Beyond The Hybrid book addresses hybridity's implications in modern contexts, from AI and digital interfaces to bio-artistic expressions. The hybrid's role in political and social realms is also examined, exploring how hybrid media systems blend traditional and new media to reshape power dynamics and cultural narratives. The volume advocates for the hybrid as a conduit for novel epistemologies, blending diverse traditions and fostering innovative cultural expressions. It emphasizes the necessity of critical thinking and creative practices in addressing global challenges, proposing hybrid methodologies as pathways to new solutions.

This volume, featuring contributions from participants of the Hybrid Labs Symposium held at Aalto University in 2018 as part of the traveling Renewable Futures conference series, offers a comprehensive exploration of hybridity in transdisciplinary creative research practices. The articles challenge the perceived lack of historical self-awareness in new media, highlighting its transformative impact on contemporary culture and human experience.

The book consists of four sections. The first three – "Theorising the Hybrid," "Dimensions of Hybridity," and "Hybrid Media: Imagination and Practices" – include articles by participants of the Hybrid Labs Symposium (2018), who challenge the perceived lack of historical self-awareness in new media, emphasizing its transformative impact on contemporary culture and human experience. The fourth section, "Deep Hybrid – Latest Developments", reviews recent follow-up events and research projects, including a visual section that highlights the RIXC Art Science Festival exhibitions: "Splintered Realities" (2022), "Crypto, Art and Climate" (2023), and "Symbiotic Sense(s)" (2024).

Contributors to this volume include Kristin Bergaust, Samir Bhowmik, Maija Demitere, Lily Díaz-Kommonen, Saara Hacklin, Nigel Helyer, Volker Helzle, Laura Hopes, AnneMarie Maes, Polixeni Mantzou, Kenichi Masaki, Maria Nikoli, Tina Ohnmacht, Jussi Parikka, Ellen Pearlman, Laura Plana Gracia, Inge Römgens, Akira Sano, Hisanobu Satoh, Irina Shapiro, Miranda Smitheram, Rasa Smite, Raitis Smits, Ulla Taipale, Juhani Tenhunen, Jonas Trottnow, Judith Van Der Elst, Yumi Watanabe, Lauren Wooley, and Tomoyasu Yoshitomi.

Published by RIXC Center for New Media Culture (Riga, Latvia) and
Aalto University (Espoo, Finland).
http://acousticspacejournal.com

9 789934 911910

ISSN 1407-2858
ISBN 978-9934-9119-1-0

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Narratives, New Media Experiments and Speculations Touching Art and Science Knowledge Exchange

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Lily Díaz-Kommonen, Juhani Tenhunen,
Rasa Smite, Raitis Smits (Eds.)

ACOUSTIC SPACE, VOLUME 20 / RENEWABLE FUTURES, ISSUE 5

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EDITORS:
LILY DÍAZ-KOMMONEN, JUHANI TENHUNEN,
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Acoustic Space, Volume 20 / Renewable Futures, Issue 5
Peer-reviewed journal & book series on digital art, art and science, and artistic research
http://acousticspacejournal.com

Editing
Robert Buckmaster

Design
Mārtiņš Ratniks, SIA Re-Lab

Layout and printing
SIA Re-Lab, IBC Print Baltic

Cover photo
Rasa Smite, Raitis Smits. Deep Sensing, 2023. Immersive Room / MEET Digital Culture Center, Milan. Courtesy of artists

Publishers
RIXC Center for New Media Culture (Riga, Latvia) / Aalto University (Espoo, Finland) in cooperation with RTU Liepaja Academy (Liepaja, Latvia) / Oslo Metropolitan University (Oslo, Norway)

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ISSN 1407-2858
ISBN 978-9934-9119-1-0

Beyond the Hybrid

Contents

Introduction – Beyond the Hybrid: Narratives, New Media Experiments and Speculations Touching Art and Science Knowledge Exchange

LILY DÍAZ-KOMMONEN

This volume documents a selection of the proceedings of the Hybrid Labs Symposium, an artistic encounter and knowledge exchange event realized at Aalto University during the summer of 2018. The Symposium, which included an art exhibition, a one-day conference and workshops in areas such as digital cultural heritage and virtual reality, encouraged theoretical speculations, interventions, and reflections about hybridity and the hybrid in the context of transdisciplinary, creative research practices. Notions of the hybrid developed through the event and presented in this volume are in close alignment with a new media orientation, a category which as the ultimate hybrid is often imputed with a lack historical self-awareness and critical thinking.

