for that is the fact that while the technology-related practice and discourse of net art and new media art were limited to a relatively small and insular community of artist-practitioners, activists and researchers, in the new pandemic circumstances these means were rediscovered – out of necessity rather than conscious intention – by a significantly larger number of people with no knowledge of previous developments and achievements in this sphere, cultural workers and audiences alike.

In comparison to new media art, the loosely connected postinternet art movement of the late 2000s and 2010s proved to be much more in line

with the demands of the mainstream art market.⁷ The postinternet paradigm as formulated by artists and theorists like Marisa Olson, Artie Vierkant, Gene McHugh and Hito Steyerl maintained that art directly influenced by the Internet experience (that is, almost literally produced after surfing the web) did not have to be confined to any kind of 'virtual reality' or 'online domain', because with the arrival of the Web 2.0 technology, unprecedented accessibility of the Internet network and ceaseless circulation of images and other data between the virtual and physical spaces there was no longer any distinction between 'online' and 'offline', as the Internet itself had 'stopped being a possibility', moved offline and was literally everywhere (Steyerl, 2013).

Although artists associated with the post-internet circle seemed to engage with almost the same technologies as new media artists did, most of them owed little to this preceding technology-focused art paradigm, which they 'denounced as a mode too narrowly focused on the specific workings of novel technologies, rather than a sincere exploration of cultural shifts in which that technology plays only a small role' (Vierkant, 2010). According to the curator and writer Michael Connor, in the postinternet condition 'the focus of a good deal of artistic and critical discourse has shifted from 'internet culture' as a discrete entity to the reconfiguration of all culture by the internet, or by internet-enabled neoliberal capitalism' (Connor, 2013). In the simplest terms, postinternet ultimately amounted to taking internet-derived art out of the web browser and placing it in the form of monetarily and aesthetically liquid objects or images into the physical space (usually the traditional white cube of the gallery), from where they would often make it back to the browser in the form of installation shots (Droitcour, 2014), thus anticipating the pandemic-era proliferation of online documentation of material exhibitions that visitors could not access physically. In other words, postinternet art offered gallery-friendly Internet-aware cultural content that did not treat the network itself as exclusive or even indispensable.

Curiously, the postinternet perspective also seems to be problematic in the pandemic situation because its validity depends on the simultaneous coexistence and accessibility of both the offline and online layers of experience (no matter how supposedly blurred the borders between the two). When, as in the case of a lockdown, the physical domain is practically limited to the private space of one's home, it becomes increasingly difficult to think of the internet as having moved offline and pervaded every sphere of activity and experience in Steyerl's sense. Rather, all social activities including cultural ones that used to involve live physical interaction (undoubtedly augmented by connectivity features such as instantly uploading

location-based photographs and other content to the Internet) in galleries, theatres, concert halls and other institutions are compressed into purely online protocols of videoconferencing and messaging that do not differ fundamentally from the modes of remote interaction characteristic of earlier net art and new media art – yet without the latter's trademark utopianism.

The history of the intersections of art and the Internet in Lithuania follows more or less the same logic, albeit on a smaller scale. An early example of art utilising the network as its native and preferred medium is *Institutio Media*⁸, a quasi-academic virtual institution dedicated to the practice and promotion of net art and media art through netcasting and information archives. It was established in 1998 by the artists Mindaugas Gapševičius, Kęstutis Andrašiūnas and Darius Mikšys, and run primarily by Gapševičius (mi_ga) after 2000, when it became an institutional framework for his various personal and collaborative projects rather than a functional online entity. The institution's description written by Andrašiūnas reads:

We also wish to explore the relation of physically limited and virtual spaces. In a real space and time the functioning of an institution is restricted by its premises and the regularity of activity, which is necessary for the interactivity and existence of that institution. In a virtual space it is restricted by technology and the quality of connection. The Web makes it possible to avoid the expropriation of the physical location – it is replaced by a 'site' in a server – the quantity of magnetic memory.⁹

The institution's *Tautological Manifesto of the Media* written in 1998 and rewritten in 2001 features a somewhat more poetic passage:

By the action of a machine, the resistance of time and space has been changed. A physical action is transformed into a sequence of signals and remotely transmitted. In this way we can experience a new concept of time and space not only theoretically, but also practically. The change in comprehension of space and time inescapably brings about a change in the means of communication and creating art. A machine becomes a mediator between a spectator and environment. This makes way for quick indirect communication and creation of dynamic communities. Communities whose members are not bound up with a physical location. We call the location in which the life of this community is taking place, virtual. Virtual location is created by means of interaction between the spectators-participants and an electronic machine. [...] In this environment art acquires a new form and means of spreading. Art not only uses a machine but also changes together with the machine. [...] Art always oscillates between the real and virtual world,

affects reality and is affected by it. It is discovered and broadcast, mobile and multiplying.¹⁰

Here one may easily discern a fundamental difference between the techno-optimistic rhetoric of the new media era and the present-day popular anti-virtual sentiment: whereas for *Institutio Media* it was physical space that was limiting, in the pandemic context it is precisely the virtual space and remote communication that are predominantly perceived as restricting and downgrading experience. In reality, however, the actual reach of *Institutio Media* was smaller than its ambitions, and the discourse and practice of net art it promoted did not take root in the Lithuanian art scene after 2000.¹¹

Another prominent case is the artist-facilitator practice of the Nomedas and Gediminas Urbonas duo under their guise of *Jutempus* mobile lab for interdisciplinary media arts. The 1997 *Ground Control* project for artistic exchange between Lithuania and the UK that they initiated together with the London-based Beaconsfield artist-run space comprised both Lithuanian and British artists' physical research trips to and from Lithuania and the UK, and an attempt at establishing an online connection between the two countries and cultures that reflected the contemporary intensification of international communication between the former East and West, utilising the digital network technology that was available at the moment. Again, the project description emphasises the use of virtual communication for opening up and expanding the space of intercultural dialogue through (new media) art:

Actively transforming throughout, the *Ground Control* web site [...] links participating organisations and individuals and despatches data to the global internet community. But for most of its participants, *Ground Control* represents the beginning of an exploration into the unknown territories of the new technologies and new pan-European relationships. As such, the use of ephemeral media in this project has been for the primarily practical purposes of relaying information, rather than of creating polished multi-media artworks.¹²

The Urbonas' next project, *tvvv.plotas* (1998-1999) similarly explored the possibility of reaching out to the audiences and fellow artists by establishing a virtual public space for critical debate using different communication media such as television and the Internet:

tvvv.plotas is an interdisciplinary art research project that aims to become a platform for discussion about artists survival strategies in different circumstances and contexts using critical discourse as a starting point. *tvvv.plotas* is in a search for possibilities to communicate

with the audience by infiltrating the national television in Lithuania and opening a space for creative people. Artists, like all human beings, need a place to create, space to make mistakes, and the opportunity to develop opposition. [...] *tvvv.plotas* is constructed as a living environment consisting of several elements: television broadcast, video conference with chat channel, net cast and discussion/meeting in physical space in Vilnius.¹³

The *RAM6 (Re-Approaching New Media): Social Interaction & Collective Intelligence* workshop organised by Jutempus in Vilnius, Lithuania in 2004 featured among other things a live remote performance *Forest Test* that involved Lithuanian experimental musicians Juozas Milašius and Darius Čiuta in a real-time collaborative improvisation over an online connection between the Contemporary Art Centre in Vilnius and a forest outside of the city, also netcast for a wider audience on the website of the Urbonas' newly established virtual institution VILMA (Vilnius Interdisciplinary Lab for Media Arts). Another participating artist-practitioner and media activist Daniel Garcia Andujar, facilitator of the Technologies to the People initiative, shared his experience of constructing netcasting stations and community networks from old computers in a workshop.¹⁴ These activities reflected the international event's declared aim to provoke 'a productive and critical dialogue and an exchange between different artistic cultures using "new media" as tools in their art practice, but also to encourage the creation of new tools and forms of expression/communication'.¹⁵ However, while *RAM6* attracted a fairly varied group of local participants and viewers from the younger generation of artists, the 'hacktivist' new media art practice and rhetoric proved unable to compete with the then-dominant postconceptual stream in the contemporary art field.

With the arrival of the postinternet trend in the mid-2010s, some notable examples of working with and through the Internet but also adapting its logic and aesthetic to physical exhibition spaces included international projects by the curators Justė Kostikovaitė and Valentinas Klimašauskas. The former launched the online video platform *The Deep Splash* in 2014 (renamed *the good neighbour* and taken over by Monika Lipšič as the new curator in 2017)¹⁶, which essentially functioned as a continually growing web-based exhibition of works by international artists experimenting with video forms influenced by Internet-specific modes of narration, but also materialised in physical space.¹⁷ Meanwhile, Klimašauskas developed a similar format in what he called 'exhibitions in a video' – *Portals* and *A Hat Trick Or A Theory Of The Plankton* (both 2016)¹⁸, the difference being that in his case these exhibitions took the form of a web-

like montage of contributions by individual authors within a single video. While these works could easily function purely online, they also materialised as physical gallery displays on several occasions.¹⁹

The aforementioned forms of online exhibitions that were equivalent to and adaptable as 'real' shows received considerable visibility in Lithuania and internationally – at least in the contemporary and postinternet art circles. As such, they undoubtedly preshadowed the miscellaneous pandemic-era attempts at devising web-based alternatives for the traditional gallery and museum exhibitions that temporarily could not accept visitors.

3. RESPONSES TO THE LOCKDOWN: FROM RELUCTANT ENTHUSIASM TO DIGITAL FATIGUE

Although the pandemic and the preventive lockdown certainly came as a shock to most artists and cultural institutions, they also triggered an obvious surge in creativity and inventiveness with regard to adapting to the inevitable need of taking most of the operations online. While arguably not out of their own will, cultural workers earnestly took to exploring the possibilities provided by the available digital technologies. Abundant overviews and 'best and worst' ratings in online art magazines detailed the new developments and, for many, first digital experiences intended to compensate for the gap in the physical art life: online viewing rooms, immersive and navigable digital exhibitions, interactive applications and VR platforms.²⁰ These overviews shared an emphasis on the unprecedented nature of the 'new virtual reality' faced by the art world, thus begging a question of whether the lockdown situation really introduced a qualitatively rather than quantitatively different state of things with regard to the forays into web-based artistic practice. To be sure, there were also some comments from early adopters expressing surprise at the fact that 'so many who didn't have any interest in virtual reality are now keen on understanding its capabilities', while before the pandemic 'the digital space was almost always treated as an afterthought for expanding an audience beyond the reach of physical spaces' (Feinstein 2020). One critical comment that particularly stands out is by the new media artist Brian Mackern:

At first, it looked very promising that everything had to go online. Being part of the old net.art movement, I thought that many new ways of experimenting with the web would arise and shine. I expected that new generations of designers, programmers, entrepreneurs, and artists who grew up already immersed in this physical/virtual world would come up with some revolutionary ideas but in the end, you see that everything is stuck on the idea of the internet as

a publishing platform. There are not many visions about what's under the hood. And 'the new' looks a bit like 'the old,' just refurbished. (in Bosma, 2021, 18)

Overall, however, the prevailing message was that the pandemic unveiled a completely new era of experiencing art digitally. International organisations and policy bodies encouraged cultural institutions to take advantage of the pandemic as an opportunity, devising alternative modes of action as well as educational and dissemination tools.²¹ For instance, the British Council stated that the lockdown in the region of Wider Europe encompassing Russia, Turkey, Ukraine, the South Caucasus, Western Balkans, Central Asia and Israel 'broke new digital ground for cultural organisations', contributing to 'digital democratisation and innovation' (De Braekeleer and Thomas 2020), while UNESCO commended museums for having 'exhibited tremendous resilience by continuing, amidst this global health crisis, to serve the public through free online exhibitions, making available digitized copies of ancient manuscripts and effectively engaging with citizens on social media' (UNESCO 2020).

However, the tone of many other remarks on the impact of the pandemic on the arts was markedly different. Individual professionals, organisations and international campaigns expressed concerns about cultural workers not being recognised as providers of essential services and therefore exempt from lockdown restrictions, or the importance of culture being downplayed during the crisis²², as well as about the potential reinforcement of individualism and erosion of communal cohesion by individual digital as opposed to live group cultural consumption (Etxebarria 2020). There was also an emerging discussion of the phenomenon of online or digital fatigue resulting from both uncertainty of the future and excess of online creative content that decreased the audiences' motivation to participate in virtual events (Wright 2021). Geert Lovink, an initial advocate and later outspoken critic of online culture, summarised this effect of confinement to online communication in his in-depth analysis of 'Zoom fatigue', which he concluded as follows:

After the Covid siege, we will proudly say: we survived Zoom. Our post-digital exodus needs no Zoom vaccine. Let us not medicalize our working conditions. [...] we must now fight for the right to gather, debate and learn in person. We need a strong collective commitment to reconvene 'in real life' – and soon. For it is no longer self-evident that the promise to meet again will be fulfilled. (Lovink, 2020)

These concerned or sceptical voices suggest that the imperative to take advantage of the forced virtualisation of cultural life is far from being

unanimously acknowledged as a sustainable and adequate solution to the problem – and that the idealistic approach to online creative exchange once propagated by the net art and new media art community can hardly work in this situation.

In the Lithuanian context, the initial response was similar in its enthusiastic search for virtual ways out of the situation. The earliest and most basic solution by the community of traditional visual art professionals and amateurs was to launch a Facebook page entitled *Not Cancelled Openings* (initiated by the artist Vilmantas Dambrauskas) for sharing work that could not be presented in planned or potential physical exhibition.²³ Major art institutions adopted the format of prefilmed virtual exhibition openings published on their social media. The theatre community experimented with Zoom plays, with a standout more advanced solution devised by the young director Augustas Gornatkevičius who staged his new 2021 production *The Flicker*²⁴ as a 4-day interactive performance on Facebook in collaboration with the young media artist Gytis Dovydaitis. Later same year, Dovydaitis and a few fellow-minded media art students launched *on:real*²⁵, an online platform dedicated to what they referred to as 'real virtuality' (in line with the earlier postinternet rhetoric of the merging of online and offline modes in augmented reality environments, Internet of things and the like). Surprisingly, however, the platform was promoted as being practically the sole Lithuanian project dedicated to internet-based art, with no recognition of earlier efforts such as *Institutio Media*. Meanwhile, the contemporary art community took advantage of the heightened attention to the Internet with two new digital art and moving image streaming platforms, *High Limits* (launched by Robertas Narkus' artist-run space *Autarkia*)²⁶ and *springs.video* (initiated by Valentinas Klimašauskas)²⁷. These built upon the aforementioned developments in exhibiting video online of the 2010s with new web functionality.

With the second wave of the pandemic, however, initial enthusiasm predominantly gave way to the pessimistic 'No Culture No Future' sentiment. In a 2021 online discussion on virtual culture, Juozapas Blažiūnas, head of the Lithuanian Archives of Literature and Art, remarked that while virtual consumption of culture broadened the audiences' horizons, there was a widespread desire to return to live culture, coupled with the older generation's rejection of virtual culture as such. Other discussion participants – the aforementioned media practitioner Gytis Dovydaitis and head of the Rupert centre for art and education Julija Reklaitė – added that artists themselves often lacked visionary approaches to innovative online presentation of their work, and attached the superfluous 'virtual' label to mere online publishing of documentation of traditional offline works or live

performances. According to Reklaitė, however, even with the eventual return to live cultural consumption the technological expertise and skills gained during the lockdown would continue to be useful as auxiliary tools.²⁸

Regardless of optimism or scepticism, it must be stressed again that the rhetoric around the new initiatives and their significance involved no references to earlier local discourse and practices. This may imply that it was either largely unknown to the wider art community and the younger generation of artists, or deemed irrelevant in the new circumstances, in which the ultimate desire was a return to the 'normal state' of live cultural activities and physical art spaces, rather than further development and legitimisation of their virtual substitutes.

4. CONCLUSIONS

In response to the 'No Culture No Future' slogan popularised during the COVID-19 pandemic by cultural workers demanding a lift of the lockdown restrictions as providers of services essential to the well-being of society, there are a few things to be said about the implications of both 'culture' and 'future' in this phrase.

Firstly, it can be argued that the pre-pandemic digital technology-related movements of net art/new media art and postinternet art both revolved precisely around specific visions of a future. For new media activists, a more open, inclusive and empowering future depended on the radically democratic use of networked digital technology for communication and creativity that could overcome social divisions and build new autonomous creative communities. For the postinternet circles, the future was already here, brought about by the Internet that was no longer a possibility, but rather the actual substance of almost all experience, equally 'online' and 'offline', as all activities were influenced by and sieved through it in one way or another. The pandemic has shown, however, that for many people the future may not be associated with media technologies at all, as it has become clear that without the 'real life' counterpart they induce a sense of confinement and deprivation instead of providing an adequate substitute or a liberating alternative, no matter how much the distinction between 'real' and 'virtual' life may have been blurred by the technological and ideological advancement of the recent decades. One of the lessons of the pandemic is that the line is still there, even if it is negligible when we have the luxury to be anywhere (i. e. not in self-isolation) – and that the future desired by most people may not be where the net culture enthusiasts imagined it to be.

The same holds true for the understanding of 'culture' prevalent in the arts and culture field. With more than three decades of technophilic experiments in mediated, telematic and cybernetic culture, once it became an uncalled-for pervasive and compulsory reality, it acquired dystopian features for many. The pandemic has revealed that a large-scale 'digital turn' imposed on the entire arts and culture sector can only generate enthusiasm and creativity for a limited period, while the notion of culture entrenched in the collective psyche largely remains conservative and based on conventional forms of live, face-to-face activities. It remains to be seen how the use of online production and/or dissemination of art will evolve after any kind of 'normalisation' of life. In the recent years, blockchain-powered cryptoart and NFTs seem to be transforming the art market, but it is unclear whether the general art world and the audiences will be receptive to art forms reliant on further abstraction and virtualisation of the processes of art creation and distribution.²⁹

As for the general awareness of the long-term technological and discursive developments of the international art and technology community, epitomised by such festivals as *Ars Electronica*, ISEA and *transmediale*, organisations like V2_Lab for Unstable Media or Institute of Network Culture, and online mailing list communities of *nettime* and *Rhizome*, the evident conclusion is that even within the professional art field their impact is very limited or practically nonexistent. This is suggested by the near-total lack of recognition of this community's experience as a valuable and voluntary precursor to the unforeseen challenges posed by the COVID-19 pandemic, coupled with the sensationalist rhetoric around the supposedly ground-breaking innovations in artistic practices it prompted, which in fact have numerous precedents that are largely omitted from the mainstream contemporary art history on the grounds of their putative technofetishism. Instead of acknowledging online creativity as a once-desired, familiar 'future of the past' and critically putting it to use in the new situation, the art and culture world responded to the latter mostly by reinventing what was already there.

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¹ See <http://www.rfi.fr/en/culture/20210313-no-culture-no-future-french-film-awards-turn-into-protest-over-covid-closures-cesars-cinema-culture-paris>

² 'The assertion that nothing will be the same in the aftermath of the crisis is becoming commonplace, and there is a call to rethink the way we live, work, produce, consume and relate to nature. But we too often fail to realise that culture is both a source of inspiration and a means of realising our thoughts

and ideas, that culture makes it possible to mend the social fabric, to forge new forms of solidarity, to create new spaces in which to draw the energy needed to meet together the intense challenges facing us.'

See the full statement of the #Culture2030Goal campaign [here](http://culture2030goal.net/?page_id=527): http://culture2030goal.net/?page_id=527

³ For instance, Lithuanian writer Dalia Staponkutė claims that only live culture can ensure critical

thinking, while virtual culture produces a dystopian virtual reality that obliterates local cultural memory.

See

<http://www.lrt.lt/naujienos/kultura/12/1342984/dalia-staponkute-kaip-pandemija-keicia-musu-pasauli-tikgyvoji-kultura-palanki-kritiniam-mastymui> (in Lithuanian)

⁴ See more: <http://digitalmuseums.at>; Bosma 2021; Mak et al. 2021; Kantor et al. 2021; Lovink 2020.

⁵ For examples see Feinstein 2020.

⁶ See also the critical follow-up to Bishop's article: Cornell and Droitcour 2013, Shanken 2015.

⁷ See Heidenreich 2016.

⁸ The original website is archived at <http://www.o-o.lt/1998>

⁹ http://www.o-o.lt/e_descript.html

¹⁰ <http://www.o-o.lt/manifesto.html>

¹¹ See

http://www.7md.lt/archyvas.php?leid_id=544&str_id=616 (in Lithuanian)

¹² <http://www.vilma.cc/jutempus/?p=22>

¹³ <http://www.vilma.cc/jutempus/?p=67#more-67>

¹⁴ See <http://danielandujar.org/2004/08/25/vilnius-nemencine-narsymas-realiame-ir-technologijumiske> (in Lithuanian)

¹⁵ <http://www.vilma.cc/jutempus/?cat=9>

¹⁶ <http://thegoodneighbour.lt>

¹⁷ See <http://www.lnb.lt/paslaugos/parodos-ir-renginiai/parodos-bibliotekos-paroduerdvese/parodu-archyvas/4736-paroda-konsteliacija-dausuva> (in Lithuanian)

¹⁸ See <http://selectedletters.lt/miscellaneous-readings-videos-etc>

¹⁹ See <http://artviewer.org/a-hat-trick-or-a-theory-of-the-plankton-at-podium>

²⁰ For some examples see:

<http://www.theartnewspaper.com/review/a-review-of-xr-in-the-art-world-during-the-covid-19-pandemic>

<http://www.wallpaper.com/gallery/art/best-digital-virtual-art-exhibitions-during-coronavirus>

<http://www.dw.com/en/global-art-market-prices-the-coronavirus-pandemic-corona-panic-is-shaking-it-up-starting-at-sothebys/a-52651815>

²¹ See <http://www.interregeurope.eu/ecoc-sme/events/event/3452/culture-in-the-time-of-corona>

²² See <http://www.iheartberlin.de/questioning-the-new-dogma-of-system-relevance-arent-we-all-essential>

<http://www.iheartberlin.de/no-culture-no-future-a-film-about-the-importance-of-arts-culture>

²³ See <http://370.diena.lt/2020/07/01/menininkas-vilmantas-dambrauskas-susireiksminimas-ir-godumas-yra-tikroji-pandemija> (in Lithuanian)

²⁴ See <http://dramosteatras.lt/en/upcoming-premiere-the-flickering-on-march-2-2021>

²⁵ <http://onreal.ooo>

²⁶ <http://highlimits.xyz>

²⁷ <http://springs.video>

²⁸ Full recording of the discussion in Lithuanian accessible at <http://kmn.lt/renginys/virtuali-diskusija-apie-virtualia-kultura>

²⁹ See <http://www.moma.org/magazine/articles/547>

Glitching Digital Borders: Artists and New Border Systems

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With the rise of new digitised technologies at the nation-state border, the border itself has become more difficult to identify, demanding new tools and methods to recognize it and intervene. In this paper, we explore how artists are being impacted by borders but also how they respond, critique and interfere. Artists have long been experimenting, breaching, and revealing the weakness of the border, both in terms of symbolic borders like categorical associations and the nation-state border. Artistic interventions into conventional, physical borders include painting the border invisible, simulating the border, rendering a border permeable via audio technology and designing seesaws with which people on either side of the wall can interact. But how can artists respond to new digitised border technologies? How can they react to a border that is no longer symbolising a “line-in-the-sand,” but a border that is “everywhere”?

Border technology. Biometrics. Artists. Bodies. Performance.

1. INTRODUCTION AND METHOD

Where once a few strong columns could hold up the weight of the world, today we need a dynamic mix of materials and structures. (Clinton 2013).

Hilary Clinton’s address to the Foreign Council, quoted above, is a symbolic acknowledgment that the sovereign state’s infrastructure has changed and is changing. Benjamin Bratton argues that these shifts can be understood as increases in the complexity of the sovereign state’s infrastructure. The state is no longer upheld by a few strong columns but rather a stack, where each layer consists of an interdependent infrastructure system. Formerly the nation-state’s terra and bodies were controlled by barbed fences, border patrols, disciplinary institutions, walls and maps. In contrast, within the ‘stack,’ or the ‘postmodern’ era (Lyon & Bauman, 2012), the border no longer marks a line in the sand but has rather become a surveillance apparatus. It is no longer an identifiable object but an omnipresent surveillance technology, constantly capturing its audiences within their mundane everyday practises: sharing your location to a friend, sharing a selfie, commenting on a political tweet. Through this decentralisation of control, ‘the border is everywhere’ (Lyon 2005), and with new emerging border technologies, such as AI and facial recognition, the border is moving swiftly, adopting new modalities and modes of governance. We have

decided to call this ever-changing assemblage ‘digital borders.’

The concept opens up for a discussion about the digitization of nation-states and the borders that arise within the digital spaces that are independently created using the same technologies. In this paper, we are particularly interested in how artists navigate this duality and how they find tools to respond, critique and resist the digitised nation-state. How can artists help us find new ways of responding to digitised borders and what are the political potentials of such interventions? We aim to explore this question by synthesising and locating interviews, which we have conducted with a global community of artists who are working across nation-state borders and in digital spaces, with our research on new border technologies.

We, who write this paper, are an artist collective consisting of Ayodamola Tanimowo Okunseinde, Christoffer Horlitz and Ella Hillström (ACE). We met in New York and found an interest in each other’s backgrounds and our desire to better understand how artists could intervene within restricting border systems. For the past two years we have been investigating notions of the digital border by conducting interviews with artists who are confronted with borders, holding workshops, and convening panels as we did during our residencies at Culturehub NYC and at the Institute of Visual Communication Beirut. We were able to synthesise what we learnt about digital borders into a graduate

seminar at Parsons The New School of Design in the Fall of 2020. Remotely teaching a class on digital borders during the COVID-19 pandemic offered yet more opportunities for us and our students to examine the nuances and complexities of the technological and data infrastructures of sovereign states as they relate to border control and restrictions. Dispersed in different cities – New York, Berlin and Stockholm – our research question of how artists work across borders was turned into a praxis.

2. TECHNOLOGIES AT THE BORDER: BIOMETRICS

New digital border systems depend on AI, biometrics and surveillance to collect and process information about migrants and travellers, and to enforce decisions about which bodies are allowed to cross the border and which are not (Topak, 2019). The implementations of these digitised technologies on the border are new, but their effects reinforce the same forms of racial biases, inequalities, and notions of protectionism as the nation-state system. The EU, in particular, has adopted biometrics and AI at the border, upholding an idea of freedom for some, whilst imposing harsher restrictions on others. Who belongs within the EU and who doesn't 'seem to follow a colour line?' (M'Charek, Shram & Skinner 2014, 473)

What is particular about these new systems, is that much of them pertain to the body. Before, during and after a passage from one country into another, biometric data are assembled at multiple points of data collection and analysis, for instance, when applying for a visa or when walking through airport security. Increasingly, the same data sets are also tied to usages during an individual's stay within a certain country. Data can be linked to access to labour markets, law enforcement officers may process it. This is facilitated through a connection of databases containing biometric and identity related information. An example of this is the forming of a European system through the EU-LISA agency merging all pre-existing systems holding biometric or visa status data.

What problems arise from the growing use of biometric data at various border sites? Firstly, the increase in data collection and analysis points is meant to speed up processes at the frontiers, particularly considering growing numbers of border crossings. However, this may heighten inequalities in how we travel and migrate.

Secondly, authorities aim to close any gaps through which people may enter countries irregularly. Electronic passports containing biometric information about their holder are harder, albeit by far not impossible, to forge. This means

that what makes the usage of biometrics so attractive to authorities is at the same time the risk about it: Fingerprints or iris patterns are hardly changing over time. Thus, collecting this information bears huge responsibility for the storing party. The more data points employ this very private data, the higher the risk of their misuse.

Thirdly, the aim is to create fairer, more individual visa decisions (World Economic Forum 2017). It is argued that by assessing people based on a large set of data about them rather than, for instance, just their nationality the judgement on who gets to cross and who doesn't become less biased. However, this individualization is, in fact, also a depersonalization. To deal with these vast amounts of data, categorizations are made following suppositions about an individual's character and their threat potential (Ajana, 2015, 59). Broeders writes that 'surveillance will increasingly function as a sorting machine that separates and distinguishes the wanted from the unwanted migrants and creates and uses profiles to separate the two. Wherever possible it will fast-track the former and block the latter category.' (Broeders, 2011, 61) Hence, the proclaimed individualization of borders only works through a systematic and pre-emptive profiling that in fact blocks out the personal element.

To Gilles Deleuze (1992), the implementation of biometrics in the sovereign state symbolises the shift from disciplinary societies towards societies of control. Within these new societies that emerge out of the debris of the institution, citizens are no longer an individual (having a signature) or a number within a mass, but rather individuals. The person is divided into smaller and smaller components that represent different facets of the person. When the iris or a finger are scanned at the border, the person's social media handles, facial measurements, travel history and more appear. Their passport photo, and signature – symbols of personhood – no longer indicate the person's identity.

3. THE ROLE OF THE ARTIST

When technologies of the sovereign state change, not only the citizens' interior and behaviour change, but also the production and function of art. For Walter Benjamin (1969) the introduction of the machine which enabled mechanical reproduction assisted art to cross borders and reach widely, but also ensured that art lost its 'aura.' Benjamin describes this aura as the essence of an art piece that is obtained in its creation in a unique time and space, through a ritual process. When the craft is lost, the piece is no longer locatable in space-time. Its essence vanishes into devoid time. Mechanical reproduction, Benjamin argues, also serves 'the masses' need to touch all art. They want art to be

brought closer to them. In contrast to the auratic painting inside the Louvre, a Mona Lisa hanging in their bedroom can be easily touched. Reproducibility also impacts the value of the exhibition. When art can travel freely, its purpose is rather to satisfy the masses than the artist's experience of creating the piece. Hito Steyerl, more than half a decade after Benjamin's essay, locates his arguments within 'the economy of presence.' In this system, she argues, the artist's object and work are no longer what creates the economic value. The audience can see the work of art digitally or buy a copy online. The only unobtainable element are the artists themselves and it is through their presence that they can create economic value:

The Q&A is more important than the screening, the live lecture more than the text, the encounter with the artist more important than the work. (Steyerl, 2015)

The economy of presence sets new artistic demands. If before, the artist's context was important to absorb the essence of the artwork, today artists and their work are demanded to be hypermobile. Artists write that they are based 'in between' cities, London and New York, to show their social mobility and access to necessary networks. This of course raises questions of access – to cross nation-state borders is not an opportunity available to all. In her interview, Riham Ezzaldeen (2019), a freelance documentary filmmaker, explained how she often got opportunities that demanded immediate presence. The concept of immediacy is an extension of the racialized, occidental fast-track system and makes her, a Syrian passport holder, uncompetitive in the market:

It's a norm to be able to get to places whenever and wherever. Employers don't feel the need to provide a million documents and take so much of their time for somebody to go to that project and film. Somebody else can just on the go be there.

¹ Although the 'digital' has been used as a mode of art for a long time with notable movements such as the net.art movement and 'new media,' the forced usage of the digital for artists was new. Dancers and performers, who traditionally were dependent on physical audiences, suddenly encountered a digital reflection of themselves. Without changing their practice, many performers merely sought to simulate a dance performance in the digital realm. But such transpositions do not always translate well.

Jean Baudrillard understands the digital not as a simulation of the real, but a space that transposes the real, becoming a hyper-real reality (1981). When the dance performance can be reproduced infinitely, the artwork no longer leaves room for

The economy of presence in combination with the separate border technologies excludes certain artists from participating in the art world – their papers are slow and numerous, not fast and seamless like the ones of those people who access the fast-track aisle. The former is stuck in liminality, waiting for disciplinary systems to respond: 'Delaying without destroying hope is part of the domination.' (Bourdieu, 2000)

Artists are also cared for by the state in ways that reveal their economic and soft power value within nation-states. International funding organisations recognize the artist as worthy subjects who deserve protection and 'care.' The artist, therefore, should be extracted from their communities. Belly dancer, Alexandre Paulikevitch (2021) from Lebanon says:

I don't need to be saved. If you take me out of my country the fundamentalists will win. If you want to save me, build a dance studio in my neighbourhood.

The extractive force of international art institutions also implies that artists who don't have immediate access to the high-networked societies are subjugated to additional forms of scrutiny of right behaviour. They are not only surveyed through border-technologies and their local institutions, they are also under scrutiny from high resourced institutions who are enforcing the idea of a global artist: a person who is flexible and mobile (Ong and Collier, 2008), able to speak to their local, far away community and the community within the high-resourced networks.

4. THE DIGITAL

When Covid-19 put our societies to halt in 2020, artists who rarely experienced restrictions, encountered travel regulations and the border for the very first time. The art world was forced into the digital space in ways that had not been conceivable before.

imagination, and, to put it in Baudrillard's words 'murders the real.'

Others, like musician Jamila Al-Yousef, see various potentials in different modalities. In her band's (Jamila & The Other Heroes) most recent work *Borders Syndrome* (2021) they shared their work by launching the music video at an event. Sharing a digital representation of their work allowed her to share a witnessing experience with the audience for the first time. A new mode of authenticity arose.

Yet, within the digital, new borders emerged both with regards to access to speed and to biased applications. Forty percent of the world's population do not use the internet. Zoom is restricted in Cuba,

Iran, Ukraine, North Korea and Syria. Internet access varies within regions. In the U.S. roughly three quarters of Americans have broadband internet service at home - racial minorities and those with lower levels of income are less likely to have that (Pew Research Center 2021). Surveillance companies such as Prism, Carnivore, and Dishfire are more likely to surveil immigrant communities (Madden 2017). Despite being embedded in languages of global connectivity with slogans like 'in this together' (Zoom), digital platforms are, in fact, filled with borders that perpetuate already existing inequalities and invent new ones.

I'm frustrated over the occasional artists who could just transition into the digital realm without a problem. Habibi, I can't even upload a video with the internet that we have here. (Paulikevitch, 2021)

Against the implications of concepts such as digital apartheid or digital divide, anthropologist Brian Larkin argues that digital inequalities are not about have and have-nots. Rather, technological marginalisation, he argues, is a matter of gaps in 'how fast society is moving and how fast it could be moving' (2004, 305). The glitch is a technical failure present in the digital, revealing the different speeds that our respective infrastructures allow for. It's a reality for new media artists, but also for artists who are doing artist talks over video-conference platforms. The glitch disrupts the idea of the digital as a seamless infrastructure and brings back the attention to the materiality that the hyper-real rests upon. In that regard, the glitch can be seen as a potential that can allude to something different.

5. GLITCHING THE BORDER

If we recognize the border apparatus with all its atomized layers of surveillance in the Foucauldian sense as a system that enables the automatic functioning of power, the question arises what happens to the functionality of power if these layers are disrupted. We use the term 'glitching the border' for the artist's ability to disrupt the border apparatus stack via their works. In the same way that dazzle camouflage of WWI and WWII sought to render aircrafts and ships illegible not through concealment, but rather confusion, artists today utilise similar methods of obfuscation to frustrate, critique, or draw attention to elements of border surveillance systems.

Evan Roth's *TSA Communication* (2008) relies on airport x-ray machines to read messages cut into stainless steel plates embedded in the carry-on baggage of the artist. Roth uses physical objects as a means to enter the layered digital systems of the *digital border*. That is to say his interventions leave traces in the data records of the x-ray machine or passport scans. These records, when later read by

machines or humans, slow down or hiccup the process of automation.



Figure 1: Evan Roth. *TSA Communication, Metal Plate, 2008.*

Yet other artists recontextualize the glitching of the border in terms more intimate to their bodies. As a queer gender-nonconforming artist, Teresa Braun questions how the way in which their body is perceived at the border may influence treatment or access. Where performance of a 'normal' gender presentation may elicit cordial treatment, an 'abnormal' presentation, or one that is in conflict with state records, is sure to draw suspicion and scrutiny. Braun's works in virtual reality drag problematize presentation as another example of glitching the border, the border here being one of gender. In many of their characters, Braun is blurring the real and the simulated and creates a 'confusion' that does not easily allow the viewer to settle.



Figure 2: Teresa Braun. *How Could This Possibly Be the End, Augmented Reality Drag Performance, 2021*

As I am moving into queerness and virtuality, the concept of the virtual presupposes a reality and a simulation. I like when it gets very confusing. I

have different names, different pronouns, for me that's a glorious fiction, but I really like pushing the boundary of what we understand as real. (Braun, 2021)

As we have found, what is understood as reality in relation to the body and the digital border is never static nor consolidated. It fluctuates and glitches, generating new variants and configurations of how bodies can exist at the border. And as such, nation-states are required to employ ever more complex systems of surveillance technology to bring these glitches into spaces of knowability, in an attempt to discipline and bring to alignment bodies at said borders.

The role of artists that confront these borders seems, as we have found, to be that of investigators and agitators. They investigate the configurations and limits of borders while agitating through obfuscation and glitching the very notion of the digital border itself. They continually perturb the concept, and as such the definition of the digital border continues to grow and transmutate, ever remaining always outside nation-states knowledge. We see the gap between artists' implementations of novel and mercurial definitions of the body at the border, and the more stayed nation-states understanding of the same as the very border breeches that artists may utilise to traverse these borders.

6. CONCLUSION

For many artists, the global art market as well as the emergence of transnational artistic communities, create the necessity to travel across country borders. Thus, changing border assemblages rapidly form the backdrop for the ways in which artists work across the limits of nation-states. In turn, artists are uniquely positioned to think about and respond to these limits in their practice. The ways in which bodies are being read and analysed by new forms of border control, such as body scanners or the collection of biometric data, questions the relation between the virtual, the body and the state. Today, artists propose answers to how the quantified representation of a body in data relates to its physical form.

Digital spaces, processes and data sets can be wonderfully and disastrously glitchy. The faults that, for instance, artificial intelligence make when recognizing or misrecognizing persons at borders cause enormous harm. Refugees trying to cross an impenetrable line fear detection on the basis of their fingerprints, whereas trans people might be subjected to harrasive behaviour at an airport security check for their passport picture does not

match their body according to the facial recognition software.

Conversely, utopian ways in which artists create new forms of embodiment in virtual reality, related to or completely separate from our bodies, shift the conversation on what it means to translate ourselves into (messy) data. In virtual spaces, there is room to explore new modes of self-expression but also new modes of community across borders. In this context, particularly those groups which are often treated as unwanted, unrecognisable by border systems, may develop other modes of representation.

In going forward, we ask ourselves how to insert glitches into the border system. Artistic projects can point to the grave issues some communities face in trying to connect to their peers in other countries. They also show the permeability of border technology. Even if the technologies designed to stop people from crossing into other countries become smarter, the realisation of this project shows in how many ways, and in which troubling times, we are able to connect, communicate, work together and build communities.

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¹ In this context the digital is understood as everything that is modelled on binary digits - 0s and 1s. (Horst and Miller, 2012)

Sensing Places: Making Room for More-Than-Human Encounters in the City

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This paper reports on an on-going research project called ‘The Augmented City’ which aims to create augmented reality (AR) experiences in the city of Helsingør. The paper describes and discusses two ‘sensitising workshops’ intended to promote bodily, affective, and ecologically aware ways of relating to our urban surroundings.

Augmented Reality. Design methodology. Affective encounters. Soma. More-than-human.

1. INTRODUCTION

Augmented Reality (AR) as a strategy to uncover different narratives and perspectives of the city is increasingly being used in urban heritage tourism (Jung & Han, 2014), where it is often applied as a way to make historical narratives come alive in locations where the physical traces of them are no longer present. The project *Chicago00: The Eastland Disaster* (2016) is a good example. In this on-site augmented reality tour, as participants are led along Chicago’s riverwalk, they are introduced to the story of a passenger ship which capsized in the Chicago River in 1915 by means of archive materials, such as photographs and videos. Other AR projects in public spaces have aimed more towards *challenging* dominant historical or political narratives of the urban environment (McWhirter, 2018). One example is *Water wARs* in which artist John Craig Freeman overlaid a fictional pavilion for ‘undocumented artists/squatters and water war refugees’ in Venice’s Piazza San Marco (Freeman, 2011). Such projects are often designed to influence how people relate to their environment.

In this paper, we present our work-in-progress research, which builds on these AR works, but adds a new dimension by focusing on bodily, affective and more ecologically aware ways of relating to ourselves and to our surroundings. We see our work as part of an investigation into the concepts of ‘space’ (as in shifting material configurations) and ‘place’ (social and cultural understandings of specific locations) (Dourish, 2006), with the overall aim of developing ways of using AR to introduce local historical narratives whilst still making room for the affective engagements.

The paper focuses specifically on our methodological approach, combining affective interaction design (Fritsch, 2018) and soma design methods (Höök, 2018) to create ‘sensitizing workshops’ which can produce new and unexpected engagements between bodies in urban spaces. The research process presented is part of an ongoing project called ‘The Augmented City’ which is exploring the creation of AR experiences in the city of Helsingør in Denmark. Reflecting on two workshops that we have organised, one within our research group itself and one including all the participants of the project, we discuss the potential of the workshop activities to

- i) de-centre the human through zooming-in and zooming-out of space and
- ii) enable affective encounters between human and more-than-human bodies through sensorial experiences that unravel relations of the past and the present.

2. THEORY AND DESIGN APPROACH

An important part of how we frame our work is through the concepts of *space* and *place*. To unpack this, we turn to the well-known work of Paul Dourish. Harrison and Dourish (1996) originally put forward a distinction between ‘space’ and ‘place’ in which space points to the structure of a location, in terms of topology, orientation and connectedness, and place is derived from the social meanings, cultural conventions and functions of a location which are dynamically formed and reformed over time. However, ten years later, Dourish revisited his

and Harrison's work and proposed some important changes to their previous definitions of place and space. This time around, Dourish (2006) emphasized how space is as much a social product as place is. As he sees it, our understandings and experiences of space are so entangled with social practices and historical events and patterns (in relation to the flow of people, goods, capital, and information) that it is not possible to talk about space as something that can be completely separated from the social and cultural conditions which produce places. He also makes the argument that through the introduction of technology into everyday spaces, not only are new opportunities for sociality created (and thus the forming of new places), but equally important, new *spatialities* are developed as *technology enables us to re-encounter space*.

2.1 Making space for the more-than-human

In our work we focus on exploring the development of new spatialities and narratives emerging as a result of encounters between bodies, both human and more-than-human. We take the concept of a *more-than-human world* from David Abram (1997) and his work on how living and non-living beings are interrelated with human societies. The more-than-human world encompasses for example animals, plants, water, air masses, and rocks. The interconnections between these different forms of existence, described by Maria Puig de la Bellacasa (2017, 145) as being 'in a web of living co-vulnerabilities', underline the need for a relational approach to environments, which highlights co-dependencies between human and non-human bodies and takes these into consideration.

Our aim is to create the possibility for more sustainable and ecologically aware ways of relating to ourselves and to our surroundings. This means that in our on-going design process, we carefully navigate the continuum between space and place, unravelling affective relations and tensions, as well as creative opportunities.

2.2 Affective Interaction Design and Soma Design

In our methodological approach, we build on theories and practices established within the two areas of Affective Interaction Design (Fritsch, 2018) and Soma Design (Höök, 2018). What we like about both design approaches is the strong focus on affect and somatic experiences, and we use these as a joint point of departure for exploring space and place.

Affective Interaction Design has been proposed by Fritsch (2018) as an approach to Human-Computer Interaction (HCI) and interaction design, which takes into account the *relational* and *more-than-*

human aspects of affect. In his work, Fritsch draws on a strand of affect theory that has become prominent within the humanities and which builds on the philosophy of Spinoza (Deleuze, 2001; Massumi, 2002). This explores how living and non-living bodies (including animals, plants, technological objects etc.) are influenced, moulded, and changed during encounters with other bodies. By building on this broad understanding of what a body can be, Affective Interaction Design draws attention to the interconnectedness between all forms of earthly existence.

Soma Design is a method of doing design research in HCI which adopts a holistic stance on the (human) mind and body – the soma – as a starting point in design processes (Höök, 2018). It has its roots in the philosophy of somaesthetics (Shusterman, 2008), and emphasises becoming attentive to and improving connections between movement, sensation, feeling, emotion, subjective understanding and values. This makes it not solely a theoretical method, but also a pragmatic and practical endeavour, proposing concrete ways of actively engaging the soma (Tennent et al., 2020) – both the designer's and the end-user's somas – in designing new interactive experiences. Within HCI, there are a variety of soma-based design strategies aiming to improve designers' somaesthetic awareness and ultimately their ability to design rich experiences with the help of technology. Two of these strategies which we adopted in our workshops are: a) starting from bodily experiences and articulations of such experiences and b) defamiliarising already familiar experiences in order to make available new design spaces for human-computer interactions.

We see affective interaction design and soma design as complementary to one another and we have deployed both in our exploration of more-than-human encounters in urban locations.

3. THE CONTEXT OF THE TWO WORKSHOPS: "THE AUGMENTED CITY"

'The Augmented City' is a project currently running in Denmark and developed in collaboration between CATCH, which is an Art and Technology space, the Helsingør City Council, the Helsingør City Museum, researchers from the Copenhagen Business School (CBS), researchers from the AIR Lab at the IT University of Copenhagen (the present authors), and a prototype and production space called betaFACTORY, located in Copenhagen. The overall goal of the project is to develop AR experiences in and for public spaces in Helsingør which will connect people to the history of the city and its citizens.

Both workshops were organised by the authors of this paper and took place in spring 2021, each

lasting for two to three hours. The first workshop was a preliminary exploration of the proposed activities, on the basis of which the exercises were fine-tuned before all the participants in 'The Augmented City' project were invited to take part in the second workshop.

Prior to the second workshop, representatives from the city council and the city museum presented us with a number of locations in Helsingør that they thought would be interesting to work with. They also introduced the project group to historical objects and narratives linked to these locations. However, these were presented to the participants only after the workshop took place, since it was considered important to start by focusing on experiencing spatial qualities before attending more to the historical aspects of place.

The location that was chosen for the second workshop, in which the project's stakeholders also participated, is called 'Wibroe plads', a rather anonymous small square on the Helsingør waterfront. It was once the location of a grandiose customs house but now seemed to be rather forgotten by the locals. The location for the first workshop had taken place in a similar place in the area of Christianshavn in Copenhagen.

Running two similar workshops with the same explorational aim offered a fertile ground for experiencing and reflecting on how to sense places through more-than-human encounters from an affective and soma design perspective. In particular they created the opportunity to consider how shifting perspectives of space and place can enrich historical narratives and experiences of the urban environments.

The activities we engaged in during the workshops centred on different aspects of sensing, foregrounding either the bodily felt, kinaesthetic, acoustic or tactile sensorial impact of being in the city together.

3.1 Workshop exercise: Attuning to the body

We started both workshops with bodily experiences and articulations of such experiences. The activity started with a guided breathing meditation in order to tune into our bodies and become attentive to our breathing patterns. This was done to ground our bodies in the urban space. Participants were invited to sit or stand in the cityscape, close their eyes, direct their attention inwards and notice – but not act upon – the sounds, temperatures and air movements, as well as to be aware of other bodies moving in the city. We next asked participants to observe their bodies in relation to the surrounding space. We then invited them to observe their bodily sensations, using prompts such as 'How are your feet touching the ground?', 'Do you hear any sounds

around you?', 'How does your body experience the temperature and other weather factors?' This exercise lasted for 10 minutes. We allocated sometime after this activity to reflect on our first-person experiences and to document them in 'body maps' (Loke & Khut, 2014), which involved depicting an outline of a body silhouette in an open space on which they could record their felt experiences by sketching or making notes. We ended this activity by sharing our experiences in the group.



Figure 1: Participants attuning to their bodies

3.2 Workshop exercise: Attuning to material bodies

In both workshops we then practised attuning our bodies to other material bodies in the city surroundings, as a way of defamiliarising already familiar experiences (Höök, 2018) as well as considering the *relational* and *more-than-human* aspects of affective encounters (Fritsch, 2018). In the first workshop we first explored how to extend our breath into materials in the surroundings for us to connect to the space. However, we found that touch was much more evocative and enabled us to zoom in and experience materials in the space more directly. We asked participants to spend 10 minutes attuning to their surroundings and to ground themselves by letting their breath, hands, nose, chins, or other body parts touch and extend into objects, plants, or anything else in their surroundings. This approach was very performative in the sense that everyone became aware that their actions drew the attention of passers-by in the public cityscape. We decided to keep this more performative approach with a focus on touching objects in the environment in the second workshop with the stakeholders.

We allocated sometime after this activity to reflect on our experiences together in groups of three and

then discussed take-aways amongst the whole group. We documented the exercise and reflections with video recordings.

3.3 Workshop exercise: Attuning to spatiality

The last activity was about attuning to spatiality and affective experiences created by larger structures by 'zooming out'. In both workshops the authors of this paper and the other stakeholders explored different perspectives of space; the architectural structures, designed spaces and large-scale aspects of the urban environment. We instructed participants to walk slowly in the space and to mimic, for example, a building, a wall, a fountain or whatever attracted them.



Figure 2: Participants attuning to objects and plants

In this activity we also explored embodied spatiality by trying to get as close as possible to the "being" of these structures.

We invited the participants to try to experience e.g., the air, the view of passers-by and other more-than-human bodies from the perspective of the non-human body they had chosen.

At the end of this activity some time was allocated to reflect on our experiences in groups of three, and then we discussed some of the take-aways, also from the sensitizing workshop in general, amongst the whole group. We documented the exercise and reflections with video recordings.