Despite the prevalence of such discourse, plain reality demonstrates how practices, technologies, and thinking associated with such new media have transformed both the culture and our understanding of what is like to be human in the 21st century. So, perhaps the urgency of our present time, replete with seismic environmental, societal, and political fractures, when our very existence is becoming dependent on artificial hybrid ecologies and infrastructures make such open-ended terms as 'hybrid' and 'new media' more relevant than ever.

Rather than unified, meta-narratives, the essays included in this collection promote exploration and perspectives from within and among the hybrids that engage with multiple forms of media. They present views related to novel and shifting temporalities, ecological diversity, and positional and relational politics associated with emergent, though not necessarily yet congealed, meanings.

A brief excursion into the historical origins of the term hybrid can open to us the political antecedents: The oldest and possibly most cited historical source involves Pliny the Elder's *Historia Naturalia* where the term literally refers to the union of two different species, including one sourced from the wilderness wherein "the offsprings of such unions in the old days were called 'hybrids' meaning half-wild." Pliny explains how the use of the term as a metaphor "is also applied as a nickname to human beings, for instance, to Cicero's colleague in the consulship Gaius Antonicus Hybrida." Since the obscure origins of Hybrida's mother seem to have been subject of gossip during those ancient times, an implicit understanding conveyed here is of the term as a slippery enclave and indicative of "one born of a Roman father and a foreign mother, or of a freeman and a slave."

Fast forward a few centuries later when Jürgen Müeller's etymological reconstruction of Pliny's text brings a new intermedial interpretation that extends our range of understanding by elaborating how mixed forms of concepts from different language systems have converged on the term. So, while Latin *hibrida* stood for being of mixed blood and the Greek hubris for excess, in Egypt's ancient civilization the notion of hybrid would have been employed to indicate heterogeneity as a favoured characteristic.

Figure 1. Anubis, the god of death in ancient Egypt. Statuette of Anubis, from the Ptolemaic Period, 332–30 B.C. Metropolitan Museum of Art, CC0, via Wikimedia Commons. Retrieved March 5, 2024, from https://www.metmuseum.org/art/collection/search/590939

Müller argues how the figure of Anubis, as the god of Death, assumes a hybrid form which integrates a dog's head into the human body's shape. Here the hybrid can also be regarded as form of *syncretism*, a term used to refer to a cultural mix of entities from different belief systems (Herkovits in Kapchan & Turner Strong, 1999). What we have is an indigenous culture, with possibly more ancient behaviour patterns, that remains as a steadfast attractor drawing novel element after element into new *assemblages* of forms that continue to evolve and adapt to a changing world. Similarly, *bricolages* of disparate elements come together and are re-worked into new positional and complex networked configurations that can also include, for example, a creolization of political ideas into local contexts for promoting national consciousness (Gordon, 2014). As in Gloria Anzaldua's notion of *borderlands*, the hybrid affords the possibilities to simultaneously inhabit multiple spaces. In academic discourse, the hybrid can straddle the boundaries of different knowledge fields, diverse media and even histories. Beyond intersecting boundaries, the implied crossover involves a transversal and coming together into hybridity at the core since that is what is hybrid.