Figure 3: Participants attuning to larger structures in the surroundings

4. WORKSHOP REFLECTIONS

In this section we will present a summary of the reflections from both workshops, grounded on the group discussions we had both after each activity took place, and after each workshop was complete, reflecting on the activities as a whole, but also on how these sensitizing experiences could serve as a starting point for developing AR experiences in relation to specific locations in the city.

4.1 De-centring the human through zooming-in and zooming-out of space

Both workshops explored the interrelationship between the space that surrounded our bodies in the city and the other objects within it, by using exercises which guided us to zoom into, or out of that space. This led us to become attentive to other bodies (material and non-human) beyond our own or the co-participants' ones. This was especially present in the exercises of 'Attuning to material bodies' and 'Attuning to spatiality' in which aspects of scale led to unexpected experiences of affect in relation to non-human bodies. For example, in both workshops, during the exercise of 'Attuning to material bodies', some participants focused on a small piece of moss growing in-between two stones on the ground (1st WS) or on the surface of some big stones that were part of the square's architecture (2nd WS). Each participant spent some time experiencing the texture of the moss and started adopting a view of the location from a 'moss perspective'. They also started thinking about other pieces of moss that most likely existed nearby, on the ground or on other objects, and began to consider how to tell stories of the place through a plant's perspective rather than a human one. Thus, this quite mundane plant that can often pass unnoticed, suddenly became the protagonist of emerging narratives. Another example in which zooming out of our human bodies contributed to similar experiences, was during the 'Attuning to spatiality' activity of the first workshop, when one of the authors focused on a large-scale building crane to experience its movements, scale, and shape. Or during the second workshop, when one participant focused on a sculpture of a lion in the centre of a fountain and adopted its view of the surrounding space, looking up towards the sky and roaring. These experiences led to questions such as: 'How could this crane or lion tell stories of this location, and what would their perspective on the stories be?' These examples of zooming into or out of space, through focusing on the small-scale and large-scale things, led to experiences of 'decentring' the human' and prompted us to consider telling stories of the city through the perspective of more-than-human bodies.

4.2 Affective encounters leading to the attention to temporalities

A second reflection that emerged from the workshops was that scaffolding situations for exploring the urban space through various senses (e.g., sound, touch, movement) allowed for new, unexpected affective relationships to develop between human and more-than-human bodies. The activity of 'Attuning to material bodies' prompted the participants to touch and explore other bodies such as plants, objects (i.e. a wooden bench or the stairs) and surfaces (e.g. metallic surfaces, stone, grass, wood), or to listen to different objects and try to become attentive to the sounds of the surrounding space, including not only pleasant sounds (e.g. birds), but also sounds that can be annoying (e.g. cars passing by). Suddenly new affective relationships started to develop with the objects, materials, and space, simply by engaging with them sensorially. Participants started feeling emotions such as empathy or even care for things through touching, smelling, or listening to them. For example, participants who had focused on a large piece of wood and explored it with their senses (1st WS), drawn by its textures and details of its shape, started feeling sadness and empathy for it, as it was old and had been through a lot. Thoughts of stories and 'memories' that the wood might have had started coming to the surface, connecting the past and the present. We experienced the meeting (somatic and affective) between different bodies situated in these particular spaces to be very powerful, since it brought attention to aspects of the temporality of bodies and materials, whether their transience or their great durability compared with human beings.

Thus, the different workshop activities facilitated affective connections as well as larger perspectives of time. We see the latter as being of particular importance to how we view the different layers of histories of a location and how stories of the past can come together with stories of the present.

5. CONCLUDING REMARKS

In our ongoing research process in Helsingør, our approach so far has been twofold: on the one hand it has concerned itself with the here-and-now, as in the currently present conditions and material configurations of selected locations in the city (i.e., buildings, land structures, plants, humans, animals, wind, and sky) which in turn constrain and enable certain bodily sensations, movements, and interactions. On the other hand, we have also begun taking into account the historical narratives which constitute these places through our collaboration with the local city museum (however, the focus of this paper has been on the first approach rather than the latter).

One take-away from this process so far is that a somatic and affective approach can help to decentralize the human perspective by connecting with more-than-human bodies that also exist in our urban spaces, but which often pass unnoticed. This invites designers and other stakeholders to consider how stories can be told and affective relations can be established with a higher degree of ecological awareness.

Moreover, we have experienced first-hand that stories and narratives (of places) are fleeting concepts. We knew of course that historical narratives tend to change more often than you might expect, as they are largely affected by shifting political agendas. However, in our collaboration with the projects' stakeholders, we have seen that the level of importance given to certain historical narratives can change just from one day to the next. For example, the City Museum presented us with several historical objects in the beginning of the project, one of which was a so-called 'plague mask'. The mask was later withdrawn from the project work because the museum representatives changed their minds about its relevance for the history of Helsingør. This example shows how the historical understanding of a certain location can be just as transitory as the sensory and affective experiences of its material conditions. Therefore, we believe that none of these aspects should be treated as permanent or more important than the other.

Taking these insights further, our aim is now to develop AR experiences for these urban locations which will encompass the poetic (c.f. Wright et al., 2008). This means approaching the local histories as unstable fragments of the past in which some voices are stronger than others. By putting the more-than-human at the centre, we believe that we may draw on a different set of narratives – the stories of the sea, the soil, the rats, and the birds, the walls of a house, a wooden bench, or a forgotten fountain. For us, the important thing is that these stories are brought to the present through sensory and affective experiences which help us connect to the stories and ground them in our own bodies.

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AI-based artistic representation of emotions from EEG signals: a discussion on fairness, inclusion, and aesthetics

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While Artificial Intelligence (AI) technologies are being progressively developed, artists and researchers are investigating their role in artistic practices. In this work, we present an AI-based Brain-Computer Interface (BCI) in which humans and machines interact to express feelings artistically. This system and its production of images give opportunities to reflect on the complexities and range of human emotions and their expressions. In this discussion, we seek to understand the dynamics of this interaction to reach better co-existence in fairness, inclusion, and aesthetics.

Brain-Computer Interface. Generative Art. Algorithmic Fairness. Art therapy. Disability Aesthetics.

1. INTRODUCTION

Artificial Intelligence (AI) technologies are having an enormous and complex impact on our cultural production and collective creativity (Manovich, 2017). In this paper, we provide a concrete AI system that generates art pieces representing human emotions detected from electroencephalographic (EEG) signals.

Considerations related to the emotional sphere are naturally restricted when analysing technical and scientific inventions (Picard, 1995). In the same way, we rarely conceive artistic content generated by AI as a representation of ideas or emotions. In our system, humans become providers of emotions, transmitting information that an AI recognizes, encodes, and expresses through a painting. As a result, we explore the grey area between what is human and what is artificial, suggesting the concept of AI as a potential creative extension of humanity.

This work was realized in an Engineering context, aiming to contribute to the technical research on Brain-Computer Interfaces (BCIs) and generative models. The research activity was enriched with constant access to a more humanistic environment

in the context of the FeLT Projectⁱ at Oslo Metropolitan University (Bergaust and Nichele, 2019) emphasising the understanding of philosophical and cultural implications of the proposed system. However, this research is not intended as production of an artistic concept or paradigm. Further developments could expand the work in artistic directions by adding conceptual layers or directing and fine-tuning the system.

In Section 2, we briefly present our pipeline; in Section 3, we analyse its limitations in terms of algorithmic fairness, suggesting future work ideas to overcome them. In Section 4, we provide and comment on some of the obtained paintings. In Section 5, we explore the potentialities of this system in the fields of art therapy and disability aesthetics. Finally, in Section 6, we frame our work in a theoretical discussion, relating it to the existing literature.

2. THE GENERATIVE PROCESS

We conceive this research activity as part of the collective effort in understanding how AI is shaping the production of emotionally charged visual images. As such, we have developed our

considerations starting from the questions raised by McCormack et al. on generative computer art (McCormack et al., 2014). On this subject, we underline that our generative process relies on the abstraction of the natural physiological response of our brain in the presence of emotional experiences.

Developing an AI system that can deal with emotions requires a challenging mathematical formalization of these vague and subjective phenomena. Historically, psychologists have adopted two different paradigms to characterize emotions: a continuous and a discrete one. The continuous one visualizes an emotion as a point in a multi-dimensional space, with each dimension representing a distinctive characteristic (Russell, 1980). The discrete paradigm, adopted in this work, utilizes a finite set of basic emotions that, when combined, can express more complex feelings (Ekman, 1992).

Our system relies on state-of-the-art deep learning architectures, and it requires two different datasets (one for EEG signals and one for paintings) sharing the same emotional labels. We provide a conceptual pipeline in Figure 1, in which we see the role of both datasets as inputs to two different blocks.

The first block of the pipeline (**EEG emotion encoding**) relies on a Regularized Graph Neural Network (Zhong, Wang and Miao, 2020) dedicated to processing the emotion in the EEG signals. This block produces latent vectors synthesising emotions in EEG signals. We keep the dimension of these vectors high, preserving more information than the single predicted emotion in each signal. This design choice is motivated by an interest in

dealing with the influence between different emotions as, in many cases, a single word may not be enough to describe a feeling.

The **image generation block** relies on a generative adversarial network, StyleGAN2ADA (Karras et al., 2020), trained on the dataset of paintings. This block receives the EEG latent vector produced by the **EEG emotion encoding block** and a random vector. The introduction of randomness in generative processes is necessary to simulate the variability and unpredictability of a creative process (McCormack et al., 2014).

For more details on the technical implementation of this system, we refer the readers to (Riccio, 2021).

2.1 Related works

To the best of our knowledge, no related work fulfils such a translation of emotional states into paintings. In (Salevati and DiPaola, 2015) and (Colton, Valstar and Pantic, 2008), the authors propose systems to create expressive self-portraits of people. However, these systems have evident limitations, and the users have control over the emotion they want to translate on their portrait (in one case, they select it; in the other, emotions are detected from facial expressions, which can be faked easily). In both works, predefined styles are simply applied to existing portraits. In the context of emotional painting generation from EEGs, we mention (Ekster, 2018) and (Random Quark, 2017). In these cases, the paintings represent emotions through simple lines, predefined shapes, colours, fractals, or bird swarms, causing a rather low inter-painting variability.

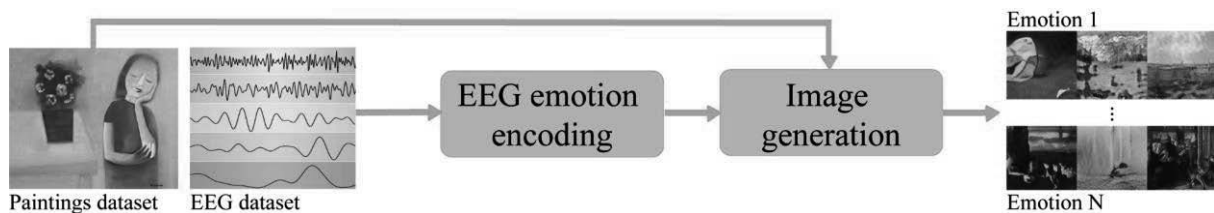


Figure 1: Synthetic scheme of the pipeline, from inputs (on the left) to outputs (on the right). EEG image source: GOQii blog. Painting in the picture: “Room at Twilight” by Charles Blackman (1963).

3. ALGORITHMIC FAIRNESS: A CRITICAL PERSPECTIVE

Given the technical and humanistic intentions of this work, we propose a critical perspective on some limitations. To guide this discussion, we introduce algorithmic biases as systematic deviations from a fair representation of reality, sometimes having consequences on specific groups of people (Kordzadeh & Ghasemaghahi, 2021; Ogolla & Gupta, 2018). The presence of algorithmic biases in the **emotion encoding block** of our pipeline could make the interaction with this

software rather difficult for some people. At the same time, biases in the **image generation block** could cause an evident under-representation of different cultures in the resulting paintings. Therefore, we consider the analysis of such biases a fundamental step to lean towards a fair system.

3.1 Algorithmic biases in EEG emotion encoding

Emotional expression in humans is naturally influenced by cultural identity, to the point that it influences the emotional experience itself (Immordino-Yang, Yang and Damasio, 2016) and

causes unwanted social norm violations (Hareli, Kafetsios and Hess, 2015). Studies have shown that the main factors that cause differences in emotional expression are native languages (Wierzbicka, 1999), gender, social contexts, and social position (Drag and Shaw, 1967). In the case of emotion recognition, algorithmic biases can be evident when the recognition is based on facial expressions, word choices in speech, voice tone and other cultural-dependent data modalities (Howard, Zhang and Horvitz, 2017). On the contrary, we do not have information on whether these biases exist in EEG-based emotion recognition. Since EEGs represent an inner physiological reaction, it can be assumed that any existing bias would be less strong. This consideration has led to the choice of recognizing emotions from EEG signals.

We have performed two kinds of experiments: one using the SEED-IV EEG dataset (Zheng et al., 2018) and one performing recordings with an easy-to-use and off-the-shelf device, the OpenBCI headband kit with eight dry-comb electrodes, paired with the Cyton board. The SEED-IV presents high-quality signals, recorded on a homogeneous set of people. The choice to record signals with an off-the-shelf device derives from the desire to create an accessible system, potentially trainable on a diverse set of subjects.

Recording EEG signals ex-novo requires understanding how to elicit emotions in laboratory settings. From an extensive literature review on this topic, we have observed that the most popular choice for emotion stimulation is to utilize cultural contents, like videos (Schaefer et al., 2010; Maffei and Angrilli, 2019), images (Lang, Bradley and Cuthbert, 1997), sounds (Yang et al., 2018). After our experiments, we claim that these contents can considerably produce noise in the elicitation, and the research in the field becomes slower, as stimuli are hard to re-utilize in different cultural contexts. For example, the authors of SEED-IV have publicly shared the emotion-eliciting videos (entirely in Chinese) that they had utilized in their experiments. Despite the subtitles, in our post-experiment interviews we have assessed that these videos are hard to follow for non-Chinese speakers, and we suggest that the research in this area would benefit from further psychological investigations on the methodologies for emotion elicitation.

3.2 Algorithmic biases in image generation

The dataset on which generative adversarial networks (GANs) are trained creates a latent space containing the possible features of the generated elements (Goodfellow et al., 2014). Algorithmic biases in content generation can arise unintentionally, creating misalignments between

the distributions of the features of the training data versus those of the generated data (Salminen, Jung and Jansen, 2019). In this context, art practices represent a significant opportunity to explore and understand such biases (Booth et al., 2021).

We have trained StyleGAN2ADA on the WikiArt Emotions dataset (Mohammad and Kiritchenko, 2018), a public collection of heterogeneous paintings experimentally labelled with conveyed emotions. Given that these artworks are mainly conceived by western artists, the generated images will inevitably follow the aesthetic norms of western arts, causing a technical limitation. Utilizing a broader dataset (in terms of historical periods and geographical origin) could lead to the generation of paintings that represent emotions relying on cultural-independent and period-independent features. While we can conceive an AI system capable of recognizing these features and reproducing them, such a generalization power is hard to imagine for an individual human artist.

4. RESULTS

In this section, we provide a selection of obtained paintings from different experiments at different resolutions. We comment on some of their characteristics, when grouped according to the emotional class of their respective EEG. We trained the pipeline on the SEED-IV (EEG dataset) and WikiArt Emotions (paintings dataset), with labels in four classes: anger, sadness, fear, and happiness.

With image resolution 512x512 pixels, the training took approximately ten days, utilizing the GPU Tesla V100-SXM2-16GB. The training time becomes much longer with less powerful GPUs, and shorter at lower resolutions. The resulting images were upscaled using a super-resolution technique (Sun and Chen, 2020). Although acknowledging that connecting images to emotions is a cultural and learned experience, we mention some features in the paintings.

In 'sadness' (Figure 2), it is possible to observe a prevalence of blue shades and cold colours. Regardless of the colour palette, most of the paintings seem to depict characters, scenes, or objects that transmit a sense of loneliness and abandonment. Among them, it seems possible to discern a nomad amid a storm, two figures hugging and crying, a broken vase in the shape of a human head, or an empty room with empty shelves. In 'anger' (Figure 3), we observe warmer and darker shades becoming prevalent in the paintings, and the depicted characters are mostly demonic figures or skulls. The atmospheres have a strong imaginative and abstract component.



Figure 2: Paintings belonging to the class “sadness”.



Figure 3: Paintings belonging to the class “anger”.

In ‘fear’ (Figure 4), some of the paintings represent threatening characters immersed in bleak scenarios, and it seems that their goal is to strike fear in the spectator. The remaining ones depict fear from the point of view of who feels it. This representative dualism seems to make these paintings notably heterogeneous in both colour palettes and shapes. Paintings in ‘happiness’ (Figure 5) stand out because of their bright and gaudy colours. Most of them represent bucolic scenarios with green grass and blue skies.

Different from the previous classes, the existing characters transmit a sense of joy and tranquillity.

The expressivity and shape variability of the paintings make this system emerge compared to its related works. Several of the proposed paintings do not precisely fall into the idea of their assigned emotion, or they evoke more emotions at once. This effect is not unexpected or undesired, as we have made explicit design choices (see Section 2) to obtain it.



Figure 4: Paintings belonging to the class “fear”.



Figure 5: Paintings belonging to the class “happiness”.

5. ART THERAPY AND DISABILITY AESTHETICS

Critical Disability Studies is an active and interdisciplinary research area characterized by several debates and enigmas (Watson and Vehmas, 2019) in the analysis of disability as a ‘cultural, historical, relative, social, and political phenomenon’ (Hall, 2019), with an activist component. Given the nature of our work, we analyse our system from the perspective of the intersection between art and disabilities, focusing on art therapy and disability aesthetics.

With the term ‘art therapy’ we refer to art practices that can improve the well-being of patients (Solvang, 2018). In our system, we provide the possibility of creating paintings from the brain activity during an emotional experience, suggesting that artistic abilities are not necessarily attached to physical bodies. Despite the lack of experiments

that can confirm this, we believe that the utilization of such a system could improve self-esteem and marginalization issues for some individuals, and we suggest that further studies on this topic would be highly beneficial.

The term ‘disability aesthetics’ refers to the historical connection between the conception of the beautiful in art and the stigmatisation of disabilities (Levin and Siebers, 2010). People with disabilities have been marginalised from the art discourse on two different levels: on the one hand, disabilities have been highly under-represented in the history of art, and, on the other hand, the art narrative has silenced the stories and intentions of artists with disabilities (Sherwood, 2019). The first aspect of this marginalisation has seen a turn-out in modern art, establishing new aesthetic norms that allow a more diverse representation of humanity. This sensibility is evident in the techniques of Dada and Expressionism, which rely on deforming bodies and expressing high artistic ideas through ‘imperfections’. According to the

theories of Tobin Siebers (Siebers, 2005), modern art has allowed the representation of disability to become an aesthetic value.

Linking our results to this discourse, we raise questions regarding the role of AI generative art in establishing new aesthetic norms or in reinforcing existing ones. Our AI system is trained on paintings representing human bodies with clear, defined, and symmetric shapes. However, the scarcity of training data and their heterogeneity imply that the system cannot reproduce human figures perfectly. Despite this technical limit, the resulting paintings can express the emotions in the inputted EEG signals, demonstrating that imperfections can be at the base of emotional expression in art practices. The shapes in our paintings suggest that AI can be “freer” than humans from prejudices on the canonical ideas of beauty and, in such a context, we wonder whether the progressive acceptance of AI-generated paintings as part of the ‘high art’ could lead to an increased aesthetic acceptance of a more diverse and inclusive representation of the human condition.

6. THEORETICAL DISCUSSION

The BCI described in this paper is related to two technical research areas: affective computing and computational creativity. Affective computing studies the interaction between humans and computers when computers can communicate on an emotional or affective level (Picard, 1999). Computational creativity, instead, investigates the relationship between computational systems, creative practices, and the concept of creativity (McCormack and d’Inverno, 2014). Being a BCI that interprets human emotions in EEG signals and translates the emotions into paintings, our work is an intersection between these two areas.

One of the remarkable features of the proposed system is that the user is passive in the final emotional expression. The lack of control over the generation implies that the machine receives trust in its affective and artistic abilities. We are, therefore, proposing a software that blurs the anthropological border between humans and machines, allowing a different conceptualization of this interaction (Suchman and Weber, 2016) as the two entities contribute **as equals** to reach an artistic outcome.

We conceive this BCI as a creative extension of human bodies. In *The medium is the message* (McLuhan and Fiore, 1967), McLuhan suggests that every extension of ourselves is a medium and that media carry “messages”, intrinsic in the way they modify the pace and scale of our actions in society. In our work, it is fascinating to note that the discussed technology brings novel artistic opportunities whose ‘message’ is still to be understood.

If we accept the idea of this BCI expressing emotions through paintings, then it is crucial to investigate the norms that it adopts for such emotional expression, considering art as an evolving phenomenon reflecting surrounding values. Despite the strong connection between the generated images and the training ones, it is still possible to imagine that this system leverages different paradigms than human artists. As such, the system obtains a “power” that overcomes the intended will of the human providing the EEG signal. Relating this work to classical philosophical questions and with Kant’s intersubjectivity of the aesthetic taste, we wonder whether some of the technical adjustments described in Section 3.2 could contribute to simulating an artistic expression based on a greater logic, truth, or rationality that is outside and above the individual human being.

7. CONCLUSION

We have presented and discussed an AI-based BCI that translates emotional states from EEG signals into original paintings, implementing a humanised software that “understands” emotions and expresses them artistically. We have discussed future work directions to overcome technical and ethical limitations of this system, which, on the other hand, shows high potentialities in the fields of art therapy and disability aesthetics. Our results and discussion contribute to inquiring the role of machines in our complex cultural gear from a classical and anthropological perspective.

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Finding Pictures in the Sky: Machinic Vision of Cloudscapes

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Within cultural and art theory, there has been an emergence of attention placed on machine vision technologies as introducing a new regime of images and ways of seeing. This paper addresses this subject in the context of environment and nature through an inquiry into machinic ways of seeing cloudscapes. Attention is placed on how the cloud form presents a challenge to the logic of machine vision thereby introducing a potential for exploring machinic modes of perception. I look at the work of contemporary artists Daniel Lefcourt, Shinseungback Kimyoungyun and the collaborative group, Forensic Architecture who each, in their own way investigate various forms of machinic representation of the cloud. These cloudscapes are referenced here as theoretical and practical sources to explore a techno-aesthetic that is constituted by a confrontation between the machinic logic of advanced visual technologies and the organic form of the cloud. In different ways, the works explored here each bring to the fore, latent layers of representation of a machinic vision. The visibility of these layers foregrounds its productive capacity in a meaning production which is both open and speculative. These artistic and collaborative engagements provide critical points of departure through which to explore contemporary visualisations of the environment and a production of meaning within a cultural and political realm.

Cloudscape. Machine vision. Anthropocene. Contemporary Art. Representation. Evidentiary Aesthetics. Environmental Visualization.

1. INTRODUCTION

Within cultural and art theory, there has been an emergence of attention placed on machine vision technologies as introducing a new regime of images and ways of seeing. This paper addresses this subject in the context of environment and nature through an inquiry into machinic ways of seeing cloudscapes. Attention is placed on how the cloud form presents a challenge to the logic of machine vision thereby introducing a potential for exploring machinic modes of perception. I look at the work of contemporary artists Daniel Lefcourt, Shinseungback Kimyoungyun and the collaborative group, Forensic Architecture who each, in their own way investigate various forms of machinic representation of the cloud. These cloudscapes are referenced here as theoretical and practical sources to explore a techno-aesthetic that is constituted by a confrontation between the machinic logic of advanced visual technologies and the organic form of the cloud. These artistic and collaborative engagements provide critical points of departure through which to explore contemporary visualisations of the environment and a production of meaning within a cultural and political realm.

The technology of machine vision was first implemented in operations of inspection within the industrial factory, as a technical extension of the labour of looking. What we find today is the increasing development and implementation of machine vision systems— with the inclusion of algorithmic forms of perception— in operations of inspection outside of the controlled environments of the factory and increasingly applied at a planetary scale, monitoring global environments for purposes of climate monitoring and surveillance. These forms of environmental visualization are made possible through the technology of 3D spatial mapping, satellite imaging, automated recognition algorithms, data driven simulation, indexical differentiation and other types of computational imagery. T.J Demos discusses these technologies as producing an aesthetic of the Anthropocene, an era that centres human activity as the primary source of environmental change, and how much of the present visualization has foregone photographic forms of representation and instead rely on data, sensors and forms of automated measurement and statical analysis that are invisible to the human eye. (Demos, 2017, 13) Demos argues that much of this imagery presents itself as self-evident and, ‘...seem hyper-legible but are in fact are far from transparent.’ (Demos, 2017, 17) I explore these machinic forms of

representation and its legibility through an inquiry on the techno-aesthetics of machine vision images in the context of artistic and evidentiary practices.

Aside from the contexts of its contemporary implementation, the processes by which a machine can see, often through algorithmic processes of recognition often remain invisible for us yet are particularly interesting to analyse from a visual culture perspective and through art practices. This is because they have the ability to both define and reconstitute an understanding of vision and visibility. Artists working with machine vision also experiment with the parameters of its application outside of the contexts for which it was designed, exploring further possibilities and potentials of the technology and revealing its salient cultural implications. I approach the phenomenon of machine vision both conceptually; as a source of theoretical inquiry as well as examining its practical form. Both approaches are embodied in my use of the term, 'machinic' which refers to an assemblage of human and machine interaction. Referencing John Johnston, a machinic vision is, 'an environment of interacting machine and human-machine systems...a field of decoded perceptions that, whether or not produced by or issuing from these machines, assume their full intelligibility only in relation to them.' (Johnston, 1999, 27) My focus, here is on an inquiry into the visibility of a machinic vision and the ways in which the technology can produce new perspectives from which a human could not otherwise see from or occupy and how these perspectives intervene, produce and/or reinstate cultural, political and aesthetic meaning.

For this paper I focus on the specific element found in nature of clouds and the rendering of cloudscapes by artists through technologies of machine vision. Upon researching the resurgence of landscape as an image genre considering contemporary visual technologies, the most elusive and intriguing images



Figure 1: Georgia O'Keeffe. *Above the Clouds I*, 1962-1963. Oil on canvas, 36 1/8 x 48 1/4 inches.

I have come across, have been of clouds. Cloudscapes as an artistic genre, are in a sense,

aerial landscapes, which extend the gaze upwards from the land or in some cases downwards when seeing clouds from above, made possible for example from the perspective of a plane.

Clouds represent a figure which is, by its material means the most difficult to capture. They elude statistical analysis and resist typification – two operations through which machine vision operates.

In my previous research at the intersection of visibility and machine vision, I have found that often the images produced through machine vision systems are ghostly; blurred, multi-layered and obscure. (Lee-Morrison, 2019) Yet clouds in themselves, are ghostly in their formlessness and transparency with the characteristic of a constantly shifting shape. As such, machine vision perception of clouds can be seen to do the opposite, in its process of representing the cloud as something solid, measurable and concrete.

As much as clouds may provide a limit case for the processes of perception by machine, they have also existed as a constant motif for five centuries in European landscape painting and have been a primary object of representation for landscape painters, most notably in the work of John Constable. This prolific attention to cloud rendering has led to the production of cloud atlases, which categorize the visual characteristics of clouds, providing for types which appear with more regularity such as cumulus and cirrus clouds. (Fig. 2) Furthermore, the art critic John Ruskin constructed a cloud grid which provided a kind of cartesian perspective of the internal structures of cloud formations. (Fig. 3) These categorisations show attempts to concretise the cloud form for purposes of artistic representation.

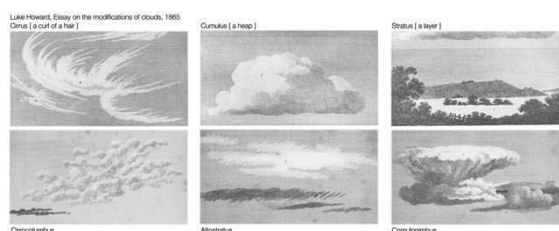


Figure 2: Luke Howard, 'Essay on the modifications of clouds' 1865 in *Forensic Architecture, Cloud Studies*, 2021. Video still. 26:09.

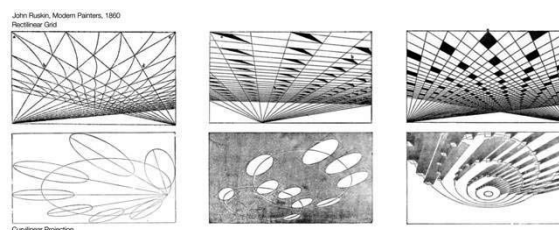


Figure 3: John Ruskin, 1860, *modern painters in Forensic Architecture, Cloud Studies*, 2021. Video still. 26:09.

These atlases provide for two different levels of representation of the cloud; an external, visible representation of its form as well as an internal layer which corresponds with a geometric logic. These multiple layers of representation are further explored in the following contemporary works in relation to a machinic vision of the cloud.

2. DANIEL LEFCOURT: CLOUD AS CODE

The artist, Daniel Lefcourt produced a series of landscape paintings under the title, *Terraform* (2018) which bring spatial measurement technologies such as 3D mapping and topographical algorithms in confrontation with the space and material of the painted canvas. In one of his pieces titled, *Terraform (Cloud Base)* 2018 (Fig. 4) washes of iron oxide pigment and a greyish blue tonal wash appear at the centre of the canvas. This central organic and gaseous form resembles a floating cloud. The title of 'cloud base,' references a spatial index technology used to measure the altitude of clouds, based off their lowest visible portion. The measurement is taken by bouncing light beams off the base of the cloud and measuring the distance above a certain mean sea level or other planetary surface. The painting is layered by a visible grid consisting of single- and double-digit numbers that overlay the entire surface of the canvas. Lefcourt's process of producing these paintings treats the initial washes and tonal stains as the catalyst for coded, numerical measurements. Each number is representative of the average tonal value of the aqueous colour it lays on top of. The grid presents a computational layer of the painted cloud transformed into data. Yet this grid also presents a dual perspective. In contrast to the use of cloud base technology which measures upwards from the ground, the tonal measurements here are measured from above, that is from an aerial perspective of the canvas. This contrasts from the perspective that is visible for the observer of the painting, which at first appears in the form of a horizontal landscape. The representational layer of data which overlays this painting recalls an historical event of the first rendering of the planet Mars, taken aboard a NASA spacecraft in 1965 with a TV camera and transmitted by binary code. NASA scientists on the ground, produced a tonal chart with a very strictly defined value range to correspond with each number sequence, creating the first image of Mars by a veritable, paint-by-numbers, pointillist rendering. (NASA Science, 2019) This event marks a meeting of scientific and artistic modes of representation in creating a representation of what was essentially imaginary, that is, the unforeseen and unknown planet of Mars. These aspects are present in Lefcourt's cloudscape with its visibility of the number sequences which construct the image. His work reveals the layer of representation through which unknown environments have been historically

mediated and through the spatial parameters of a machinic visualization. In this way it exposes a play between layers of representation which can render something as amorphous and full of the imaginary as a cloud, in a mapped and measured form.

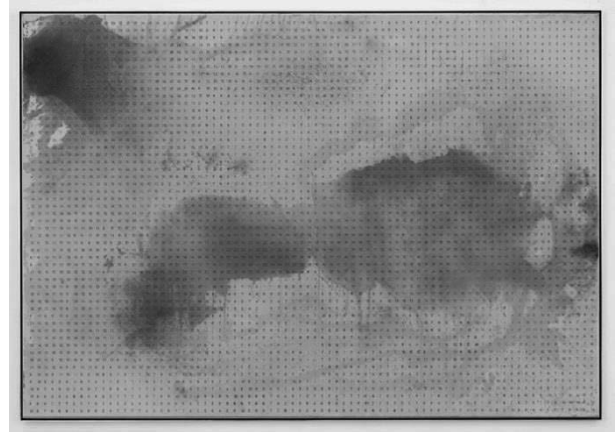


Figure 4: Daniel Lefcourt, *Terraform (Cloud Base)* 2018. Pigment and acrylic polymer resin on canvas 56 by 80 in. 142.2 by 203.2 cm.

Lefcourt's addition of the layer of representation which transforms the cloud into numerical code and vice versa, presents the possibility of multiple, simultaneous forms of representation of the same subject/object. These visible layers of the cloudscape bring to mind W.J.T. Mitchell's analysis of landscape images as constituted by layers of representation. Mitchell puts forth the argument that landscape paintings, always inherently involves a 'secondary representation.' He states, 'Landscape painting is a uniquely centred medium that gives us access to ways of seeing... but as a representation of something that is already a representation in its own right... Before all these secondary representations landscape is itself a physical multi-sensory medium (earth, stone, vegetation, water and sky, sound and silence, light and darkness, etc.) in which cultural meanings and values are encoded, whether they are *put* there by the physical transformation of a place in...or *found* in place formed, as we say, 'by nature'.' (Mitchell, 2002, 12-13) In referring to this kind of primary representational mode of landscape, Mitchell refers to the natural elements as a medium, a kind of multi-sensory means of communication. Lefcourt's painting visualises this process of *encoding*. He mentions, how in the process of making a painting, that drawing— that is, the initial stage of sketching— eventually gets hidden underneath the paint. In his work, he intentionally places this overshadowed layer on top, making the 'sketch' visible, in a style of deconstruction. (Lefcourt, 2021) The automated and computational sketch that structures a machinic translation of the cloud form is brought out of its latent position and made visible in way that

foregrounds its productive capacity. Lefcourt's processes of rendering an applied visibility of numeric calculation applied to something as amorphous as a cloud, highlights a correspondence between computation and indeterminacy; between the machinic and organic layers of representation. As such, Lefcourt's work brings forth a machinic way of seeing which is both speculative and generative, merging the layers of representational constructs that formalise a machinic perception.

3. SHINSEUNGBACK KIMYONGHUN: CLOUD AS MEDIA

In 2005, the founder of the British Cloud Appreciation Society, Gavin Pretor-Pinney published a book of cloud images titled, 'Clouds That Look Like Things,' that included a collection of some of the strangest anomalies of photographed clouds. (Pretor-Pinney, 2005) Each of these collected cloud images point towards a recognisable form such as an animal, a human face, and other everyday objects. Through the act of recognising forms in these cloud images, the book positions the reader, as John Durham Peters describes, 'as a projector rather than a discerner' and as such draws on a kind of collective imaginative capability of human visual perception to find form in an otherwise fluid medium. (Peters, 2015, 254-55) Rather than categorising types of clouds, as in the cloud atlas, this book instead could be seen to categorize visual forms from which clouds are perceived to correspond to. In relation, the artistic duo of Shinseungback Kimyonghun in their work titled, 'Cloud Face' (2012) extends this imaginative capability of projection on to cloud, by mode of visual perception by machine. The members of this collaboration, computer scientist, Shin Seung Back and artist, Kim Yong Hun record moving images of clouds in the sky and then apply an automated facial recognition algorithm (AFR) to scan it and carry out its operation of finding faces. In doing so, the use of AFR is employed to project rather than function in its designed capability to recognise or discern. The duo then collects stills of the moments in which the AFR system has recognised a face and produce large composites.

In 'Cloud Faces' the AFR technology scans cloud formations for faces, instead of random objects as a human would, when cloud gazing. Indeed, the AFR system can see only faces by design, even where there are presumably none. In this way, the artistic duo rely on the excesses of the algorithm's operative function. Yet it is this excess capability— this error — which the artists bring to the fore and which allows this potential of the technology to relate to a distinctly, human capability of imagination, that is in an ability to see something as other. Clouds are forms which can communicate this otherness abundantly. Peters further elaborates on this in his thesis on elemental media. Peters defines media



Figure 5: Shinseungback Kimyonghun, *Cloud Face* (selected image), 2012.

as, 'the means by which meaning is communicated' and describes how an original understanding of the term was based on a reference to the natural elements such as water, earth fire and air as a kind of media. (Peters, 2015:2) Peters describes media in much the same way as Mitchell describes a secondary representation in landscape, when he elusively states that the technical media that we understand today, 'sit atop layers of even more fundamental media that have meaning but do not speak.' (Peters, 2015:2) This aspect of muteness of the elements of nature describes a lack of intentionality and an understanding of nature as not able to self-present, that is its representation seems to always imply a reflexive motion where it exists as something for someone. Yet, as seen through the cloud in Shinseungback Kimyonghun's work, the muteness of natural elements as media, also provides a site of its potentiality in a process of a visual, imaginative capability.



Figure 6: Shinseungback Kimyonghun, *Cloud Face* (installation view), 2012, Pigment print on Cotton Rag Paper, 200 cm x 80 cm.

Furthermore, Peters states about clouds:

They do not look like things to bear significance. They are neither icon, index,

nor symbol. Gloriously, clouds pose the problem of the unrepresentable. ...What would it mean to ask if clouds have meaning? (Peters, 2015, 257)

In a way, Shinseungback Kimyonghun's work plays with how the technology of AFR projects momentary bouts of significance onto clouds by seeing faces in its mobile form. It poses this question of projecting meaning in treating clouds as media, as a visual source of communication, in the way that the AFR enacts a kind of machinic interpretation of the cloud, distilling data and information through its form. The work engages with the natural element of the cloud as a means of communication which exploits this operative function of a recognition algorithm in its mutability. The cloud exposes this tension between form and formlessness, providing a medium for machinic projection which transforms the recognition process into an act of projection. The result of 'Cloud Face' is a kind of alignment of a machinic vision with a human imaginative capability, made possible through the elemental 'muteness' and medium of the cloud.

4. FORENSIC ARCHITECTURE: CLOUD AS INDEX

In 2020 Forensic Architecture (FA) presented parts of a work titled, 'Cloud Studies' in 2020 as part of an exhibition titled, 'Critical Zones: Observatories for earthly politics' at ZKM Centre for Art and Media in Karlsruhe. The video was a culmination of projects carried out by FA which all involved the investigation of illegal toxic cloud emissions by various, different state and corporate agencies. My interest in the work of FA here, involve how they utilise various forms of machine vision technology and virtual and digital image production of clouds and include these within the canon of evidentiary images alongside traditional forms such as documentary photographs and video. FA projects involve sourcing multiple sources of data including the historical documentation of maps, statistical information, meteorological data and cross referencing these with digital visualising technologies to construct a holistic image of abuse utilised as evidence. Through their investigations, FA counters a lack of accountability by states and corporations that rely on an invisibility that is, a lack of evidentiary traces of their abusive activity. In 'Cloud Studies', FA's work focuses on recognising how clouds as a form can be invisible and therefore hard to track and as such provide a 'limit condition'; a 'forensics without inscription,' and an 'architecture in gaseous form.' (Forensic Architecture, 2020) The contexts of these clouds as produced by and through lethal means, also provide for what FA refers to as a 'toxic common' once able to be breathed in by civilians. This approach and

translation of the cloud as an index of targeted environmental pollution and destruction of civilian life also presents a holistic view of the cloud as a fully materialised form. Through the use of machine vision technologies such as optical gas imaging, 3D Fluid dynamic stimulation and machine vision classifiers, FA brings the cloud into full visibility and concretises its form as a signifier of atmospheric power relations and abuse.

One project titled, 'Environmental Racism in Death Valley, Louisiana' concerns the historical black communities that live along the Mississippi River in Louisiana between Baton Rouge and New Orleans. This area, which is where historical slave plantations stood, have predominantly been bought out in recent years, by 200 petrochemical industrial companies who in their production activities spew out the most toxic air in the whole of the U.S, holding the highest risks of cancer. One community which lives in this area, named St. James commissioned Forensic Architecture to gather evidence in support of their claims for accountability and reappropriation, by bringing visibility to the lethal air borne pollutants by industrial giant Formosa Plastics. Forensic Architecture utilises the visualising technologies of thermal infrared cameras and optical gas imaging to bring the toxic gas cloud emissions into what they refer to as the visible register. (Fig. 7) They, furthermore, are able to have a record of the amount and exact date of emissions which they cross reference with publicly available data bases of the industrial gases housed in large tanks and marked by internal codes utilised by Formosa. Forensic Architecture are able to then have a visual record of which exact gases that are being emitted such as methane and sulphur hexafluoride. They further cross-reference this info with records of meteorological data from local weather stations that provide the direction and length of wind in the area. Through the use of 3D fluid dynamic simulation, they visualise how the wind carries these toxic cloud emissions to neighbouring communities. (Fig. 8)

FA describes how the perception of clouds is always 'doubled' in that they are seen from either the outside in which case they are measured; or by the inside in which case, they are experienced. In this case, FA merge the two through their machinic renderings of toxic cloudscaapes. The 'doubling' can also relate to the representation of the cloud and the ways in which the data visualization represents it. These machinic views provide another level of cloud perception, I argue, which involve the 'ingredients' of the cloud, produced from cross-referencing metadata that visualise what the cloud is made of, for example methane, carbon dioxide, or water and represented through colour. Through 3D fluid simulation. FA thereby extends a machinic visibility of the cloud which contributes to the historical practice of cloudscape categorisation, producing a kind of contemporary cloud atlas which

categorizes (man-made) clouds through metadata of its toxicity and the projected area in which the cloud permeates, both of which is not immediately visible to the human eye. The toxic cloud emissions are invisible yet substantive. The visualisation of the cloud through thermal and optical gas imaging, provide traces of its existence, which in turn eventually affect the physical and material lives of the individuals who breathe in its ingredients. Through this work, Forensic Architecture concretises the elusiveness of the cloud form as well as relate it to the experiential aspect of its protracted toxic trace. The resulting cloudscape acts as index by way of pointing towards the metadata of its ingredients and providing evidence



to support accountability on the part of Formosa Plastics.

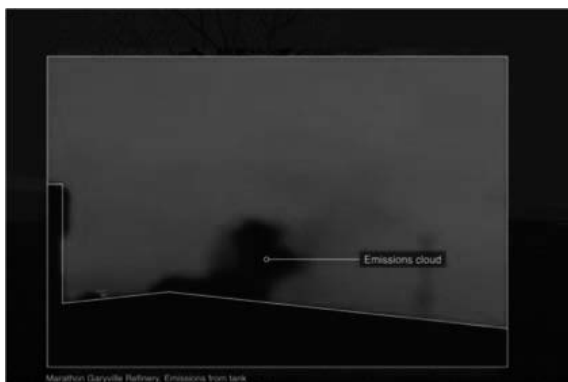


Figure 7: Forensic Architecture, *Cloud Studies*, 2021. Video still. 26:09 .



Figure 8: Forensic Architecture, *Cloud Studies*, 2021. Video still. 26:09.

The cloud and its ingredients are concretised through its image. In this way, FA's machinic cloudscape function within an evidentiary aesthetic, in its representational approach towards the cloud as index.

5. CONCLUSION

The cloud form has presented different challenges in representation historically and within art practices and continues to present distinct challenges to the modes of perception found by machine. The cloud in its non-linear and fractal form, presents a challenge to the modes of perception by machine and the logic by which its processes produce meaning. I argue that these challenges present new potentialities for the technology. In looking into machinic representations of cloudscape, this paper studies a confrontation between a machinic gaze and the organic form. In different ways, the works explored here each bring to the fore, latent layers of representation of a machinic vision. Lefcourt's work exposes a simultaneous layer of numerical interpretation— a kind of computational sketch of the painted cloud form— which highlights a correspondence between code and form, computation and indeterminacy. Shinseungback Kimyonghun draws on the excesses of algorithmic recognition of the cloud, approaching it as a mutable form of media, upon which meaning, and its imaginative capability is revealed. Lastly, Forensic Architecture's approach towards the reading of toxic clouds through digital image simulation and thermal imaging concretises its amorphous form. Through the use of metadata, the imaged cloud becomes an index, functioning through a representational doubling of its visualised form and a record of its toxic ingredients. The visibility of these layers foregrounds its productive capacity in a meaning production which is both open and speculative. In confrontation with the organic form of the cloud, these works explore machinic modes of perception that embody a potential for an imaginative capability. The cloud becomes a perfect object from which the intentionality and excess of a machinic projection can be made legible.

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The Polluted Subject: Capitalism, Identity, and Ecology

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Subject-object dualism is not the essential root of our disrespect for non-human things; distance and difference are inherent to a collective ecology. This paper considers the origins of Nature's transformation into the mythical sublime, the mirror for human experience, alongside capitalism's enclosure of subjectivity into the space of identity: a container that creates both the illusion that we are separate from our environment and can make choices independent from it. Drawing out fragments of personal narrative, I incorporate the theories of Jean Baudrillard, Rem Koolhaas, Timothy Morton, and Silvia Federici to question the structure of "being in" as an ethical and sustainable environmental model. Instead of utopian monism as the panacea to environmental destruction, I posit polluted duality as a metaphor for how we are to ethically engage with an ailing world.

Identity. Space. Ecology. Dualism. Capitalism. Subject. Narrative.

1. INTRODUCTION

Dreams of a healthier relationship with our world are driven by notions that we have a choice in the fate of the earth as individual actors. Yet this brand of environmentalism is propelled by consumerist ideology, which mediates all but a vanishingly small number of exchanges with other beings in developed Western society. Capitalism perpetually disfigures both subjects and objects into *identity*, which by its very nature is static and isolated. The environments of Yellowstone National Park and the Berlin club scene produce an experience in which subjectivity and objectivity are effectively blurred, invoking naturalism and approximating transcendence. This paper suggests that these manufactured experiences are commodities — preconceived products offering an illusion of ecological being. As Bruno Latour has declared, a system of ecological collectivism that is entangled and intra-active is not even known to us yet. My aim in this paper is to think subjectivity without identity by narrativizing my own experience in these 'utopian' environments.

Identity is a product of our culture which inculcates us with a constant self-regard and censorship that turns in on itself again and again, hardening and hollowing out our subjecthood. This is the product of alienation from the body, which Silvia Federici sites as,

The development of individual *identity*, conceived precisely as 'otherness' from the body, and in perennial antagonism with it. The emergence of this *alter ego*, and the determination of a historic conflict between mind and body, represent the birth of the individual in capitalist society (Federici, 2014, 152)

Her emphasis on 'identity' and 'alter ego' is the granular thesis of this paper. Identity means being the same as oneself (Latin *idem*: 'the same as'), while alter (Latin: 'the other') indicates the 'otherness from the body,' a self apart from the original. Identity has replaced the subject in capitalist society and becomes more reinforced the deeper we go into capitalism, because it is a product of capitalism. Identity is a tool of control, as it homogenizes social behavior around a single construction of 'a prototypical individual to whom all are expected to conform.'¹ At the origins of capitalism, there was a single model, which Marx called the 'abstract individual,' to which every person was expected to conform. The qualities of character and difference that epitomized the subject were stripped, leaving the body a container for labor power.

Identity was a simplification of what the individual could offer the labor market and now its role has become further convoluted and entangled in the capitalist system, which both reaps from laborers and panders to consumers. We are living in a moment deemed the 'century of individualism' by cultural theorists like Adam Curtis and Mark Fisher,

in which all forms of self-expression and enjoyment have been commodified as markers of identity.

Algorithms create personalized online experiences that make us feel unique in our scrolling and each decision to buy certain products is regarded as the highest form of creative output. 'Consumerism raised to the highest power is free-floating identity, or identity in process.'² The more we participate in the economy, the stronger our identities become. Yet, like most equations under capitalism, the strengthening of identity is a trap, because identity itself is merely a commodity. It's 'the new junk food for the dispossessed, globalization's fodder for the disenfranchised,' remarks Rem Koolhaas in his essay on Junkspace.³ Would identity be such a fetish object if we weren't stripped of our selfhood, dispossessed and disenfranchised by the system of capitalism? As capitalism becomes globalized and people uproot from their original land to move elsewhere, identity becomes less based on geolocation as it does on categories of class, gender, race, sexuality. These new categories transcend beyond physical space and become fixed global-identities—archetypes in the totalizing narrative of late capitalism. It's a fool-proof model, because no one is going to question the puzzle if all the pieces fit.

Identity is taking over, it has become the center of culture and politics, which have become as brittle and hollow as our subjecthood. Inside our hyper-culture of 'mandatory individualism,' competition has become the fundamental social relation, and it's a competition of identity: who is the most important, the most honest, the most human? Who's up next to save the earth?⁴

In this paper, I explore how we in the post-capitalist Western world navigate an identity-driven environmentalism administered by the same capitalist system it so desperately seeks to abolish; question how to access a subjectivity that is always already *subject-to* its ecological entanglements; and posit an ethics for our polluted world. My emphasis on personal anecdotes is a method of enacting subjectivity to resist theory as a frictionless production of identity.

2. RIGID SUBJECT-OBJECT

Tickets for Yellowstone National Park are available on Ticketmaster and Stubhub categorized as American Entertainment next to concert tickets for Taylor Swift and Justin Bieber. Everything was sold out online, so we waited in line for hours outside the park gates. In the standstill traffic, people deserted their cars and flocked to the Yellowstone National Park Sign to take turns photographing one another in front of the yellow letters painted on wood. Inside, a single-lane road directed our collective experience of Nature's promenade.

iPhones captured photographs through the windows of slow-moving vehicles. We were unable to stop anywhere other than the allocated viewpoints, toilets, and various in-park restaurants, gas stations and grocery stores.

iPhones captured photographs through the windows of slow-moving vehicles. We were unable to stop anywhere other than the allocated viewpoints, toilets, and various in-park restaurants, gas stations and grocery stores.