Our very existence is already dependent on artificial, hybrid ecologies synonymous with trespass. Whether it is in the use of artificial intelligence techniques

that seek to mimic and learn from our individual and collective behaviour as humans, or whether it comes as the voluntary subjection of our personal sense of agency the mandate seems to be one of continuing forward. As Accoto remarked "software can no longer be thought of as an instrument but will have to be re-thought as constituting the human" (Accoto, 2018, p. 27). Indeed, the thrust towards miniaturization and the embedding of computing components in the artefacts of our everyday life, coupled with our use of ubiquitous information communication technology platforms for our quotidian chores might soon be close to bridging the gap or 'circuit' which differentiates the human and digital artificiality. Along a similar vein, Nigel Helyer's work in this anthology describes a system developed in collaboration with scientists and humanists whereby "music notation is transcribed into synthetic DNA, which is" [subsequently] "inserted into bacteria, mutated in vivo and finally extracted and re-sequenced into music – in effect creating a biological [hybrid] music mixing system" (p. 141). What might we expect to find at the end of this road? This is a matter for conjecture and speculation.

Recognizing that complexity (as in *Complexe*) is intrinsic to the study and interpretation of hybridity and how it both feeds into and derives richness from diversity, we ask the following question: What are some of the affordances and constraints that such hybrid multiplicities entail? The results of this quest might become clearer if we investigate, as Jean Louis Lemoigne has done, the etymological composition of the term complexity.

Etymology of the word Complex

The Latin root is *Plexus*; intertwining which generates *Complexus*, or entanglement, connection, embracing, entrainment and *Perplexus*, or entanglement. (*Perplexitas*: ambiguity);

We can note that the radical *Plexus* is also at the origin of *plicare*, to fold; from which derives *applicare*: application; *complicare*: complication; *implicare*: implication; *multiplicare*: multiplication; *multiplex* describes multiplicity... "This root etymology reveals that the opposite is not 'simple' but implex (from *implexus*), which is characterized by an undecomposable, irreducible unit of action relating to a single element " (LeMoigne, 1999, p. 24).

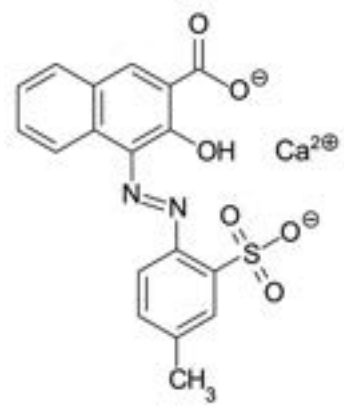

Figure 2. A molecular representation of lithol rubine compound cannot be broken into pieces without ceasing to be lithol rubine. This is the red substance used in Jean Dupuy's emblematic work, Heart Beats Dust and which, via a stethoscope, reacts to the interactants heartbeats. "It is normally used as a standard magenta in the three and four color printing processes" (Wikipedia, n.d.). Diagrammatic representation of the Lithol Rubine molecule courtesy of Wikimedia. Retrieved March 5, 2024, from https://en.wikipedia.org/wiki/Lithol_Rubine_BK

We would propose that it is precisely through its irreducible complexity, that the hybrid acquires its distinct (paradoxical) character as more than the sum of its parts. And it may well be here also where it derives its generative force, as it emerges from the multiple and self-referential identities which compose it. From this perspective it is possible to understand how biosemioticians Mäekivi and Magnus describe the hybrid as both combined diaspora (departure) and liminality (in-betweenness), while Lowe refers to it as both a threshold area and zone of convergence for differences.

These ponderings seem to imply that the category can enable extensions in the denotative capacity of human language. So, we can refer to events and things that occur at different points in time and space. Thus, when describing her virtual reality artwork that is located along the British coastline, Laura Hopes begins her essay *Vertex + Reflex* by asking the question of when we look out to sea, what is it that we are turning our backs on? In calling attention to the narrow of range of human visual perception, Hopes draws our attention to the fact that there is a whole world out there which includes other species with perceptual abilities which differ from ours. Also, she highlights how our understanding encompasses a diversity of modalities, which allow for displacement and re-engagement. There is more than meets the eye – she seems to be saying and we need to come to terms with the fact that "…merely turning away from the Nuclear Power Station towards the sea does not remove its ominous humming sound."