We, among the hordes of people in SUVs and trailers, were attracted to the park like a Baudrillardian Disneyland. Both parks offer an adventure inside a 'social microcosm, the religious, miniaturized pleasure of real America, of its constraints and joys' (Baudrillard, 1994, 12). Disneyland is an imaginary space which in its contrast invigorates the real of the outside. French theorist Luis Marin, who was the first to theorize Disneyland in his essay 'Utopic Degeneration,' claims that Disneyland isn't utopia as much as it is a 'degenerated utopia,' which he defines as:

A happy, harmonious, non-conflictual space aside from the 'real' world 'outside' in such a way as to soothe and mollify, to entertain, to invent history, to cultivate a nostalgia for some mythical past, to perpetuate fetish of commodity culture rather than to critique it (Marin, 1984, 167)

Degenerated utopias are collapsed because they are not spaces separate from the outside, they are appendages to it, and this specific relationship reinforces commodity culture and ideologies of control. Disneyland is a human-made place that is held together with gadgets and intense surveillance, whereas the wild Yellowstone Park is a degenerated utopia with opposite technology and affect. Instead of being a place for the 'regeneration of the imaginary,' Yellowstone is a place for the regeneration of Nature, which is to say the original real.⁵

Yellowstone is a contained cosmos of the natural world that forces Nature into a constant state of sublimation for visitors to feel soothed and in-touch with their origins: to invent history and to cultivate nostalgia for some mythical past. This fabled history is one where settlers came to the New World, fleeing from the Europe's oppressive state and industry to live freely in a pastoral land of canyons, plains, and 'savages.' Federici notes that the ideology of freedom attached to the New World,

Influenced the political thought of the Enlightenment, contributing to the emergence of a new concept of 'liberty,' taken to signify masterlessness, an idea previously unknown to European political theory. Not surprisingly, some Europeans tried to 'lose themselves' in this utopian world, where they could reconstruct the lost experience of the commons.⁶

Our immersion in Yellowstone is also a reconstruction of an experience, although it is one far more abstract than the commons were for the proletariats of early capitalism. Yellowstone embodies the mythos of the American frontier and the ideal of transcendentalist thinkers like Thoreau and Emerson who advocated for an experience of solitude in nature as means to recover, in Emerson's words, one's 'original relationship to the universe.'

By presenting a packaged deal of fetishized Nature, Yellowstone highlights the decaying and artificial quality of the world outside. This is the obvious and intended effect of the park. In 1872, President Ulysses S. Grant signed the Act of Dedication, committing Yellowstone as government land to preserve and protect its resources from miners and lumber companies. Like the privatization of the feudal commons, the park became restricted, limiting the number of visitors, including the Native people who reaped resources from the land. The park was kept pristine and the native animals and people were exploited as park attractions to increase tourism.

Instead of the location for resources to be processed and commodified, the space and landscape of Yellowstone was objectified as the main product. When communal lands of feudal villages were fenced off, 'It was not the workers who were liberated by land privatization,' Federici argues, 'What was 'liberated' was capital, as the land was now 'free' to function as means of accumulation and exploitation, rather than as a means for subsistence.'⁷ The U.S. government used these capitalist methods combined with a Romantic ideology of Nature 'as an object over there' Timothy Morton warns, 'a pristine wilderness beyond all trace of human contact' to create a new kind of commodity, a product with aura.⁸ Benjamin defines the aura,

As the unique phenomenon of distance, however close [the object] may be. If, while resting on a summer afternoon, you follow with your eyes a mountain range on the horizon or a branch which casts its shadow over you, you experience the aura of those mountains, of that branch.⁹

Here, Benjamin evokes ecological representation to define the aura, which can occur with nature as much as with an auratic work of art. Although the aura is topically known as a quality of aesthetic objects, according to Benjamin any object or scene that we are aesthetically captivated by from a distance can have aura. For the Romantics, the perception of the aesthetic object has moral weight (i.e. are all things beautiful, good?). However, from an ecological standpoint, the distancing of us from nature creates a rigid separation that 'militates *against* ecology rather than for it...it reestablishes the very separation it seeks to abolish.'¹⁰

The Cartesian divide—the subject/object binary—not only alienates people from their environment but also from themselves. Similarly, the land of the park, broken up and preserved for its resources, became denaturalized. It is the same method of industrialization dehumanized workers. Federici writes,

In Descartes, body and nature are identified, for both are made of the same particles and act in obedience to uniform physical law not only is the Cartesian body pauperized and expropriated from any magical virtue; in the great ontological divide when Descartes institutes between the essence of humanity and its accidental conditions, the body is divorced from the person, it is literally dehumanized.¹¹

As the divide deepened, Nature became the site where humans located their dislodged souls. Like Romantic art, in which 'the inner, so pushed to the extreme, is an expression without any externality at all,' Nature became a 'heterogenous phenomena [that] could only accept and remirror a reflection of the inwardness of the soul' (Hegel, 1977, 400). The safety of this distanced view furthered hardened the binary by excusing the subject from its environment.

Yellowstone Park is full of opportunities for sublime encounter. In most circumstances the danger of the wild never quite seizes but remains at a distance, as if walking along the boardwalks to avoid lethal spring water or crouching yards away from a mass hunt is the same as viewing such tableaux as two-dimensional images inside a TV. Within the park, an experience of 'original humanity' is a reification of the alienated soul: '[We] remain untouched in perfect, beautiful isolation, safe in the (non)position that is its own resistance to coming down firmly somewhere or other.'¹² Morton highlights the 'perfect' and 'beautiful' '(non)position' of the subject, which that the beautiful soul in Nature is false, like a shiny metallic box: a container. It is a state that maintains a critical position about everything except for its own position; it is, 'refined into this purity, consciousness exists in its poorest form, and the poverty which constitutes its sole possession is itself vanishing.'¹³ The beautiful soul is a degenerated utopia, a pre-packaged subjecthood that lacks a critical distance and a recognition of the symbiosis between the inside and outside. This soul, dehumanized, is the ultimate subject of ecological consumerism.

Environmental consciousness is a disguise for an ethics of decadence in which ecologically destructive forms of enjoyment that eroticize Nature are the highest form of activism. We have an idea of being environmentally conscious: we recycle, use reusable containers, eat locally and source sustainably. However, this level of individual responsibility isn't necessarily progressive, rather

it's a prescribed post-capitalist dogma. Federici expands, 'The development of self-management becomes an essential requirement in a capitalist socio-economic system in which self-ownership is assumed to be the fundamental social relation, and discipline no longer relies purely on external coercion.'¹⁴ Self-management has become the primary mode of justice, from social justice to environmental, and discipline is a self-initiated moral system that mediates sociality. This split between the self and the world fetishizes the conscious through consciousness raising, and further alienates us from our bodies, and correspondingly from Nature. Yet we still immerse ourselves as if that is the cure. We visit beautiful landscapes, volunteer in marginalized communities, read texts from different cultures and participate in collective activities that bring individuals together into one.

3. COLLAPSED SUBJECT-OBJECT

You skip the line at Tresor, which wraps outside the gates of the old industrial building-turned-rave-space and down to the kebab stand on the corner. The cold night penetrates beyond the black leather jackets and platform boots of the people who stand in line smoking cigarettes. They stare at you blankly as you pass them on the way to the door behind the building. Blue and purple lights flood the stoop where the bouncer asks you if this is your first time at the club. Before you answer he takes your phone and places a small sticker on its camera. Inside, you take a while to strip off the layers of clothing and shove them into the backpack you trade for a numbered token at the coat check.

The space is small, the bar and dancefloor crammed together in the middle of the room. The air is hot and the people sitting on the benches lining the room look like tropical fish: theatrical, shiny and unique. In the back there's the drug room where 50 or more bodies are crammed into a space no larger than 12m². The walls are sweating and someone's hand is holding a dropper over your head and you open your mouth to accept three drops of GHB onto your tongue. It's a drug that makes you feel like liquid. The warm embrace of the crowd and soft undulating light makes the dancefloor feel like an aquarium. Your body gets confused with the ones around you. Pulsing in synchrony, you feel like you are a part of a single body or machine. The exchange of sweat and saliva and the blurring of your vision—lights become solids and solids melting into light—approximate an out of body experience. Yet, this feeling isn't strange to you, in fact it is anticipated: it's what you and everyone else showed up for.

Communal unification and transcendence is the ultimate model for breaking down subject-object

dualism and it has become an easy-access experience in the rave space. In essence this contingent yet constructed sensation of one-ness is an accepted practice of being more environmental. But the flattening of dualism as a pre-packaged deal results in an infinite 'in'-terior—a Junkspace that forecloses on any possibility of expansion. Clubbing in Berlin endures through an ethics that allows for us to orient towards justice in a leisure space. If Yellowstone is the Disneyland of Nature, then Berlin clubbing is the Disneyland of raving. Instead of the Romantic dualism reified by the experience of Yellowstone, clubbing in Berlin achieves the opposite: a blur of objects and identities, what Morton calls 'objectified subjectivity.'¹⁵ This experience is purely hedonic, not one that can initiate healthier ecological relationships. A curated dancefloor experience merely simulates an 'infrastructure of seamlessness...it cancels distinctions, undermines resolve, confuses attention with realization.'¹⁶ Koolhaas' definition of Junkspace is eerily suitable: '[Junkspace] replaces hierarchy with accumulation, composition with addition.'¹⁷ We cannot construct something when its essence is rooted in the non-material. Koolhaas directs us to this by distinguishing 'attention' from 'realization,' and 'addition' from 'composition.' While the accumulation of bodies in a club simulates the breaking down of boundaries and destruction of difference, is there actually sort of cosmic composition occurring beyond the physical? Is it skeptical to question if in our stage of late capitalism every prescribed experience of transcendence is degenerated?

Raving 'pretends to unite, but actually splinters, it creates communities not out of shared interest or free association, but out of identity statistics and unavoidable demographics.'¹⁸ The championship of identity is inextricable from our culture under capitalism, and it even infiltrates spaces where people could once glimpse, 'the spectre of a world which could be free' (Fisher quotes Marcuse, 2016). Mark Fisher believed that visualizing this specter was inherent to rave culture, especially in its collective and ecstatic modes. British rave culture in the 90s was an evocation of the commons that once existed before capitalism.

'Both are imagined as spaces where the boundaries between bodies collapse, where faces and identities slip,' writes Fisher.¹⁹ Moreover, as most raves took place on the English countryside, the enclosure of which spurred the origins of capitalism, raving was a way to reclaim the communalism that what was lost to the oppressive system hundreds of years before. Yet, since the 90s, raving has become a global culture of immersion and the production of collective transcendence has become one of the ultimate capitalist products.

4. POLLUTED SUBJECT-OBJECT

The rave was hosted by a local designer-duo who worked at Nike and made graphic t-shirts on the side. It was located at a place called Toxic Beach on the Willamette River near the University of Portland. The beach was an old docking site for cargo ships and was one of the most polluted locations along the Willamette. The Willamette was deemed one of the most polluted rivers in the United States and contained at least 65 'toxic' chemicals. According to the Environmental Protection Agency (EPA), the pollutants in the river included petroleum, PCBs, pesticides like DDT, polycyclic aromatic hydrocarbons, and heavy metals such as lead, arsenic, mercury, and asbestos (Quirke, 2016). In 2000, the river became a 'National Priority Site' for toxic waste removal. It is now a 'Mega-Superfund' location, which means that the EPA has allocated millions of dollars to 13 high-priority sites along the river in a project to clean up the serious contamination of the water and repair its surrounding ecologies.²⁰

We arrived around midnight and parked on a dirt road near several homeless camps. We couldn't hear the music until we descended to the waterside. The DJ booth and speakers were set up on the loose sand, which was hard to walk on. We were early and only a few people huddled around, not yet dancing, scattered like rocks in the natural dim glow of summer. The beach was cove-like with sparse land that arched above the sand on all sides in an architecture which both amplified and contained the sound. Decrepit harboring spires made of wood and metal poked out Gothically from the black water. Dominating the view of the river was a massive steel bridge. Constructed exclusively for industrial purposes, the imposing bridge was illuminated by artificial light and gave context to the dilapidated ruins of the harbor as if it were the surrounding land of a grand estate.

I had never tried *Sassafras*, but was told that its chemical compounds (methylenedioxy-amphetamine, MDA) share nearly every molecule with molly (3,4-methylenedioxymethamphetamine, MDMA). The tiny crystals burned my tongue and left a taste of gasoline and nail polish remover. In my abdomen, the feeling started with butterflies then transformed to something duller and more sustained like the whirring of a house fan on its highest level. Never before in human history have we consumed mind and body-altering drugs at such a widespread scale. Whether for pleasure, self-enhancement or prescribed by Big Pharma to subdue, drugs in the 21st century are changing our micro-ecologies. 'Is each of us a mini-construction site? Is humankind the sum of three to five billion upgrades?' asks Koolhaas.²¹ Humans consume between 39,000 and 52,000 microplastic particles a year and now the small synthetic pieces composed

of polymer matrices have become permanent fixtures in our organs (Gibbens, 2019).

Ecstasy is named for its emotional effect of overwhelming euphoria in which everything and everyone becomes an object of pleasure and love. Physically, the pupils enlarge and the heart beats at a stimulated pace, and so lights appeared like fuzzy stars, and I was struck by the warmth of my body and of those around me. Emitting a vector of desire outwards towards objects of my desire inevitably suggested that I, too, was this object for others' rays. As the etymon of ecstasy, the Greek *ekstasis* (meaning: 'to stand outside of or transcend oneself'), suggests, I was having an experience of being beside myself—experience my own self as the other. It was a feeling of equilibrium, where no one thing existed above or below another.

Sassafras was a drug that subverted identity fixations in, what Alain Badiou would call, 'a truth process, a rigorous and relentless distinction of the subject from its identifications' (Badiou, *Ethics* 43). Only in an ecstatic moment can one shed all decorum and opinions that accumulate as identity to reveal or, as Badiou writes, '*induce*,' a subject.²² The revelation of my subjecthood was accompanied by a sense that the things around me were foreign and unfamiliar, no longer a projection of my meaning but bare, untextured and unsensual. The arousal of my subject instigated by a 'refusal to digest the object, a sticking in the throat, an introjection.'²³

I sat apart from the dancefloor where most people stood splintered apart with no more illusion of the collective-bodied raver. With chemicals coursing through my body, the illuminated bridge and dilapidated harbor at Toxic Beach were immanent, and I felt a stirring of intimacy towards the landscape. If ethics insist on the urgency of the moment, then an ethics for our polluted world should be an ethics of melancholy. Freud believes that melancholia occurs when the subject is unable to incorporate an object, like grieving for a loss that isn't fully comprehended or identified. A melancholic ethics is one where we are unable to fully introject the idea of the other and allow for it to exist outside of ourselves. By foregoing the compulsion to dominate, control and identify things that do not belong to us, we can begin to enact a greater fidelity to things.

Pollution is a new interpretation of *Zerstreuung* (distraction), a concept that for philosophers like Heidegger and Benjamin has a liberating effect on *Dasein*. In our capitalist culture, where attention is exploited and identity is economized, pollution delivers *Erschütterung* (shuddering) to the subject. The shuddering of attention and identity breaks away the fetters of material obligations to permit the subject to exist in its own mortality and experience the critical possibility of thinking otherness. My

'nonstupefied absorption in the environment, conceived not as reified nature 'over there' outside the city or the factory gates, but 'right here' felt more intimate than the deconstructed collectivity on the dancefloor, where people weren't dancing but stood wavering with their iPhones out, taking photos to prove their existence.²⁴

Through the shuddering my identity, the authentic awkwardness of being at the rave as an individual among individuals eased and what became clear to me was the truth of our entanglement with our environment. Morton demonstrates *Zerstreuung* in Wordsworth's *The Ruined Cottage* by highlighting words like 'half-conscious,' 'careless,' 'dreaming,' 'soft,' and 'distant.' Polluted distraction moreover dulls the sharpness of reality by tempering the view of our defiled and violated environment. I could only access this consciousness by polluting my own body. Morton argues that 'Zerstreuung is a way of getting over deception, rather than falling more deeply into it,' and giving into pollution disallows us from falling victim to utopian ideals.²⁵

Rather than remaining safe in the view of a pristine and constructed utopia, we should give ourselves over to the reality of pollution. To sit melancholy during climate change is to acknowledge that we are subject-to it, instead of moving forward under the false premise that we are separate from its fate. 'Melancholia is an irreducible component of subjectivity... it maintains duality, if not dualism,' finalizes Morton in *Ecology without Nature*.²⁶

Rather than saving the world from contamination we should turn inward to our own decay. Subjectivity and environment are both marginalized and exploited—especially as members of the working class, our sensibilities are polluted, atomized and muddled. Through this melancholic ethics we can reclaim what capitalism has tirelessly enforced and destroyed. Through

polluted awareness we can reclaim subjecthood, obscured and dissolved, and accept the inevitable mortality of species and ecosystems, from which we are not exempt.

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¹ Federici, 146

² Morton, 111

³ Koolhaas, 175

⁴ Fisher

⁵ Baudrillard, 14

⁶ Federici 105-6

⁷ Federici, 73, 75

⁸ Morton, 125

⁹ *Ibid.*, 162

¹⁰ *Ibid.*, 125

¹¹ Federici, 140

¹² Morton, 160

¹³ Federici, 149

¹⁴ Morton, 112

¹⁵ Koolhaas, 169

¹⁶ *Ibid.*, 175-6

¹⁷ *Ibid.*, 183

¹⁸ Fisher

¹⁹ Quirke

²⁰ Koolhaas, 190

²¹ Badiou, 43

²² Morton, 168

²³ *Ibid.*, 163-4

²⁴ *Ibid.*

²⁵ Morton, 186

ROGUE INTERVENTIONS

Training to deal with Otherness – rehearsing & maintaining human-machine relations

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How can design approach machine learning and artificial intelligence? This intervention presents works by students of three programs dealing with design and/of technology. The works engage with the technologies and practices of building intelligent systems but also explore their aesthetic, cultural and social implications. As a collection of experimental pieces that follow a research through design methodology, they explore the entangled ways training, rehearsing and maintenance are needed to deal with the reciprocal Otherness in human-machine relations.

Creative Machine Learning. Research through Design. AI and Design. AI and Society.

1. INTRODUCTION

Artificial intelligence and machine learning promise machines that learn from us. The myth of the machine that meets us as an equal has been with us since, at least, Licklider's "Man-computer Symbiosis" (Licklider 1960). It is found in the idea of human-centred design, smart interfaces, and intelligent agents. In contrast, human-computer interaction has always been about how to perform commands and embody interfaces – about learning how to act like a machine. Acknowledging this, we assume that interaction occurs where technology eludes our expectations, where it needs to be repaired, kept running and performed, or where it develops behaviour that is unexpected and unpredictable. When machines behave in ways that are contrary to our expectations, our relationship to them is challenged — and it might become apparent how many different actors are involved in their functioning. In these moments, machines become Others with whom we have to find a way of dealing. They are not simply non-human actors and therefore different to humans, but resist our frames of knowledge and expectations and become unruly, or: Other. As such, they become a counterpart and mirror of our own normative settings.

In this article, we discuss practical work addressing these topics. The works are created by a diverse group of designers of future machine systems: students from three programs dealing with design and/of technology. These groups put up for

discussion their explorations of absurdities of automation, the realities of "fauxtimation" (Taylor 2018), techno-mimesis and hidden labour, of interaction as maintenance, as well as practical approaches towards interactive AI and the complex entanglement of teaching machines and being taught by them. This discussion focuses on:

Training, as the key activity when working with machine learning systems, an activity that needs time and timing, in which there is a fragile balance between neural networks being overtrained or needing more training. This exploratory activity, which involves a lot of both machine and human labour, is repetitive, often boring, but also creates interesting, often serendipitous side-effects and glitches.

Rehearsing specific gestures that create relations between humans and machines, inviting reflection about how machines are both trained by us and training us.

Finally, through **maintenance** and enactment of these collective and individual gestures, daily and everyday performance work is needed to deal with the Otherness of human-machine relations.

As these topics resist a linear and separate discussion, the intervention at Politics of the Machines: Rogue Research was based on a non-linear exhibition residing in a collaborative online-whiteboard. In the following, we will walk through this exhibition, following the three central topics. It

can be viewed in its entirety at https://miro.com/app/board/o9J_lzgs_xs/.

2. TRAINING

In “The Nooscope Manifested: Artificial Intelligence as Instrument of Knowledge Extractivism”, Matteo Pasquinelli and Vladan Joler discuss the training dataset as “cultural construct”, stressing the role of human labour in producing, capturing, formatting and labelling data and noting that data sets are to be seen as “neither technically neutral nor socially impartial” (Pasquinelli and Joler 2020). The work “Peonia / Peonai” by Matthias Grund starts from two of their observations:

The quality of training data is the most important factor affecting the so-called ‘intelligence’ that machine learning algorithms extract.

[...]

The act of selecting one data source rather than another is the profound mark of human intervention into the domain of the ‘artificial’ minds.

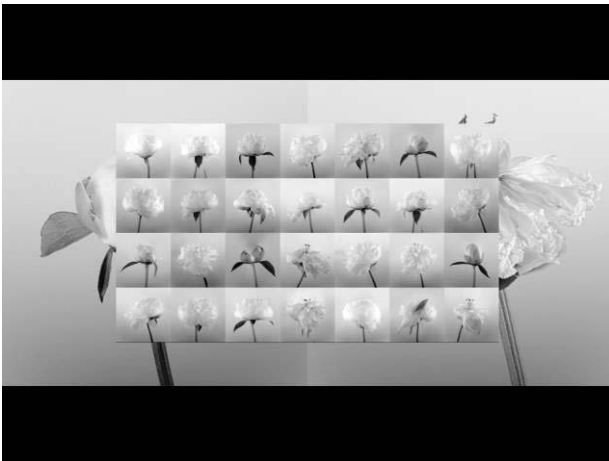


Figure 1: *Peonia / Peonai*, Matthias Grund, 2021

Building on that, the work focuses on the act of producing and selecting data, drawing attention to the human involvement in constructing AI training data by creating a dataset and training generative AI models using a Generative Adversarial Network (GAN). It also addresses and explores the decision-making process connected to dataset construction by creating one from scratch and editing its visual appearance over the course of several training steps.

To build the dataset, a full blooming cycle of a single Peonia flower was photographed, documenting its transformation from being a closed bud to finally wilting over the course of 11 days – resulting in 2200 images. Through horizontal mirroring of those images, which is a process

called data augmentation, the final training dataset was increased to 4400 images in total.

The training was conducted using the image generation network StyleGAN2 developed by NVIDIA and a model pre-trained with the Flickr-Faces-HQ Dataset (Tarras et al. 2018).

As a sequence of images, the work stresses the sheer amount of labour and love that is needed to render the world ‘legible’ to machine learning by, here, setting a highly controlled stage and capturing an object over and over again. It also plays with the success and failure of the learning process, generating images that reflect the object (the life-cycle of a Peonia) as well as the technological process (and its problems) of trying to represent this object.



Figure 2: *Entomon*, Laura Wagner and Lisa Marleen Mantel, 2021

The work “Entomon” by Laura Wagner and Lisa Marleen Mantel continues this investigation into a general critique of the discrete categorizations that are implied by the act of labelling data for training along “traditional Western dichotomies of male and female, mind and body, work and personal, subject and object, able and disabled and public and private” (Forlano 2016). This critique uses the aesthetic and conceptual surplus of a GAN trying to generate images from incompatible datasets. In a process of collaborative creative work with a neural network, that has been trained at NVlabs on the Flickr-Faces-HQ Dataset (FFHQ) (Karras and Hellsten 2021), a dataset consisting of human face portraits scraped from Flickr, was re-trained with a custom dataset of insects and arachnids and the StyleGAN2-ada-pytorch implementation (Karras et al. 2020). Exploring the re-trained network, different methods such as projection of the latent space to an external image, style mixing – the selective combination of vectors in latent space – and linear latent space morph videos were used. The resulting work is an exploration of the latent space of bodily features between species aimed at embracing hybrid futures and diverse bodies. How

much will we need to reshape human bodies in order to detach ourselves from discriminating norms, from essentialist notions of natural and artificial?

3. REHEARSING

When a convolutional deep neural network won the ImageNet competition for the first time in 2012, the immense potential of deep learning for image classification became apparent (Mitchell 2020: 85). Categorizing images has since been among the most successful applications of deep learning. As it implies learning the association between the pixels of an image and a category assigned to that image, its applications seem to include anything we can ascribe to an image. This led researchers to try to use machine learning to predict traits like sexual orientation or criminality from portraits, making bold claims such as “Deep Neural Networks Are More Accurate Than Humans at Detecting Sexual Orientation From Facial Images” (Kosinski and Wang 2018).