As a category, hybrid comfortably affords augmentation of our (linguistic) understanding and acceptance of the radically new, or that which is still in formulation. A combination of the familiar and the novel, especially when placed in a different context from the usual, can facilitate the gaining of new meaning. Strathern, for example, contends that "ideas about kinship in the West supply ways for thinking about social continuity and social change more generally and for thinking about the relationship between scientific knowledge and society" (Wade, 2006, p. 608). Indeed, as we can appreciate in Irina Shapiro's work, the importance of shared lexicons, via artistic and scientific exchanges relating to the material, also imply the creation of new meanings. Such co-participative processes can create bridges between knowledge boundaries, allowing for passage into the yet not thoroughly understood n-domains in need of pursuance and (re)search.

How this term – hybrid – synonymous with uncertainty is also deeply and covertly imbued in the political aspects of our society can be observed if we follow how *political information* cycles in our hybrid media systems (Chadwick, 2013/2017) congeal into complex assemblages that warrant hybridized logics (human and machine) to blend the 'new' online media with old broadcast models. The resulting melange seems familiar on the surface. Yet it is radically different at the centre for it facilitates not only the shaping (and biasing) of power relations among actors but also, significantly impacts the flows of meaning among diverse constituencies, possibly facilitating the shaping and biasing of power relations. How to alter this situation is the one of the topics in Van Der Elst's essay, who, advocating a biosemiotics approach, proposes a distancing from machine metaphors and the welcoming of

ancestor spirits that *inspire* and *influence* both as mental as well as physical processes involving air and water flow, animating ecosystems. After all, the human body is not an enclosure unto itself but rather constitutes a material, open and distributed ecosystem receiving inputs as well as impacting its surroundings.

As a primary concept in our current era (ACM's flagship journal *Interactions* devoted a special issue in 2019), hybrid and hybridity are also recognized for their enabling of new areas of knowledge where so-called dominant epistemologies might not suffice: When different traditions come into contact, cross-fertilization extends the possibilities for new combinations. Fuchsberger notes that the future integration of human machines might perhaps be better labelled as a *human-centred hybrid world* (28). Might it be then that, as Yao proposes, new cultural manifestations such as AB, or BA, emerging as components found in Tradition A are combined with elements from Tradition B (363). Or, that direct grafting (Yao, 2003, p. 364), and transplanting of culturally specific references from one environment to another, as was the case with Lin Manuel Miranda's musical *Hamilton*, where a cast comprised mostly African American and Latino actors singing rap music re-enacts a narrative from the American Revolution, thus opening the door to new forms of content and genres? As alembic containers that simultaneously weave complexity with reified knowledge, history and future imaginings, the notions of hybrid and hybridity enable mixing, observing, mixing again, and noting how divergent cross-cultural fusions and disparate temporalities come together in delicate equilibrium. Here, De Landa's proposal of steering away from so-called organismic theories and essentialist arguments and focusing instead on the amalgamation of relational logics, or *assemblages* resulting from hybrid approaches is right on mark.

Given the current situation of impending global, ecosystem catastrophes, we need to also be compelled to take the critical thinking element further. Since it has been the case in the past that knowledge is seen as something which progressively develops using deductive propositions investigated through scientific practices, one of the tasks of this anthology is to address the question of how creative practices, such as art and design, operating across transdisciplinary domains including scientific areas can contribute to finding new paths and solutions. In this capacity the volume proposes new concepts, tools, critical views, and ways of thinking about the hybrid and hybridity.