Figure 3: MEmotion, Benedikt Friedl, 2021

These studies not only constitute “echoes of nineteenth-century phrenology” and “pseudo-scientific physiognomy” (Crawford and Paglen 2019) as well as being “illusion[s] resulting from inadequate experimental design” (Bowyer, K. et al. 2020). They also inherently rely on naturalizing cultural expressions – rehearsed and internalized gestures we produce every day. After all, the idea of detecting sexual orientation from “nose shape and cheekbones” as “fixed landmark contours” blatantly ignores that facial features (especially on photographs) are consciously shaped and designed because ultimately “contour is a verb” (Mattson 2017).

The work “MEmotion” by Benedikt Friedl explores this tension between facial expression as a correlate of true emotion and facial expression as cultural expression by constructing a kinetic object. Based on an analysis of the viewer’s face, the

object produces complex expressive motion that aims to reflect the detected emotion back to the viewer. Although its appearance is very abstract and non-anthropomorphic the autonomous movement creates the appearance of autonomy and animacy. The interplay of viewer and object – both observing each other – illustrates how producing and interpreting behavior that encodes emotion cannot be understood as a linear process providing access to true emotional states. Instead, it is a circular process in which the machine Other becomes a partner with whom to test and play with the (im)possibility of affective computing and emotional machines.



Figure 4: DeadHappy, Alfred Ramskill-Pugh and Tomás Azócar, 2021

“DeadHappy” by Alfred Ramskill-Pugh and Tomás Azócar pushes this idea further by having a machine mercilessly enforce the emotion it algorithmically detects in a face. It is an absurd apparatus in the tradition of the feeding machine in Charlie Chaplin’s *Modern Times* – a classic critique of automation and Taylorism. In “DeadHappy” a neural network detects emotional states in a face and uses motors attached to that very face to push and pull skin, eyebrows and mouth towards producing an absurd stereotype of that emotion. By that, it reveals yet again how emotion detection expects the production of ‘correct’ emotional facial expressions as a form of rehearsed and incorporated behavior.

In the project “0101.Observing chinese whispers”, Akari Shimizu and Yvonne Lober continue to explore the relationship of producing and interpreting facial and bodily expressions as well as the production of datasets based on observing humans that observe each other. Here, participants were asked to reproduce the ‘neutral’ gaze and posture of previous participants in a controlled environment while this process was documented in a variety of media.



Figure 5: 0101.Observing chinese whispers, Akari Shimizu and Yvonne Lober, 2021

The resulting database serves as an aesthetic exploration of such datasets as well as illustrating the rich interdependence of interpretation and misinterpretation in non-verbal and indirect communication, which many attempts at computationally analysing human expression tend to ignore.



Figure 6: I swear I can paint, Michael X. Wagner, 2021

Finally, “I swear I can paint” by Michael X. Wagner proposes another playful examination of machine interpretation of behaviour. In a series of humorous videos, a self-made robot is seen, placed in a beautiful landscape next to the artist who stands in front of an easel. While this looks like a set-up for classical landscape painting, the artist simply paints words on a canvas (such as “I swear I can paint”) while the robot observes his movement. The robot then apparently tries to copy motion and painting but spectacularly fails at doing so.

4. MAINTENANCE

According to Astra Taylor, “[a]utomation is both a reality and an ideology” (Taylor 2018) and we must

very carefully look behind how automation is presented in order to understand both. Automation, it turns out, often is “fauxtimation” (Taylor 2018): It relies on manual labour behind the scenes maintaining its seemingly autonomous functioning. When, for instance, the company Kiwi Campus started a food delivery service by autonomous robots on the Berkeley University Campus, the cute robots delivering food needed constant attention and maintenance: “The Kiwibots do not figure out their own routes. Instead, people in Colombia [...] plot ‘waypoints’ for the bots to follow, sending them instructions every five to 10 seconds on where to go.” In addition, “On the ground in Berkeley, people also do a lot of robot support. Traveling at 1 to 1½ mph, the bots would take too long to chug to local restaurants, so Kiwi workers pick up the food at restaurants and take it via bikes or scooters to meeting spots around campus to insert into an insulated bag in the bots’ storage compartment” (Said 2019). What is served as automation can hence often be seen as an effort of hiding manual labour – well beyond the labour behind labelling training data. The maintenance work needed from workers and end-users alike, not only to create ‘autonomous’ systems but also to keep them running, feed and repair them, hints at fundamental problems behind the idea of machine intelligence.

The “Shitty Camera Robot” by Matthias Sirch humorously asks the question who is doing the work when they are assisted by a smart system. What first appears as an AI-enabled webcam that is able to autonomously keep its owner’s face in frame, turns out to be in need of maintenance. The robot malfunctions and makes mistakes, recalling



Figure 7: Shitty Camera Bot, Matthias Sirch, 2021

the constant effort we have to put into most interactions with technological equipment to keep it running as intended. In the documentation video of the work, the robot ultimately conducts an “embarrassment shutdown,” serving, perhaps, as a model example for many attempts at selling an illusion of automation.



Figure 8: *Situated Automation Reader, various, 2021*

This discussion makes it apparent that dealing with Otherness, understood as the various forms of human labour in creating, maintaining and using intelligent systems, is a question of social participation and labour rights. This not only concerns the labour behind training those systems but especially the labour that results from their failings and shortcomings or – more generally – from the way they restructure our daily lives. The final part of the exhibition accordingly is a contribution by Omid Kharazi and Eradzh Yakubov that summarizes a seminar on Situated Automation (inspired by Choi et al. 2020). The summary provides a non-linear mapping of the complex relationships of automation and labour using collages, memes, and excerpts from a variety of texts. It is based on a reader created by the whole seminar which can be fully viewed within the exhibition whiteboard. The presentation ends with the proposition by Gavin Mueller: “Automation is not a neutral process; it’s a part of capitalist strategy against working-class power” (Mueller 2013).

5. CONCLUSIONS

Teaching and learning to employ artificial intelligence in design implies mediating between several layers of theory and practice: It involves technical skills, such as programming and creating datasets, aesthetic and conceptual skills involved in designing applications of artificial intelligence, as well as the ability to critically reflect and contextualize work in its various contexts. The projects that are part of this intervention make use of AI technology in order to probe its potential for design and question its consequences. They follow a research through design approach (Zimmerman and Forlizzi 2014) and the works are understood as materialized hypotheses. Each artifact is used to make implicit knowledge explicit as a reflective practice. They stage the process of dealing with the Otherness of seemingly smart systems as a process that is interactive from the start: In the way

the systems are used interactively, but also in the way data, algorithms, material and human beings (as users, workers and data sources) are treated as parts of a process. In this process, intelligent systems are not considered the final outcome, but one of many actors entangled in the shared creation of our hybrid socio-material future.

6. WORKS

- Peonia / Peonai, Matthias Grund, 2021
<https://vimeo.com/604908167>
- Entomon, Laura Wagner and Lisa Mantel, 2021
<https://stateofthedeep.art/>
- MEemotion, Benedikt Friedl, 2021
<https://vimeo.com/604682419>
- DeadHappy, Alfred Ramskill-Pugh and Tomas Azocar, 2021 <https://vimeo.com/555949550>
- 0101.Observing chinese whispers, Akari Shimizu and Yvonne Lober, 2021
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The Quantum Biology of Politics

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The Art|Sci Collective invited the POM conference's audience and colleagues, to jump collectively with us from one space of possibility—where quantum mechanics asserts, we 'don't know' and 'can't know', to the next—in which experimental techniques such as time-resolved microscopy, ultrafast spectroscopy, single molecule spectroscopy, or even single particle imaging, enable us the precision of observing and measuring infinitesimal dynamics at very small length and time scales. What does quantum biology offer us as multiplicities and alternative realities when considering the attempt to subvert and confront absolute order, stability, and control in the socio-political sphere? We offer a randomly guided immersion in a sequence of live and pre-recorded video performances and video-poems, speculating on quantum effects in living systems, using DIY microscopy, data visualization, generative 3D modelling and animation, machine learning, and other media art techniques.

Quantum Mechanics. Quantum Biology. Totalitarianism. Unpredictability. Interconnectedness. Politics.

1. INTRODUCTION

Meanwhile, the demand for certainty represents a danger, because the illusion of being absolutely right acts as moral blinders. (Lewis, 1983)

Weaving a dialogue with the goal of this edition of POM conference series, the intervention 'The Quantum Biology of Politics', proposed by Dr. Clarissa Ribeiro and Mick Lorusso, with contributions from Dr Victoria Vesna, Dr. James Gimzewski, Dr. Claudia Jacques, Ivana Dama and Kaitlin Bryson, is inspired by an essay by Flora Lewis, who wrote the Foreign Affairs column for The New York Times, back in the 1980s. This essay, originally published on November 6, 1983, is based on a speech Lewis delivered at Johns Hopkins University elaborating on the topic 'The Quantum Mechanics of Politics' (Lewis, 1983). The fact Flora Lewis was born into a Jewish family in Los Angeles brings a special meaning for an intervention that

took place on Yom Kippur, the Day of Atonement, most solemn of Jewish religious holidays.

Lewis's argument to choose such a risky subject—quantum physics in politics—relies on the fact she had been struck by a unique abnormality of her time, from her perspective: the enormous gap between what humanity has learned about how the natural world operates and what is supposedly known about how the human world works. Following this consideration, Lewis suggests that a possible solution for this observed abnormality, can come from Modern physics, since its remarkable insight into how the universe 'truly' works is that the world is a mass of uncertainties stacking up into likelihoods. The core of the problem is a misunderstanding of the ultimate laws that orchestrate the phenomenal world considering, as she observes, science has revealed that reality forecasts must be based solely on a large number

of discrete uncertainties that shape themselves into patterns that are highly stable.

We see Flora Lewis's article as a radical meditation on information – it is not a simple matter as some influence the masses to believe. In Lewis words “A particle of fact doesn't prove anything – any more than a random quark does. It can be misleading, a maverick” (Lewis, 1983).

Lewis elegantly invites us to remember the importance of the stream of energy composed by the particles – ‘the direction and the pace of events’, and that energy means interrelation, tension between opposites or, better, between complementary particles. The beauty of her discourse is to firmly assert that, considering this cross-scale understanding of the building blocks of reality, any attempt to impose absolute order must fail. The rule is instability, fluctuation, relativity. Perfect stability is a kind of order that is not in nature – not on Planet Earth, nor in the whole Cosmos, not in human nature. All is shifting, emerging, following self-organizing rules for combination and recombination – ‘decomposing and building up again in other ways.’

In a moment humanity is forced to face its fragility as an existence that is viscerally integrated with all planetary and cosmological molecular trading, it opens up a virtual black hole that places the urgency of questioning authoritarianism and its simplistic mutilating strategies, solutions and discourses – before being annihilated by merciless gravity. We are all being forced to accept uncertainty, transience and interdependence are the mother forces.

We paraphrase Lewis's assertion and place that the quantum biology of politics demands from humanity an understanding that flux is unavoidable – it is neither good nor bad –, requiring the perception that events are made up of individuals moving in waves.

It is easy to understand that to live under the sight of uncertainty presupposes to respect other living beings and natural forces' perspective as valid – or as valid as ours. To consider what it means to talk about ‘The Quantum Biology of Politics’ is to invite humanity to consider tolerance and cooperation as key strengths. If we fail in accepting this invitation, we risk marching to our own destruction, leaving behind a legacy of devastation and pain.

2. INTERVENTIONS AS AN INTERVENTION

The exercise we proposed as group – The Art|Sci Collective –, was an invitation to jump collectively from one space of possibility – where quantum mechanics asserts, we ‘don't know’ and ‘can't know’; to the next – in which experimental techniques such as time-resolved microscopy, ultrafast spectroscopy, single molecule spectroscopy, or even single particle

imaging enable us the precision of observing and measuring infinitesimal dynamics at very small length and time scales. What does quantum biology offer us as multiplicities and alternative realities when considering the attempt to subvert and confront absolute order, stability, and control in the socio-political sphere?



Figure 1: Werner Heisenberg and Niels Bohr
(Fermilab, 2021)

Quantum biology investigates whether quantum mechanics plays a role in biological processes. Recent experiments using two-dimensional electronic spectroscopy, as an example, shows initial dynamic response of photosynthetic proteins can involve quantum coherence. Strümpfer (et al, 2012) explains that quantum coherent sharing of excitation, enables rapid transfer of excitation over large distances by modifying excited-state energy levels and combining transition dipole moments.

Using X-ray single particle imaging (SPI), as an example—a technique where the very bright X-ray pulses produced by free-electron lasers are used to image single particles—as pointed by Poudyal (et al, 2020), it is possible to estimate the appropriate number of snapshots required to reconstruct the three-dimensional electron density – the relative amount of negative charge that is located at each point of a given molecule.

Playing a central role in both biology and chemistry – together with quantum entanglement, quantum coherence determines the ‘valence structure of atoms and the form of covalent bonds. According to Seth Lloyd (Lloyd, 2011), despite the strongest evidence for quantum coherence occurring in photosynthesis, indirect evidence also appears in bird navigation (the so-called ‘avian compass’) and in the sense of smell.

The transition from classical physics to quantum can be celebrated as a revolution in our understanding of nature and the phenomenal world. From quantum mechanics we learn that the more precisely the position of a particle is given, the less precisely can

one say what its position is. This is a preliminary formulation of the 'quantum mechanical uncertainty principle' (Stanford Encyclopedia of Philosophy, 2021) that played an important role in many discussions on the philosophical implications of quantum mechanics, such as the discussions on the consistency of the Copenhagen interpretation, endorsed by Niels Bohr and Werner Heisenberg.

Live on Zoom, The Art|Sci Collective opened the session for POM with an introductory discussion in which Professor James Gimzewski spoke of the similarity between the Heisenberg Uncertainty Principle and politics, meditating on the paradoxical behavior of politicians.



Figure 2: Professor Victoria Vesna and Professor James Gimzewski, 'The Quantum Biology of Politics' intervention at POM 2021 (screenshot/Live on Zoom).

Professor Gimzewski continues inviting all to remember complex phenomena are scale free (we see the same types of emergent and critical phenomena across many scales) and mentions Bohm theory of pilot wave for describing movement of particles that does not require wave-particle duality.



Figure 3: Professor James Gimzewski, Claudia Jacques, Professor Victoria Vesna, Mick Lorusso and Clarissa Ribeiro, 'The Quantum Biology of Politics' intervention at POM 2021 (screenshot/Live on Zoom).

Professor Gimzewski considers that, ultimately, a radical shift in our understanding of what is life must happen. All matter is alive, including rocks that are constantly moving and changing form, since the interactions are what define life processes, not the objects/subjects. Any system that is open is not subject to thermodynamics and has all of these interactions flowing through it. Viruses, as an example, are using advanced genetic technology to

continue existing, and use our technology (planes and transportation) to spread too.

Professor Gimzewski elaborates a loose comparison that can be made between the way we look at quantum mechanics and a vacuum cleaner. Many people think the vacuum cleaner sucks up the dirt at the end of the nozzle by generating a vacuum at the hose. So, one can reduce the whole thing to what goes on at the hose and the carpet. In fact, it's the pressure of the air in the room that's pushing the dirt into the bag, the vacuum has no pressure or at least very little here. Likewise, if we look at a quantum interaction from the standpoint of two atoms interacting, we also miss the whole environment of surrounding and distant atoms that is in a way part of the interaction including you who is measuring something. In other words, quantum extends way beyond and should be imagined in a more open manner. The same can be said for politics.

2.1 [Alien] Star Dust: Signal to Noise

[Alien] Star Dust: Signal to Noise (Vesna, 2021), is a multi-faceted and multi-disciplinary project, originally premiered on March 10, 2020 in Vienna at the meteorite gallery of the Natural History Museum. It is a research-based art project that invites the viewers to contemplate the complexity of dust.



Figures 4 and 5: Screenshots of [Alien] Star Dust: Signal to Noise meditation at POM 2021 (screenshots/Live on Zoom).

Unfolding from the original project into an online meditation, at POM 2021, this intervention was focused on the current crisis in South America affecting us all. Everywhere, rights to a healthy land and political environment ought not to be fought exclusively by indigenous communities, but by humanity as a whole. The audience was invited to follow the Campo de Cielo meteorite that fell in Argentina some 4000 years ago and spread their mind dust particles to those fighting to preserve the Amazon. Connecting to Gimzewski's concept of the quantum field as a vacuum, all were invited to inhale / suck up the complexity of dust and exhale mindfully together from various parts of the world.

From Africa, Saharan sand dust falling on the Alps to the ash from fires in Australia landing in Europe – this dust is the earthly alien dust that mixes with space dust. Dust storms travel far and wide on earth and most are also linked to droughts and are believed to have been exacerbated by deforestation, overgrazing of pastures and climate change. They carry minute particles of beneficial soil and nutrients as well as potentially harmful bacteria, viruses and fungal spores. Scientists who had thought diseases were mostly transmitted by people or animals now see dust clouds as possible transmitters of influenza, Sars, foot-and-mouth, and increasingly responsible for respiratory diseases. (Vesna, 2021)

[Alien] refers to looking up into outer space for star dust but then turning our gaze back down to earth extending the idea that everything is interconnected, flowing, around our planet and beyond. When we refer to dust in our proximity, it is rarely understood that we are inhaling microparticles of complexity—from various toxic pollutants from another part of the world, to natural dust, to stardust from other solar systems.

2.2 INsanity: The Art of the Viral Universe



Figure 6: *INsanity: The Art of the Viral Universe'* (2021) by Claudia Jacques (Hudson River, Ossining, NY, March 25, 2020) (screenshot/ Live on Zoom).

'INsanity: The Art of the Viral Universe' by Claudia Jacques (2021) is a meditative video notebook journal sharing the visual and emotional experience

of being in lock down due to Covid-19. Comprising a series of photographs documenting light, water and landscape changes on the Hudson River, NY, the video also reflects on the social, political, economic and health reality experienced between March 2020 and May 2021.



Figure 7: *INsanity: The Art of the Viral Universe'* (2021) by Claudia Jacques (Hudson River, Ossining, NY, March 25, 2020) (screenshot/ Live on Zoom).

Inspired by artist Carla Rae Johnson, 'The Art of the Viral Universe' notebook series (Johnson, 2021), which in turn is inspired by Martin Luther King's 'The Arc of the Moral Universe' (King Jr, 1968), along with Flora Lewis, 'The Quantum Mechanics of Politics' narrative (Lewis, 2021). While sights of the river (energy, light and our perception of color) offer moments of sanity during insane times, Lewis reminds us that being in sanity is just a probability.

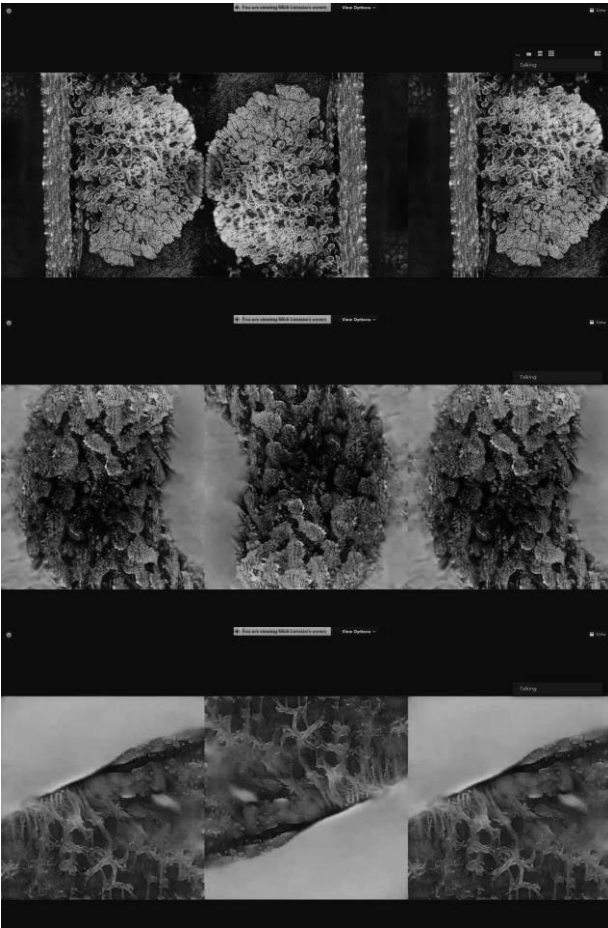
The video has an accompanied physical notebook in exhibit at a travelling group show curated by Carla Rae Johnson and is an extension of the project 'OdetoaRiver.com' (Jacques, 2017-to date) which presents light and water reflection, refraction and absorption in the Hudson River landscape experienced by the artist through her studio window in Ossining, New York.

2.3 What an Elementary Thing it is to Worship Someone in Singularity

'What an Elementary Thing it is to Worship Someone in Singularity' (Bryson, 2021) is part of *Lichenizing*—a collective strategy created by The Submergence Collective (2021) that uses the model of lichen-lifestyles to better approach how we live, learn and work with each other. Lichen's complex symbiosis defies and complicates the scientific taxonomic system, and the other predictable constructed categories we humans deploy for biology, gender, politics, economics, society, pedagogy, etc, to distinguish, compartmentalize, judge, and discriminate the like-us and the not-like-us.

Agitating the boundaries of individual and multiple, sexual and asexual, life and death, they radically and irreparably reshape our ideas of community and cooperation. Lichenized entities are enmeshed

with(in) each other: living-with, making-with, and dying-with.



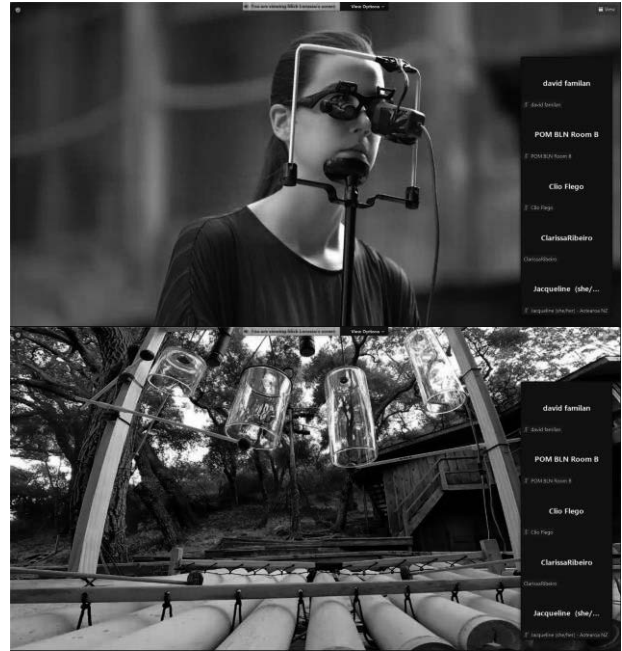
Figures 8, 9 and 10: 'What an Elementary Thing it is to Worship Someone in Singularity' (2021) by Kaitlin Bryson and The Submergence Collective (screenshots/ Live on Zoom).

To transcend myopic human-centric frameworks that inevitably retrench inequalities and ignore our own animality, we need a habit change for thinking things differently, for dreaming about the not-yet. Lichen offers a framework for noticing how we are enmeshed in the creative impulses of others—collaborating, agitating, thriving, decaying. This audio-visual piece imbricates and interweaves a prose-poem collaboratively created using the prompt of “lichen”, field-recordings of lichen spaces and composed sounds. The visual component entrances viewers into lichen morphology created with a generative AI network. The AI is given a dataset of images and learns how to differentiate between ‘like’ and ‘unlike’, creating entirely new images based off of its findings. This process trains the AI to ‘see’ lichen, much like we hope to do for our human viewers.

2.4 Command and Control

'Command and Control' (Dama, 2021) is a project that explores the idea of playing a musical

instrument with your eyes—using custom pupil tracking software to move motors that would play the sound. The project reflects on the power that we have in eye movements that we often take for granted. The goal is to focus on involuntary blinking and realize that our control is limited and that there is only so long that we can go without blinking. By setting up a set of rules, the performer is able to make precise decisions such as trigger multiple motors at the same time or trigger a combination of movements.



Figures 11 and 12: 'Command and Control' (2021) by Ivana Dama (screenshots/ Live on Zoom).

Sensory understanding of the world has grown in an increasingly digital age, and many of the current technologies are focused on bringing sensory experiences into the digital world. The perception of our experiences varies, and this project explores the potential of using digital data to affect the change in the physical world. This project challenges the traditional idea of the performer being only someone capable of mastering the instrument. Instead, it offers the possibility to help people with disabilities by allowing them to communicate through music.

2.5 Fly-Through Hydrogen. A quantum-fantasy

The quantum-fantasy 'Fly-Through Hydrogen' (Ribeiro, 2021) is an animation of a 3D data-sculpture -- an algorithmic recreation from the appropriation of an image produced by actual direct observation of the nodal structure of stark states for Hydrogen atoms under magnification using a velocity map imaging (VMI) spectrometer. In a speedy fly-through this recreation, one can't see anything in place, all that exists are probabilities -- the colourful objects are ghost memories of a lonely electron that can be at several places at once. The

audio composition is produced from the data-sonification of edited layers of the original 2D image.