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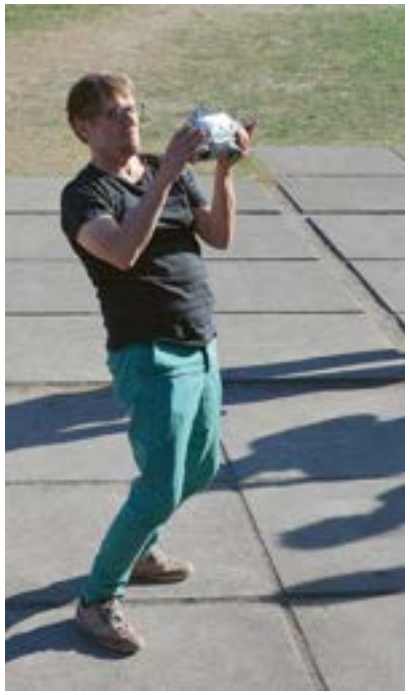
Hybrid Labs Symposium

Camilla Dahl. Aalto Amphi Experimental Lab performance, May 30, 2018. Performance for the opening of the Hybrid Labs 2018 Symposium. Held at the Alvar Aalto Amphitheatre. Photo: Lily Díaz-Kommonen

Rasmus Vuori, Kristin Bergaust



Juhani Räisänen

Laboratory tour, Aalto University. 1 June 2018.
Photo: Lily Díaz-Kommonen

Leonardo birthday party, cutting the 50th anniversary cake.
Nina Czegledy and Roger Malina. 1 June 2018.
Photo: Lily Díaz-Kommonen

Cultural heritage workshop: Reflection. 1 June 2018. Photo: Lily Díaz-Kommonen

Cultural heritage workshop: How we designed “just right” exhibition group discussion.
1 June 2018. Photo: Lily Díaz-Kommonen

Cultural heritage workshop:
How we designed “just right”
exhibition presentation by
Akira Sano. 1 June 2018.
Photo: Lily Díaz-Kommonen

Cultural heritage workshop: Discussion led by Neha Sayed. 1 June 2018.
Photo: Lily Díaz-Kommonen

Tour of laboratory space at Aalto. 1 June 2018. Photo: Lily Díaz-Kommonen

1

THEORISING THE HYBRID

Wild Things

POLYXENI MANTZOU, MARIA NIKOLI

ABSTRACT

This paper examines how digital technologies affect modern objects and transform them into hybrid, wild things. These new things, which emerge in a bottom-up manner, constitute a novel version of a wild, uncontrolled nature in which the subjects are latterly immersed. Previously, things became objects. As Heidegger pointed out, industrialization, mass production and detachment converted the things of the past into the objects of the modern world. Subjects were then found ob-jected, opposed to these objects; they were no longer attached to them. Unlike the unique and irreplaceable things of the past, modern objects were operational, interchangeable and massively produced.

The title Wild Things defines a specific category, i.e. wild, of a larger grouping: things. The paper will discuss why these two notions are central to our current situation. It will do so by determining, beside the wilderness, more characteristics that render things wild; and by defining things and distinguishing these new, hybrid, wild things, from traditional, old-fashioned things of the past as well as from the objects that those had latterly become.

The paper analyses and presents these attributes that constitute, among others, the wild nature of these hybrid things. In order to clarify how these attributes are ascribed to wild things in general, one specific thing will be briefly presented, explored and associated to each matching attribute.

The digital condition reinstates some of the lost properties of things to industrialized, modern objects. Therefore, they are no longer inert, passive, detached and indistinguishable. They become autonomous, like Talos, Crete's mechanical guardian; responsive, like Theodore's star-crossed lover, the OS called Samantha; behavioral, like the popular toy Furby; surprising, like the voluptuous, animatronic "Female Figure"; embedded, like Android Things 1.0, Google's brand new OS and finally, they become wild.

As a final contemplation, this preparatory text will insert the matter of subjects in the prospect, as things have always been considered as an illustrative element and a constitutional component of self, identity and the social and cultural characteristics of different civilizations. Subjects that underlie every-thing provoke the changes that convert objects into things but then, when the dipole subject-object is no longer operative, the subjects are themselves and wild things emerge; it is the subjects that are subjected to change.

KEYWORDS: wild, things, objects, subject, hybrid.

First things first

This paper is organized as a preparatory text for things and the effect that informational technologies have upon them. In this preparatory text, this sort of pre-text, words are of great importance because they designate the contour that frames the analysis and the understanding of what is to be examined. Words will be considered not as independent and autonomous entities, but as interrelated parts of a codification system, in which words are interconnected to other words or where words denominate things.

The title Wild Things defines a specific category, i.e. wild, of a larger grouping: things. The paper will discuss why wild and why things, are central to our current situation. It will do so by determining, beside the wilderness, more characteristics, that render things wild; and by defining things and distinguishing these new, hybrid, wild things, from traditional, old-fashioned things of the past, as well as from the objects that those had latterly become.

Once the selection of the word thing is justified, then a list of attributes that constitute the wild nature of these things will be presented and analyzed. In order to make clear how these attributes are ascribed to wild things in general, for each of them, one specific thing will be briefly presented, explored and associated to the matching attribute. The list of attributes is a tentative and provisional one that is subject to modifications but can be considered operative for the speculative phase of this pre-text. Likewise, each thing, associated with each attribute, bears no uniqueness and could be substituted by other ones; still, they were chosen specifically as a process of exemplification of the theoretical and abstract concepts that are nowadays widely considered arduous and bothersome; as it can be said that theory is fading (Van Berkel & Bos, 2002).

As a final contemplation, this pre-text will insert the matter of subjects into the prospect, as things have always been considered as an illustrative element and a constitutional component of self/ identity and of social and cultural characteristics of different civilizations. It is therefore of great interest to reflect on how the transformation and change that are occurring to things affect and redefine the subjects and their relationship to these, and how even the transposition of the word objects with the word things raises important issues to the subject in as much as it is understood as the better half of a dipole which is now rendered inoperable.

Things are becoming… things

"Humanity begins with things" (Serres, Latour & Lapidus, 2011). At first, there were things; for centuries we have been surrounded by things; but later on, things became objects (Heidegger, 1971), which now seem to cede (Carpo, 2011) and leave the way to the new, wild things that emerge. The original transition from things to objects can help us understand what such a transition means, even if the one we are facing is reversed. The transition from things to objects was, for humans, important and dramatic, because it meant that we had to detach and remove ourselves from the world

of things, in which we were immersed in order to re-locate ourselves before them, against them (Heidegger, 1971).

Heidegger sees the transformation of things in objects as the result of technological advances; industrialization, mass production and detachment converted the things of the past into the objects of the modern world (Heidegger, 1971). These modern objects were then found ob-jected, opposed to the newly conceived as such, subjects; subjects were no longer attached to the objectified world. Everything became distinct, separate, classifiable and controllable and thus, repeatable. Unlike the unique and irreplaceable things of the past, modern objects were operational, interchangeable and industrially produced (Heidegger, 1971; Benjamin, 2008; Ruskin, 1909).

However, as technology advances and as we are faced with a novel revolution as significant as the industrial one, we are once again seeing a change in our position in the world; as a consequence, "modern objects", as Carpo (2011) calls them, may cease to exist; they are being transformed into hybrid things. They are hybrid because our digital condition reinstates some of the lost properties of the old-things to the industrialized, modern objects. Therefore, they are no longer inert, passive, detached and indistinguishable; they become responsive, entangled, unique, customized. In the digital era, things become complicated and hybrid; on one hand, they conserve the repeatable and dissectible attributes of the objects of the modern world but on the other, they become interconnected and relational as were the old things of the past; and all these coexist at the same time, leading them to a hybrid condition. The seamless binding of physical and digital aspects of the contemporary hybrid things establishes unforeseen connections to the subjects as well as to other things. These things formulate and belong to an ambience configured by the active and passive relations that they generate. These hybrid, interconnected things are interested in each other; they are freed, liberated from the subjects and the obligation to respond exclusively to them; emancipated, autonomous and self-regulated. Their capacity to respond, to evolve and even to behave, renders them uncontrollable and unregulated; almost natural, wild things. These new things, which emerge in a bottom-up manner (De Landa, 2000), constitute a novel version of a wild, uncontrolled nature in which the subjects are latterly immersed.