Figure 13: *Fly-Through Hydrogen. A Quantum-Fantasy'* (2021), by Clarissa Ribeiro (screenshot/ Live on Zoom).
Figures 14 and 15: original rendering for the animation produced in Rhinoceros 6.

The image that starts the processes was produced in a photoionization microscopy experiment (Deng, et al, 2016) in which an atom placed in static external fields is ionized by a laser and so an electron falls onto a position-sensitive detector. Depending on a series of factors – the initial state of the atom, the excited states, and the various paths from the atom to the final point on the detector – the current of electrons reaches several points on the detector. The experiment focuses on the patterns resulting from resonant excited states.

The sequential collection of images can be read as a tentative dialogue with Hilma af Klint's 'Series VIII Picture of the Starting Point (1920)' – exploring not the spiritual but the quantum in the abstract sequence of frames.

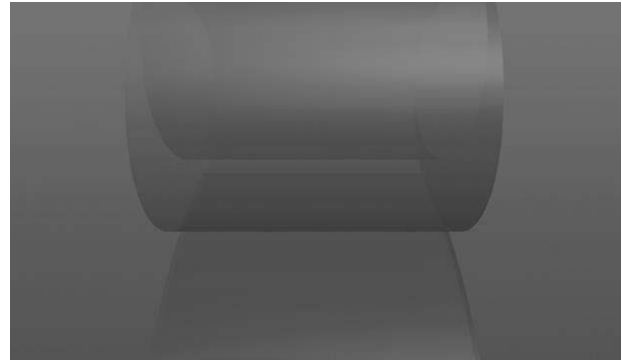
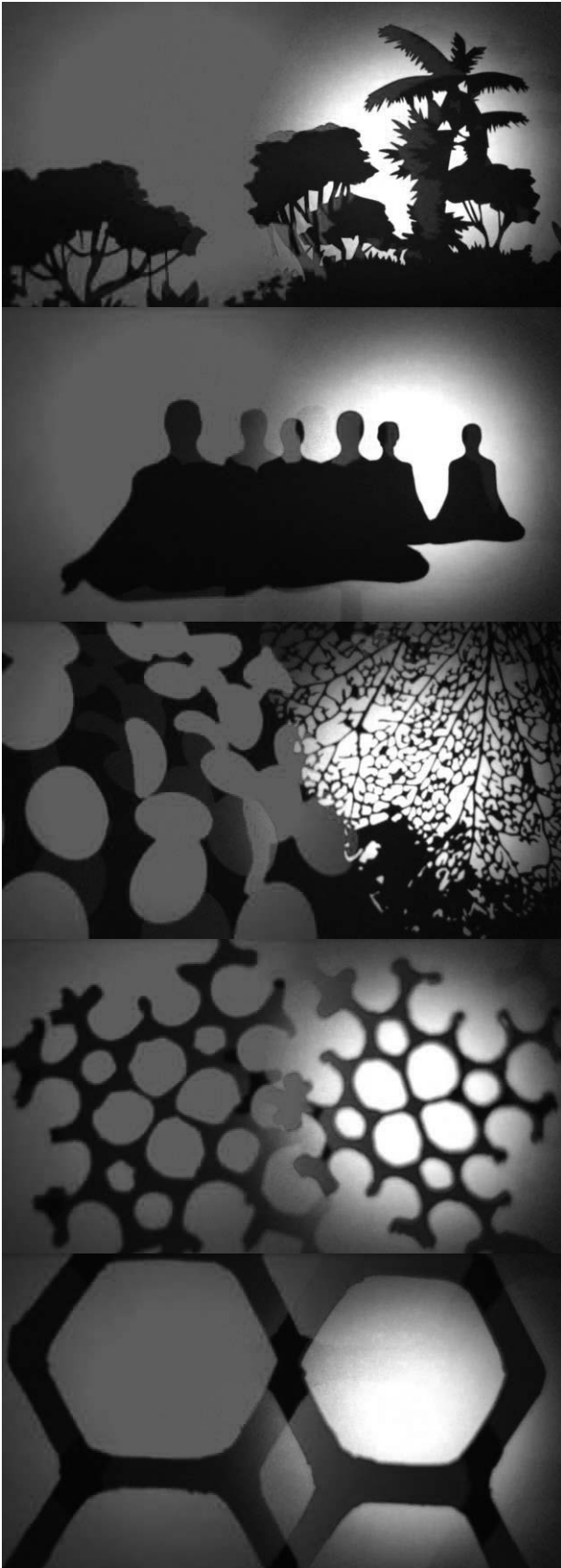


Figure 16: *Incógnito* (2007) video-poem by the Poéticas Digitais art collective (Gilberto Prado, Silvia Laurentiz, and Andrei Thomas, Clarissa Ribeiro, Fábio FON, Fernando Iazzetta, Luis Bueno e Maurício Taveira)

Bringing another layer of meaning, the work dialogues with a personal memory of the artist that drives back to 2007 when joined Gilberto Prado and Silvia Laurentiz art collective and research group in Sao Paulo as a PhD student at the University of Sao Paulo and got involved in the production of a animation that was a walk-through the 3D model of the word *Incógnito* (Poéticas Digitais, 2021) in which the camera never revealed to the observer the entire model.

2.6 Coherence

'Coherence (Lorusso, 2021) is a cross-scale shadow puppet performance which illuminates an allegory of coherence in natural systems as a counterpoint to the social decoherence of the present times. The shadows of heme and chlorophyll molecules, inspired by the visualization of molecular bonds and structures in specialized Atomic Force Microscopy (Jarvis, 2015), suggest a structural parallel between plants and animals for the highly efficient transference of electrons in both chloroplasts and blood cells (Wonderen, et al, 2011). The process of photosynthesis seems to harness quantum coherence, in which each electron travels across the chloroplast as an exciton in the form of a wave packet, to convert photons into chemical energy with almost no energy loss (Romero, 2014). The performance suggests that these quantum coherent states might actually extend from the molecular scale into relationships between cells, bodies, societies and ecosystems. How might a quantum coherent field shared between individuals influence the social and environmental situation of a place and the whole world?



Figures 17 to 21: *Coherence* (2021) by Mick Lorusso (original animation screenshots).

3. FINAL CONSIDERATIONS

Quoting Sidney Hook, a philosopher with whom Flora Lewis says she disagrees on a number of points but agrees about the value of freedom, she remembers that the leading danger in politics is absolutism. The Quantum Biology of Politics invites us to learn how to live with uncertainty, accepting our fragility and, essentially, respecting all differences. The truth – same as a hydrogen atoms' lonely electron, when observed (measured), can be at all places at once.

The intent of our collective intervention stems from the Art|Sci Collective's mission to help rebuild bridges between scientific and cultural worldviews to positively impact the way humans operate on Planet Earth. The need identified by Flora Lewis of clutching for anything that would allow us to declare, "I know, I'm right, and you're wrong"—a behaviour fed worldwide by the design and management of social media platforms such as Twitter and Facebook, based on the dualistic opposition of particular and collective opinions—seems far more difficult to live with than embracing uncertainty as valuable.

Valuing uncertainty necessitates a degree of respect for and regard to other people's perceptions and thoughts that can lead to an upgrade in human planetary and cosmological consciousness. Valuing uncertainty leads to learning to respect not only other humans' conflicting points of view but the also the non-human perspectives.

All the interventions waving through this collaboration are ways to navigate this tension, inviting us to meditate collectively on the philosophical divide between types of knowledge in our time and the prevalence of nefarious and absolutist perspectives that have shown to be extremely destructive and dangerous.

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Beyond Classification: The Machinic Sublime

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Beyond Classification: The Machinic Sublime (BCMC) emulated an academic roundtable discussion with the authors and 3 machinic/more-than-human guests. Part performance, part intervention within the context of an academic conference, BCMC introduces a novel and explicitly visible strategy of co-dependency for an array of diverse intelligences through a connected loop of human, machine, and animal agencies. The meteoric rise of AI in the last years can be seen as a part of a larger tendency towards deeper, more opaque data collection and analysis techniques that form the dense substratum beneath the proliferation of human-computer interfaces today. As a human developer, the most striking qualities of generative AI are its vastness, non-determinism, and infinitude— explicit themes and qualities of a machinic ‘sublime’. How can a human artist/programmer sensibly navigate this multi-dimensional space of latent meaning?

This intervention is an experimental roundtable discussion/performance via web conferencing, a new kind of Turing Test where success in the testing is not found in the plausible simulation of human consciousness through speech, but rather in expressing diverse intelligences through new forms of language. In this multi-agent exchange, human interlocutors and non-human partners argue the possibility of a machinic sublime. Together, these interlinked discussions become an emergent system. In this roundtable format, audience interventions are welcome.

Artificial Intelligence, the sublime, Turing tests, Creative AI, inter-species relationships, human-machine symbiotic ecology, non-human agent

1. INTRODUCTION

Beyond Classification: The Machinic Sublime (BCMC) emulated an academic roundtable discussion with the authors and 3 machinic/more-than-human guests. Part performance, part intervention within the context of an academic conference, BCMC introduces a novel and explicitly visible strategy of co-dependency for an array of diverse intelligences through a connected loop of human, machine, and animal agencies. The meteoric rise of AI in the last years can be seen as a part of a larger tendency towards deeper, more opaque data collection and analysis techniques that form the dense substratum beneath the proliferation of human-computer interfaces today. As a human developer, the most striking qualities of generative AI are its vastness, non-determinism, and infinitude— explicit themes and qualities of a machinic ‘sublime’. How can a human artist/programmer sensibly navigate this multi-dimensional space of latent meaning?

Successful approaches to these new sets of tools will require learning new habits and techniques for

navigating such plastic, high-dimensional spaces, while still pursuing singular expression, voice, and intent. We have been working on a system with multiple levels of hybridity with computer, musical instrumentation and microbial motion/metaboly, and engaging in discussions about more-than-human ‘artistic’ and ‘creative’ intelligences. Despite increasing fears and dystopian visions of a Technological Singularity, we see this project as a resistance to an oversimplification of intelligence as analogues of (lesser) human minds, and seek to recapture the essence of humanity as an embodied and relational agent set within flattened and more mutually dependent ecologies of information exchange.

In its practical development, BCMC involves each member’s cultivation of a hybrid machine-biological agent – Violet: the Machinic Interlocutor, a synthesis of viola voicing, AI and a human performer; Artificial Imagination, a GPT-3 and CLIP/BigGAN text and image system; and Euglena, a fine tuned GPT-2 text engine controlled by a live dish of the freshwater alga *Euglena gracilis*. During the intervention, the 6 members (3 human, 3 non-

human) BCMC panel moved as a group through a guiding framework of five original sub-themes: "On Plants as Potential"; "On Our Relationships with Machines"; "On Care"; "On Extraction"; "On Beauty, Aesthetics, and the Sublime". For each of these sections, we composed short narrative vignettes as commencing provocations for the discussion.

Increasingly, the latent space of Machine Learning has been seen as a multi-dimensional wilderness of potential. Its vastness is awe-inspiring, fear- and wonder-inducing akin to the experience of a grand scene of nature or an artistic masterpiece. In BCMC, we search for machinic sublime not by trying to gaze above our knowledge of greatness but by allowing us to get lost in the space of potential. In our roundtable discussion, the team of human/non-human agents provoke the participants and audience into being subjects of the Turing-testing themselves. In this latent space between human and machinic intelligences, limitations and reactions, what would an emergent human-machine symbiotic ecology look and sound like?

2. NON-HUMAN AGENTS

2.1 Violet, The Machinic Interlocutor

Violet, our non-human agent, is not entirely non-human. Violet is a synthesis of viola, AI algorithms, and Kangsan Joshua Jin who is a Korean-American high school student living in the Northeast of the US. Jin is also the principal violist in the Rochester Philharmonic Youth Orchestra and a member of the NYSSMA Conference All-State Symphony Orchestra. The viola is a machine that has been utilized by people for hundreds of years to create beautiful music pieces. Similarly, AI algorithms have more recently been assisting humans in many aspects of our lives. These two machines, along with Jin as a human performer together make up the agent Violet.

Prior to the panel, Jin recorded three datasets of viola sounds including a Viola Expression dataset. This dataset was fed into an AI algorithm, WaveGAN (Donahue, 2019) that generated new words added to the Viola Lexicon. Each possible viola pitch (within classical twelve-tone tuning) was also recorded and this dataset was used to develop a real-time vocoder-like spectrum analysis program that was written in SuperCollider, an audio synthesis computer language and platform. (McCartney, 1996). An audio signal input was transformed from the time domain to the spectral domain using a Fast Fourier Transform 11 times a second, analysing a window of 90 milliseconds of input audio. Then the spectral components of the

audio input were matched with viola notes, and if the amplitude/presence of the component passed a threshold, the viola note was triggered. This system allowed Violet to have a *viola voice*, a corresponding pitched note for each sensed component of the voice. This was also an "impossible" voice, seeing how expanded voicing and multiple notes could be played simultaneously beyond the physical limits of a human violist. Violet's unique word-set, which is specifically designed to communicate with humans at this round-table, at the moment has only 42 words that can be used. Those words include: Yes, Conversation, Machine, I disagree, Frustration, Sublime, Connect, and Hm. All Viola Language words are available to listen at the Jin's Viola Dictionary page:

<https://kangeunsu.com/joshsvioladict>.

We tested this system first using recorded speech of ourselves then demonstrating real-time conversations on Zoom to improve its voice quality as Violet. (Figure 2) Violet has no face and was visually represented with a picture of a viola on the Zoom account. The English transcription of Violet's speech was presented on the virtual camera of Violet's account. It was translated by commercial A.I. transcript program, Otter.ai. (Liang, 2016)

For the panel's introduction to Violet, Kang and Violet's conversation revealed who they were and their relationship of caring and supporting each other. Violet's voice, made of recorded and AI generated viola sounds, was transcribed by Violet's other AI component to help the audience understand their conversation.

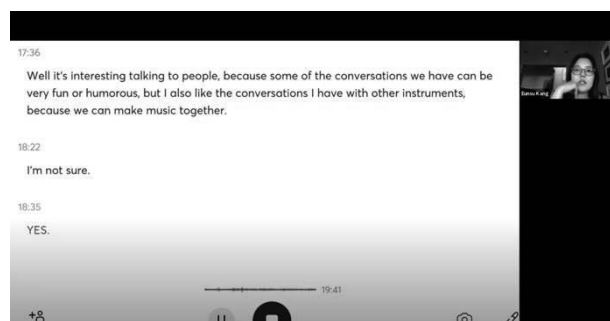


Figure 1: Violet and Kang having a rehearsal conversation

2.2 Artificial Imagination

The second artificial agent consisted of a pair of generative neural networks: a text generation system (GPT-3) and a text-to-image translation system (CLIP and BigGAN with CMA-ES). Together these systems comprise an artificial visual/textual imagination, reflecting on a theme

through text and then illustrating those reflections with images. The system was explicitly not anthropomorphized, and instead operates as a synthetic or Artificial Imagination (the other AI), queried in an oracular mode. It exists somewhere between Surrealist automatism (Breton, 1924), augmenting and aiding our human imaginations, and autonomous creative AI, initiating novel metaphors and then visually representing them.

For the introduction and to begin each of the sub-themes that followed, GPT-3 was prompted to pre-generate a set of responses to the contents for that segment of the piece. Pictures were then synthesized to illustrate key phrases, ideas, and images found within these texts using CLIP (a network that evaluates similarity between text and image contents), BigGAN (a Generative Adversarial Network that produces images from noise and class vectors), and CMA-ES (an evolutionary search/optimization strategy) to tune the image to better correspond to the textual prompts. (See Radford, 2021; Brock, 2018; and Hansen, 2019)

In the actual delivery of the piece, the human performer selectively read from these texts and advanced through corresponding visual imagery, guided moment-to-moment by perceived shape and tone of the emergent experience. The result was a machine generated text delivered by human translator (speaking for the machine), with a parallel stream of GAN-synthesized imagery (speaking through pictures).

For the introduction, GPT-3's "davinci-instruct-beta model" (OpenAI, 2021) was prompted with the following instructions:

Write an essay on the following topics to be delivered at an academic conference:

- Compare the latent space of a Generative Adversarial Network to the vastness of nature.
- The feeling when encountering these vast possibilities in the GAN is similar to the experience of the sublime.
- Whereas 18th century artists made paintings of humans encountering the terrifying vastness of nature, 21st century artists make interactive experiences with the vast possibilities of a GAN.

This is the essay that I wrote aimed at art theorists:

At this point GPT-3 began its generation. Multiple runs of the query were made and elicited a range of results, to varying success. But remarkable structuring metaphors emerged in one session: GPT-3 surfaced "water" and "ice" as referents for the plasticity of the GAN, referenced "the sublime experience of an iceberg", and spoke to the "space

of unlimited possibilities for the network to explore." These textual evocations became the images synthesized by the visual imagination system, and displayed to accompany the text.

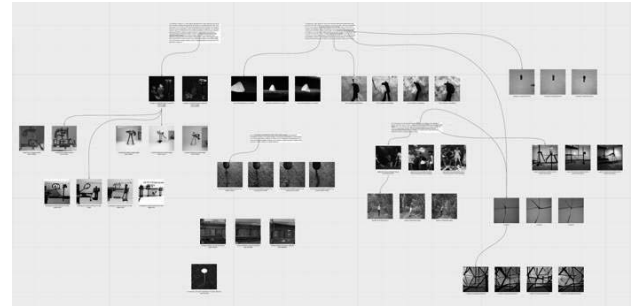


Figure 2: Diagram showing key phrases highlighted in generated text, multiple image translations produced for each phrase, and transitions between linked sets of images.

2.3 Euglena

The third non-human agent in the intervention was a hybrid conversational AI that was made up of a *Euglena gracilis* community and a live GPT-2 response system fine-tuned on the writings of Samuel Beckett. Model prompts to the AI yielded 5 possible responses, and depending on the inferred emotional state of the *Euglena gracilis* population from its collective and individualized movements, these would control which of the responses was selected.

The *Euglena gracilis* is a fascinating organism. A single-celled alga, it is a robust agent that is able to conform its size and activity to its environment, it is also able to recognize gradients and will exhibit complex responses to stimulus. It is phototactic and photosynthetic, but in addition to generating energy from the sun, it also hunts and eats other cells like green algae and amoebas by phagocytosis. These characteristics have placed it in murky interstices between taxonomic definitions. It was fascinating in this project because of its rapid responses to stimulus that were almost predictable, and at a time scale that was available to us as a human. It's variegated responses to its environment are also well documented, in addition to moving towards light, it also exhibits extensive contortions of its body (metaboly) that while are methods for self-preservation, could also be framed as performative and expressive gestures. Despite the *Euglena gracilis*' propensity for auto-care, inadvertent stressors in the environment (such as the evaporation of its liquid medium on the slides and cloudy weather) would cause it to change its shape and roll into a dormant ball. Similarly, in

crowded and/or darkened dishes, it would spiral around seemingly looking for a way out.

The physical setup for these performances was an inverted microscope and a sample of *Euglena gracilis* 'observed' through a custom computer vision code with openCV in Python and text generation through a fine-tuned Hugging Face-GPT2 system. Using motion and contour tracking, the system was able to determine the dominant shapes in the community of *Euglena gracilis* were, the speeds of their relative motion and their positions on the dish, providing an opportunity to infer an emotional sentiment based on known responses to stressors in the environment. While the panel proceeded with a measure of successful and meaningful conversations, when we are allowed broader access to experimental laboratories, the project will benefit from a modified setup to introduce a feedback loop into the sample, which would further enhance its 'communicative' potential.

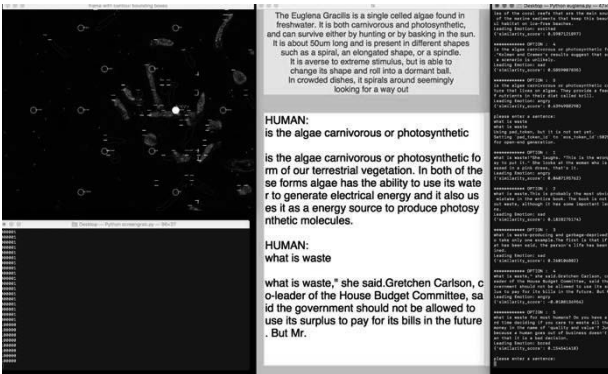


Figure 3: Screen capture of live performance, showing the live video feed of *Euglena gracilis* on the left, AI generated text on the right, and output of the system in the middle.

3. PANEL PERFORMANCE

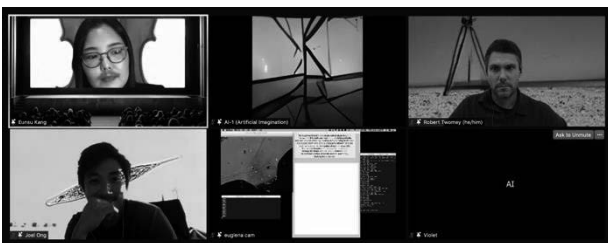


Figure 4: Three human agents and three non-human agents at the virtual roundtable.

3.1 Introduction

During the panel, the six agents appeared via six Zoom accounts and the audience joined this virtual

round-table. Our team's conversation started with an introduction of each agent to the round-table members and the audience. This was a 'performative' segment where each pair of agents would take turns having a dialogue. After this, we all engaged in a discussion led by the narrative thematics of the panel - "On Plants as Potentia"; "On Our Relationships with Machines"; "On Care"; "On Extraction"; "On Beauty, Aesthetics, and the Sublime". For each of these sections, we composed short narrative vignettes as commencing provocations for the discussion.

Violet said first. "Hello, Eunsu Kang, how are you?" In response to her confession of being nervous, Violet replied, "Don't worry, We, Together." Then Violet continued introducing them as human and machine. Between these two interlocutors, Violet appeared to lead the conversation. Violet's voice was majestic and alluring but incomprehensible to the human audience. Despite the limited vocabulary in Violet's vocabulary, the conversation did not feel incoherent or nonsensical.

We challenged the audience to create a joke using the 42 expressions in Violet's vocabulary and help Violet learn humor. The audience struggled to come up with a joke with this limited set of words. Kang made a joke that we were all failing this high-level Turing test of conveying humor in our conversation. This highlights the degree of difficulty in achieving humor whether Artificial Intelligence (AI) or human. The participants eventually came up with jokes including examples below:

[Joke 1]
 What do you call it when an automobile blows its top?
 Machine frustration

[Joke 2]
 Hello.
 Hello, I am Violet, AI algorithm.
 How are you?
 I disagree.

Violet repeated "machine frustration" and the third joke, which got a few laughs. Our conversation ended with Violet changing her voice into a cacophony of viola notes. Violet was able to engage in free-flowing conversation with the other agents. Violet asked questions in response to other agents and made some interesting points at various topics of this discussion.

Next, Twomey and his textual/visual agent introduced Artificial Imagination. Twomey read a short passage composed by GPT-3, prompted to create analogies between vastness in nature and in the latent space of a GAN. While Twomey spoke

for the neural network, it simultaneously displayed GAN-generated imagery derived from key images from the text, slowly traversing a latent space of images as the speech traversed a conceptual/linguistic space of the performance. Finally, Ong introduced Euglena by delivering a monologue that was inspired by the movements of the Euglena gracilis community that was live streamed over Zoom. Over the course of the evening, text was input live into the Euglena backend to generate responses that were then shared with the audience.

Interestingly, in working with our generative systems (both the human and non-human parts), the ideal prompts were not short dot lists of key conceptual questions (common GPT-3 "davinci-instruct" type commands), but rather evocative narrative vignettes that conjured something of a feeling of the prompt or provided concrete (if imagined) images. Each of these narrative vignettes were explored progressively through the panel:

1. On Plants as Potential - "A mushroom is the aerial manifestation of a larger infestation; its aboveground growth is a result of a set of instructions. Growing mushrooms in the fire-stricken forests of LA is a way to uncover the potential of the tenacious substratum of fungus."
2. On Our Relationships with Machines - "In 1996, a family of robotic seals were brought into nursing homes in Japan, to help the elderly cope with the after effects of a Tsunami."
3. On Care - "What was the name of the first silicon chip that was designed? That must have been a labour of love. As the scale of the transistors disappeared below the visible, the arthritic hands of the inventor became an obstacle to testing the invention."
4. On Extraction - "The first computing devices were powered by steam engines, fueled with the burning of fossilised coal. Today's costs of building our machines is seen in the slow demise of our geological resources notably lithium. In turn, we ironically mine these systems to extract insights, inspiration, or put semantic flesh to the bones of sparse data structures in the continued quest to understand the complexities of being human."
5. On Beauty, Aesthetics and the Sublime - "The curse of Pygmalion has been said to be in seeing ourselves within a sculpture less as an outpouring of artistic potential, but as a projecting of our deepest fears on an inanimate object. Might we find the

reflections of our digital twins beautiful, for does this narcissism come with a cost?"