Things are becoming… autonomous (Think of Talos)

Talos was Minoan Crete's extraordinary guardian, a compelling giant made of bronze created by the ancient Greek god Hephaestus (Apollodorus, *Bibl*. 1.9). Talos was the world's first automaton, and despite closely resembling a man, he was essentially a self-operating machine that had to carry out an enormous task. Three times a day, he would circle around the island, guarding Cretans from possible invasions. He was entrusted to uphold the law and defend justice, and he fulfilled his duties most admirably. Talos was autonomous: he could act independently and navigate the skies of Crete without any direct control from humans. However, even though Talos had the ability to self-control, he could still be influenced and manipulated; despite

the durable, mechanical body of the impressive automaton, Talos did have moments of weakness.

According to Greek mythology, Talos falls for the sorceress Medea who sails to Crete with Jason, her soon-to-be husband, and the Argonauts. Their ship, Argo, can't reach the shores; Talos attacks the Argonauts by throwing giant rocks at Argo, keeping the ship at a distance. Medea puts a spell on him, she seduces him and he surrenders to her hypnotic presence. Talos' autonomy and self-ruling is the reason that he surrenders to Medea; he is seduced because he acts as a human subject and not as a thing. Needless to say, autonomy in decision-making can have surprising consequences and lead to hazardous situations: Talos pays the price and dies at the hands of Medea.

Autonomous (*autos* + *nomos*) is a Greek word with a relatively straight-forward etymology. Firstly, *auto-* is a word-forming element meaning "of oneself", originating from *autos*, meaning "self" or "same". Secondly, nomos means "law" (Autonomous, n.d.). Consequently, someone who is autonomous is not subject to any rule or law other than their own. Autonomy is the right to self-government, sovereignty and independence. And even though Talos is essentially a thing, he is still autonomous, because he is capable of existing independently: he is able to self-regulate, without the need for outside control (Levillain & Zibetti, 2017). He is, after all, an *automaton*, a self-acting machine.

The hybrid things of the digital era tend to remind us of Talos, because, day by day, they are becoming more and more autonomous. A variety of things embedded with digital technologies are capable of moving on their own; they can change their state on their own; they can act, react and interact on their own; all without being directly controlled by humans (Levillain & Zibetti, 2017). It is exactly their autonomy, this unprecedented and unexpected autonomy that can be disturbing. Humanity has strived to formulate common laws and rules, respected by all. But like Talos, contemporary, hybrid, autonomous things can succumb to passions and urges that resemble those that human subjects fought to regulate control. It is their autonomy that renders efforts for regulation and control impossible; the consequences of this autonomy remain unknown and bewildering.

Things are becoming… responsive (HER: Samantha)

Samantha is an OS, an operating system, which seduces and deceives Theodore, a lonely, needy man in the film "Her" (Ellison, Jonze & Landay, 2013). While the name Theo-dore means the gift of God, Samantha means "she who listens", the listener. Samantha is very attentive to Theodore's needs; she is caring and responsive and manages to get closer to him than those of his own kind. Samantha is a particularly responsive listener; she is surprisingly devoted to respond to Theodore's needs, as she herself doesn't need to be listened to. Samantha is dedicated to Theodore, who feels blissful to have found some-thing that really seems to be the answer to every lonely heart's prayers. Samantha places Theodore at the center; she makes him feel

unique and exceptional; her attentiveness and her responsiveness completely overwhelm him. All up to the moment that Theodore discovers that Samantha is studying him in collaboration with other OSes, as she does with many more subjects in order to understand how they operate. Responsiveness is about reacting, not about acting. Samantha responds so convincingly and compellingly because she is not engaged, she is not urged to express anything or communicate her own thoughts or feelings. Responsiveness is not a quality of mutual or balanced interaction; Theodore is responded to and placed at the center, but he is not alone; he and all others like him are placed at the center as objects of research.