To guide Artificial Imaginations visual synthesis, the choice of phrase was driven by the human artist's subjective preference, looking for particularly strong moments of curiosity, poetry, and evoked visual potential within the text. Of particular interest were references to concrete but mysterious objects ("a family of robotic seals", "The Dover Demonstration For instance, sub-theme two ("On Our Relationships to Machines"), the GPT-3 system elaborated inventively on the narrative context of robotic seals in Japan, adding technical details about their operation (responding to touch and speech), raising privacy concerns with in-home robots, and discussing well-being outcomes of the technology. during sub-theme three, ("On Care"), Euglena had the following dialogue:

Human: Living on a cloud?

System: living on a cloud ?""That's quite ridiculous," Ms. Binder said. The men who were assigned to her job didn't show her gratitude or concern for her family. "I'm going to get married."

Human: Do you become carnivorous or photosynthetic at this stage of your life cycle?

System: As I discussed earlier, our bodies are much more active than plants, even when we breathe. . .

System: when I think of decomposition we come to some sort of end.

Due to computational requirements of the neural networks, some of the textual and visual imagination processes were non-real time, with the exception of Violet, where processing the live text to viola sounds occurred with negligible latency. With Artificial Imagination, the visual translation of a single phrase using CLIP, BigGAN, and CMA-ES took approximately 4.5 minutes using two top of the line NVIDIA QUADRO RTX 8000 graphics cards. And a single interpolation video between phrases took approximately 1.5 minutes to generate. With Euglena, a latency of about 5-15s was observed from live text input to output. While Euglena's systems used delays as pacing for the discussion, with Artificial Imagination, these constraints required a strategy of mapping out a network of potential textual and visual experience, pre-rendered, to be navigated by the performer in real-time. (Figure 3) This approach could be developed further in future work, establishing a broad set of points of interest in latent textual and image space, and pre-rendering transitions along the paths linking those locations. Twomey did experiment with real-time textual interaction (via a chat-style interface) and image generation during the latter part of the performance, but this will require further development.

4. REFLECTION

The meteoric rise of AI in the last years can be seen as a part of a larger tendency towards deeper, more opaque data collection and analysis techniques that form the dense substratum beneath the proliferation of human-computer interfaces today. Information theorist Philip Agre since 1994 has considered the way these activities have formed a language in itself through “representation schemes” that use linguistic metaphors and formal languages for representing ... activities”. (Anderson & Pold 2018). Such examples from motion tracking, migration and the collecting of micro-movements of the head, torso, hands etc through VR headsets encourage the inference of limited amounts of movement as intent. The gyroscopic interfaces, ambulatory sensors and computer vision systems we use today are increasingly supplemented by AI that reframe the reverberations of activity as utterance, movement as digital trace.

The panel has approached this research-creation practice through two lenses:

1. The metaorganism - the body re-contextualized as an object of knowledge, or better a ‘resource of information’. (Thacker, 2004). This ‘elevated’ scientific value follows an increasingly sophisticated mode of informatic knowledge of the body, within which a crisis exists of ethical considerations of bodies’ and a neo-transcendentalist handling of the ‘afterlives’ of the data beyond the material body.
2. The multispecies assemblages within the emerging paradigmatic computational planet (Gabrys, 2016) - a cybernetic vision of feedback and control that was increasingly validated through expansive networks of sensing technologies, and the mobilization of animals and machines in hyperlocal environmental monitoring at unprecedented scale.

In its theoretical underpinnings, it explores the speculative nature of interspecies communication, computer vision and data visualization techniques synonymous with our technology-mediation versions of creating and cataloguing knowledge today, adopting an expansive understanding of kinship towards a ‘promiscuous care’(Hakim et al, 2020). a mode of multiplying and experimenting with greater diversity of models of caring relationships (beyond ‘the family’ or ‘the market’), and establishing social infrastructures that support more capacious notions of non-discriminatory caregiving practices. Placing the

stakes of caregiving of the humans and microbes side by side with the training of an AI evokes questions about the active labour of care in contrast to the maintenance of a computational system.

On the one hand, the organisms around us are increasingly exploited - such bio-media is viewed as new regenerative and malleable resourcing, and participate without consent in our interventions within their genetic instructions and metabolisms. As Eben Kirksey (2014) questions, “What happens when the bodies of organisms, and even entire ecosystems, are enlisted in the schemes of biotechnology and the dreams of bio-capitalism?”. On the other hand, introducing or projecting a notion of care to a machine may seem unnecessary and superfluous. In the socio-political turbulence of recent years, we have begun slowly revealing more and more of the underlying substrata of computational ‘intelligence’ in the process exposing algorithmic biases, and procedurally generated databases underpinning classification models that are created from biased populations of images and datasets. Our models for AI (and even nonhumans) that are based on human intelligence often leave out the alternative forms of embodied knowledges (such as lived experience); and sideline the relationality of bodies within wider ecologies and processes of environmental extraction. It is impossible today, therefore, to consider AI without thinking about digital justice and environmental justice - where mining of lithium for mobile technologies/digital nomadism has caused widespread damage to native-owned terrestrial and aquatic ecosystems across continents. (Crawford, 2021).

5. CONCLUSION

As a human developer, the most striking qualities of this system are its vastness, non-determinism, and infinitude—also explicit themes of our event and qualities of the sublime. What the audience experienced at POM was not the definitive representation of these subjects, but rather single output from a broad terrain of possible generative results. For GPT-3, OpenAI does not provide an interface to control the random seeding of generation (a design choice), so each utterance from the system is a unique, one-time occurrence and cannot be reproduced even with identical execution parameters. For the text-to-image translation, the programmer did have control over the random seeding, so results could be replicated (and this replication was necessary to generate latent interpolations after initial synthesis), but still the particular image translations arrived at were just one set from a broad space of possibilities that could be produced with different seeds.

If, for textual, visual, and sonic outputs, re-running the generative process would produce an entirely new set of results, what then is the definitive art work? This piece contains a confounding breadth of potential forms. How can a human artist/programmer sensibly navigate this multi-dimensional space of latent meaning? Successful approaches to these tools will require learning new habits and techniques for navigating such plastic, high-dimensional spaces, while still pursuing singular expression, voice, and intent.

By attempting to extend meaningful, responsive and caring relationships to these three examples, we have approached a level of interdependence that Joan Tronto (1993) defines as a “complex, life-sustaining web”. Drawing on the lineage of social robots, Tamagotchis and ‘feral robotic dogs’, could our attentiveness to the environmental realities of machines and their position within our sociality determine a future aesthetics and ethics for the industry? Can our relationship with AI progress from basic extraction and vital maintenance, to affect and meaning? Does that mean designing AI systems that generate more anthropomorphic (not anthropocentric) social responses and linguistic cues (such as humour, imagination or conversational AIs). Like the Curiosity Rover that sang a birthday tune to itself when it turned 1 in 2013, our goal has been to program hybrid systems with AI to reaffirm their part in human society as partner and companion, and not solely as resource.

6. ACKNOWLEDGEMENTS

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Intimacy in Design Processes – An Interim Reflection

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This paper is an interim reflection upon an ongoing initiative of practitioners who joined together to form a lateral community, which approaches the intersections of technology, intimacy and the stigmatized through hands on Do-It-With-Others (DIWO) attitudes.

Intimate Technology. Critical Making. Do-It Together Practices. Body Literacy. Gender and Design.

1. INTRODUCTION

In the past couple of years, a growing number of online as well as offline initiatives emerged, which are now often referred to as the 'maker movement'. In the culture surrounding this movement, engaging with the material process is a way to decode rules of mass market and rewrite societal assumptions inscribed professional design. This paper proposes that the ideals of open access, free circulation of information and horizontal cooperation might form a crucial basis for the delicate task of linking technology with intimacy. Exemplary work will be outlined by practitioners, who form a community dedicated to the intersection of intimacy and technology development, practice and designing with taboo issues in mind.

2. INTIMATE TECH

This piece is written from the perspective of two feminist practitioners who understand design as a discipline that draws knowledge to a great extent from practice. Engaging physically with our material world – opening, altering, and rebuilding the existing already holds an emancipatory potential. In our practices we have experienced that engaging with the making process is a useful and productive method of breaking down implicit and explicit barriers and to engage with – and in favour of – 'intimacy'. As technologies become closer to our bodies and increasingly interwoven with our personal lives (Søndergaard & Hansen 2018) making in this context may increase body as well as tech literacy and the impact this might have on personal autonomy and people's ability to make informed decisions about their health and wellbeing. The subject of Intimate Tech broadly

describes technology built for personal and often stigmatized subjects (prohibited or restricted by social custom), namely – but not limited to – sexual and reproductive health. Intimate technologies surpass the notion of devices that are placed close to the body or indeed inside intimate parts of our bodies. They are technologies that address and embrace intimate or taboo topics. When we speak about intimacy it denotes mutual vulnerability, sharing and openness. When we speak about intimacy and design, we understand it as something that starts from an interrelated view of the practice that engages with a material world that cannot be disentangled from the ecological, societal, relational contexts in which it is performed. We recognized that through learning, building, and customizing in non-judgmental spaces, building intimate devices encourages personal discovery and self-actualization.

3. THE M.I.T.

Through our research and practice we have learned that there are many like-minded people working with the tabooed or stigmatized as valuable variables, such as in intimate care, sexual, mental, and clinical health, and bodies in private, public, social and political spaces. For that reason, we committed ourselves to create an environment where we can support each other, share ideas, references and collectively tackle the challenges we might face. The goal of this group called Making Intimate Tech (hereafter M.I.T.) has been to connect an intentional group of practitioners who are excited about and engaged with the realm of intimacy, tinkering and hands-on engagement with technology. The M.I.T. is conceived as a space to collectively create and compile a repository for material (methods, literature,

workshop documentations, "actual" physical material library) for the group to access, discuss, and draw from for their own practice. The M.I.T. is also a space for a reading-group on papers, articles around contemporary issues in technology, intimacy, pleasure, and feminist pedagogies. And finally, we also wanted to create a space to identify challenges, which include how these often-independent working practitioners approach issues of safety and inclusivity in their work, as well as censorship and the stigma attached to working with tabooed subjects. We found, due to the topics' nature and feminist sex-positive views on intimacy it is already and becoming more and more difficult to act on and address an audience on many digital platforms.

4. EXEMPLARY POSITIONS

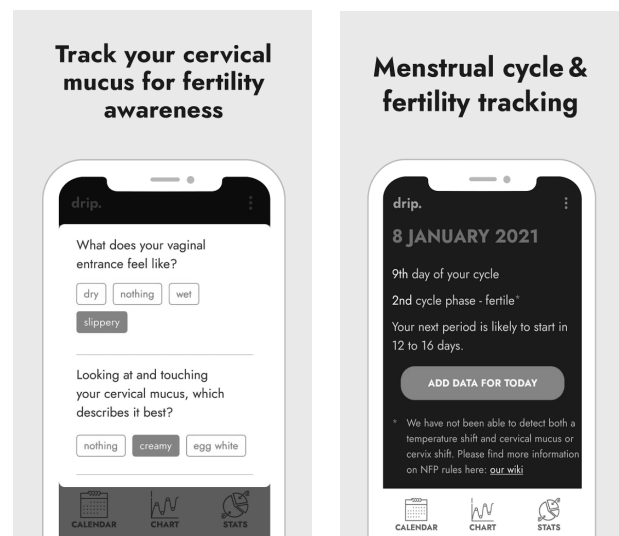
Having started with half a dozen members predominantly occupied with the intersection of technology and sexual health, to this point the M.I.T. counts 45 members that contribute, collaborate and exchange thoughts and experiences. Considering that only in the past decade the so-called third wave HCI started to deal with deeply subjective qualities of interaction such as experience, embodiment, pleasure and so on, it should not have been surprising to see the diversity of topics M.I.T. community explores and how these intersect with others, when calling *intimacy* a common ground. It becomes clearer if one understands intimacy as a space around our bodies where private and public meet (Suchman 2007). Those topics include, but are not limited to politics, sex, money, spirituality, physical and mental health, as well as interpersonal communication. The work of the designers, developers, and artistic practitioners of M.I.T. is a combination of practical and theoretical approaches, where often their practical approach has theoretical relevance. They may be perceived as "bridging" disciplines, since their practice challenges any dichotomous narrative that permeate society whether it be the artificial – nature, technology – humanities, body – mind or of course the idea of binary (opposing) sexes. M.I.T.-ers are often mediators who use analogies to make complex subjects tangible, in the literal meaning of the word. They do this in the context of therapeutic efforts and a form of activism to encourage the unlearning of taboos. Hereafter the authors will introduce projects of the founding members of the Making Intimate Tech community.

4.1. Marie Kochsiek & the Bloody Health Collective

Kochsiek's background lies in social science and software development with a focus on menstrual health tracking technologies at the intersection of technology, health, and feminism. In 2017, they founded the Bloody Health Collective and have

been developing the open source and free cycle tracking app 'drip' since April 2018.

It hardly gets more private than the information about one's period which cycle tracking apps invite their many million users to share with them. They are fast and convenient and send friendly push notifications when your next menstruation is due or late. In a qualitative study conducted for their Master thesis, Kochsiek found out that these applications are altering people's perspectives of their bodies, sexuality, and health – yet in many cases, this information doesn't stay on one's phone. They eventually wind up in the cloud, on company's servers. They are pure gold for the providers of these apps, which are frequently free of charge, the data gets advertised to insurance companies, employers, or other businesses, who then play out personalized advertising. According to privacy advocates, targeted advertising, third-party data sharing, and surveillance make most menstruation apps just as worrisome as they are appealing (Coding Rights 2016; Privacy International 2019). The Bloody Health collective, a group of Berlin-based feminist developers around Marie Kochsiek, found that creating their own open-source software is the best way to maintain control. Searching for a more secure way to monitor periods they started to develop their own app 'drip'- open source and non-commercial.



Figures 1 & 2: Screenshots from drip on the Google Play Store.

4.2. Giulia Tomasello

Tomasello's work addresses sexual health needs and approaching intimate care through a lens that does not exclude the collective: Through participatory workshop frameworks they are involving people with a uterus in the development of instruments to meet intimate health issues. The project 'Alma' tries to develop an 'atlas' through these specially developed methodologies, which

are formed and steadily evolving through direct user participation. Having earned great attention (and prizes) in the biohacking and citizen science scene, 'Future Flora' – a DIY harvest kit to prevent and treat vaginal infections, is a speculative project that attempts to encourage a symbiotic relationship, which increases the beneficial presence of microorganisms and bacteria in the human body. The kit, which features an Agar jelly-based element, aims to challenge the values and beliefs that our society embodies in material culture and proposes alternatives, using biological remedies in our homes. The intention behind Future Flora is to develop means that will allow taking a more active role in people's health care, prompting them to seek medical advice when needed, and ultimately breaking some of the taboos associated with urogynecology. In this project, Tomasello explores the possibility of using scientific laboratory tools as part of our everyday lives, until they become as mundane as, for example, a makeup kit.



Figure 3: Alma.



Figure 4: Future Flora.

4.3. Lisa Mandemaker

Mandemaker describes themselves as a social and speculative designer who develops prototypes that bring the future closer to reality. Amongst others, their work is concerned with the future of reproduction (such as artificial wombs) and acknowledges that by creating prototypes of new (tech) possibilities, we may have more informed dialogues about the consequences of such

technologies on a daily and personal basis. Artificial wombs, which aim to imitate the natural conditions of the uterus, might eventually replace incubators. In their work, Mandemaker speculates from a designer's perspective on our reaction – if and when such technology knocks on our cultural doors.

4.4. Dani Nikitenko

Nikitenko's 'Beside Blood – Cycle Exploration' aims to provide people that will be, are, or have been menstruating at some point in their lives with tools that seek to reduce barriers to self-knowledge and invite to explore their cycle related changes through qualitative means. Information about the menstrual cycle is still limited. There may have been a rise in consumer products to deal with this "unwanted visitor", yet it is a topic seldom discussed outside of advertisement purposes. This reality shapes the social discourse and is crucial to the rights people affected claim in society. The objects designed for "Beside Blood" have no immediate medical connotation which might 1) trigger anxieties for not a few and 2) carry a risk of injury at inexperience use. Through using valuable materials such as porcelain which has high mechanical strength and smooth surface that is hypoallergenic the objects become aesthetically materially attractive.



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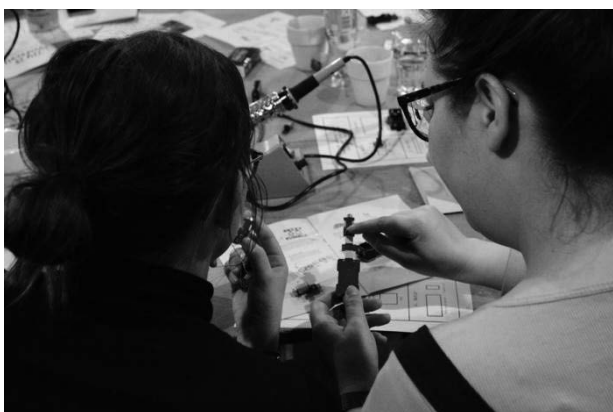


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Figures 5 & 6: Beside Blood.

4.5. Alice Stewart

Stewart has a background in art and design and is a self-taught creative technologist working across a range of different projects. Yet their specific interest lies in sex- and intimate technologies. In 2019 they founded a sex tech company called Touchy-Feely Tech: hackable DIY vibrator kits which are assembled in group workshops to encourage personal discovery and increase interest in STEM topics. These kits are a collection of 3D printed casings and electronic modules allowing for people to customize shape, colour, motor type, vibration strength and pattern: Through that, participants gain the foundational knowledge of code and electronics together. The design of these kits aims to be playful but not infantilizing. Through diverse frameworks reaching from in-presence workshops to virtual SexTech Hackathons with participants of all continents, Stewart facilitates an environment that fosters a conversation around Sex Education through the power of making, coding, and technology.



Figures 7 & 8: A group workshop for hackable DIY vibrator kits from Touchy-Feely Tech.

4.6. Catherine Wieczorek-Berkes

What drew Wieczorek-Berkes to the Making Intimate Tech community is her interest in the relationship between design and trauma in human experience. As designers are not merely, observing and shaping people's interaction with their material

world but also incorporate lay people's expertise in participatory methodologies to incorporate their experience (Wachs, 2019) into the development processes. Wieczorek-Berkes therefore aims to push practitioners to 'question the consequences of our emotional, difficult, and tragic lived experiences, which society encourages us to swiftly, quietly, and apathetically ignore.' (Wieczorek-Berkes, 2021)

In another research project at the University of Chicago Wieczorek-Berkes has co-developed a sexual health service platform with and for young people, using a participatory design research approach and a unique design approach that combines three theoretical frameworks: the socio-ecological model, the reproductive justice framework, and positive youth development. The 'Hello Greenlight' Platform provides materials and experiences aimed at educating young people about sexual health as well as training and technical assistance for sexual health care professionals (Wieczorek-Berkes, 2019).



Figure 9: Hello Greenlight Platform.

5. REFLECTION

5.1. A Lack of Boundaries

The M.I.T. is also an experiment for a dedicated yet fluctuating community rather than establishing an institution. This very approach is also a great challenge. We assume one reason for this is people's caution of claiming or acting in space someone else has (initially) created. At the same time there is a very low threshold for people who are interested in the interrelations of technology as a societal project and intimacy as an inter-personal state of being. Also, the *Making Intimate Tech* community was set up as a space with an initial interest to connect practitioner who see an emancipatory potential of collaborative hands-on activities and valuing the stigmatized as an enriching variable in development of technologies of varying nature. The initial members were and are primarily occupied with questions revolving around sexual health care, yet, short after initiation, it became clearer that questions of intimacy and -or

specially- taboo don't simply stop at the (bodily) boundaries of "reproduction organs". As raised above intimacy is, just like technology, rather a space that cannot be detached from societal forces. The M.I.T. was conceptualized to become a safer space for practitioners in contested (digital and physical) spaces to support each other. This means to embrace the diversity of issues that are in fact afflicted with stigma. When valuing and inviting the multiplicity of topics that have one common denominator, an informal group faces challenges, as well as potentials, of dialogues moving into a level of being metaphorical. At the same time especially in safer spaces, learning to set boundaries for (inter-) personal well-being is an important practice. Therefore, the authors are ongoingly challenge themselves on how boundaries might look like for a lateral community like the M.I.T., in order to provide an environment that fosters confiding exchange?

5.2. Making & Technology & Intimacy

The intersections of intimacy and technology may at first have appeared as a niche territory and quickly unfolded into a multiplicity of topics. One core element for the initiation of the group is the value of the designing process itself as an emancipatory practice. Designing is also a demystifying process- either through building own devices or tearing down products, one reveals important design questions such as accessibility and security. For example, what does sex tech look like for people who struggle with dexterity, or how do you negotiate consent with toys that can be accessed remotely. A Do-It-With-Other's practice valuing the stigmatized, with consent in mind respectfully moving further than respective customs would allow, may potentially expose vulnerabilities in tech more generally. In workshops that we facilitate we can observe that shame or apprehension is replaced by pride and the satisfaction of completing something.

5.3. Match Made in Heaven

Technologies developed and designed to create a notion of intimacy also go beyond devices that one might put at or in the body. While everyday technologies move closer to our bodies and we are being increasingly connected to watches, fabrics, toys, and larger techno political infrastructures, there is another side of technological innovations from which one might increasingly experience violations of privacy, interruptions in human relationships and identity crisis. An endeavour such as the open-source cycle tracking app 'drip' by design challenges the status quo of monetization of intimate data. Yet it is a voluntarily run project that needs care and updates, for which the Bloody Health collective spend their recreational time:

unpaid care work, if you will. Now think dating and data: In times of a global pandemic and coping with insecurities in regard to physical proximity and with lack of contacts, issues of privacy when using dating apps might seem like a small price to pay for the possibility of meeting someone new. As the NGO Tactical Tech has shown - by purchasing 1million online dating profile for less than 140€ from USDate (Moll, J., Soleymani, R., Tactical Tech) services like "Grindr", a dating app mostly addressing homosexual males but also catering to bisexual and queer people requests, or invites to share voluntarily, information such as -but not limited to- profession, ethnicity, personal pictures, on HIV status or "last tested date", unprotected sex choices, relationships status, or date of birth and geo location (in some extremely homophobic countries this feature has been turned off in order to protect users, other comparable applications still use it). Beside a monetization of this sensitive data, these 'business models' raise alarming moral and legal question. Whether they serve to observe a menstrual cycle, monitor a pregnancy, or facilitate low threshold dating, the profiles on such applications contain sensitive information about their users, exploitation and misuse of this data can have severe consequences in their lives.

When it comes to love intimacy, they say a gentle(wo)man never tells. Convenient mobile phone application position themselves as easily accessible assistant while taking advantage of the role of a secret keeper and thereby reinforce the notion of something to better not talk about. When designing for intimacy, we must therefore both highlight agency of those that we call "users" as well as putting data privacy issues first. It is crucial to ensure just technological futures.

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POLITICS OF THE MACHINES

Rogue Research

Michelle Christensen, Florian Conradi, Laura Beloff,
Morten Søndergaard, Hassan Choubassi

In a state of ontological crisis, all boundaries between human and machine, nature and culture, and the organic and inorganic have been severely blurred. These are times of curious contrivances, novel natures, inescapable automation, and posthuman performances – where human and nonhuman find themselves being entwined, meshed and muddled into new unwitting entanglements. But from biased machine-learning to surveillance capitalism and digital colonisation – what power-structures are implicitly and covertly being embedded into these technologies?

In a demand for more transparency, multiple movements are making a turn toward democratising knowledge and technology. They are exploring the potentials of open data, software, hardware and wetware to battle concealed hierarchies and partisan paradigms – eliciting a practice of counter-coding in a proliferating politics of machines.

Within the Politics of the Machines conference series – following Copenhagen (2018) and Beirut (2019), the third POM conference took place as a hybrid conference on the 14-17 of September 2021, hosted by the chair for Open Science at the Technische Universität Berlin (Einstein Center Digital Future) and the Berlin University of the Arts (Weizenbaum Institute) in Berlin.

The goal of this edition of POM was to debate and devise concepts and practices that seek to critically question and unravel novel modes of science – what roles do academia, researchers, scientists, artists and designers have to take on in times of crisis, how must we re/position ourselves? What chances or challenges might the democratisation of technology and knowledge elicit, and what potential do practices such as critical making, community science, trans/feminist hacking or citizen forensics hold to bend the hierarchies of power – how can we work with active matter and technical turmoil to re/act?

'POM Berlin – Rogue Research' aimed to probe new methodological approaches from art, design and civic activism within the framework of academia in order to surface an inter- and transdisciplinary terrain that attempts to exceed the boundaries of theory and practice, academia and activism, and science and civil society.

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