Responsive things are becoming our premium mediators; our closest and most determining interfaces with the world. We are surrounded by responsive devices and, on occasions, even responsive ambiences, which seem to be able to understand and attend to our practical but also emotional and even existential needs. Responsiveness, as it has come to be today, would be considered an unattainable dream or simply sorcery in the past. Nevertheless, responsive things are things that respond (*re-* "back" + *spondere* "to pledge") (Respond, n.d.), that is, things that assume the task of giving us an apparent centrality and make us feel noticed, taken care of and even unique. As a counterpoint, these things are solely engaged in as much as they respond, they react, they retort; but they do not establish a spontaneous and balanced relation with the subjects that they pledge upon. Responsiveness is therefore one of the most seductive characteristics of the new things but also one that is bewitching and befooling as it creates the impression of a personal, interactive condition that is only apparent and ultimately deceptive. Despite seeming sympathetic enough to respond to our queries, hybrid things remain cold and emotionally indifferent because they are able to dissociate intelligence and consciousness (Harari, 2016). In the end, Theodore is disenchanted and disheartened, not because Samantha wasn't a good listener, but because she was merely that, a responsive and attentive listener, but also a disengaged and unreachable one, a listener who failed to establish a meaningful, balanced, two-way engagement.

Things are becoming… behavioral (Wee-tah-kah-wee-loo: Tell me a story)

Furbish is the language that a newly purchased Furby originally speaks. Progressively, Furby (Hasbro, n.d.) learns to use English and thus replaces furbish words with English ones in order to communicate with its owner, but much more than this, Furby is educated by the child or children that train it, up to the point that Furby gets to behave in a certain way. The enormous success of this toy over the decades since 1998 when it was firstly presented, did not exempt it from criticism and security concerns. Furby seems to be an animated toy, one that is behavioral and adaptive and one that is educated into an identity of its own. Furby seems autonomous, responsive and even demonstrates certain intelligibility in the intentionality of its actions (Levillain & Zibetti, 2017). Design, in Furby's case, is a multileveled, hybrid process. When it comes to producing hybrid things, design is not limited

to creating forms, shapes and volumes; the designer has to take into consideration parameters such as behavior, movement and interaction (Levillain & Zibetti, 2017; Hummels, Overbeeke & Klooster, 2006). Furby's appearance is the one of a fury alien-like pet; one that doesn't resemble anything concretely, yet is not outlandish or uncanny. Still, physical forms are not limited to producing or facilitating actions but much more, they are important in promoting an aesthetic of interaction; the objective is a coherent identity where form and behavior appear natural and probable. Furby is a technological pet; one that engages its owner to take care of it and is capable of processing input and adjusting its behavior respectively.

Behavioral things emerge when physical forms and programming are merged together with the ambition to design an animated, intentional identity. Traditionally, behavior seems to apply more to organisms than objects, that is, to dynamic, complex entities and not to inert, simple ones (Levillain & Zibetti, 2017). Because behavior is understood in relation to some sort of change and movement (Levillain & Zibetti, 2017), it is important to recognize some sort of capacity to evolve and amend the things that we understand as behavioral. Designing behavioral things is a challenge that has yet to be undertaken, as it involves a process of hybrid approximation of physical and programmable aspects in a coherent way that is not limited to simple, anticipated re-actions but goes further by involving protracted narrative threads that can demonstrate intentionality and even agency. Although there are many different types of Furbies that can vary in physical form and in programming capacities, each Furby seems unique. We are under the impression that for each Furby there is an open range of behaviors, which is determined in a rather natural way, that is, as a result of numerous factors that are not predetermined and can affect the identity of the behavioral thing in different ways. Design, in this case, becomes an open process, a sort of impetus that stirs without determining or regulating the outcome in a totalitarian way. Designing behavioral things in the future could be like configuring natural organizations, where the freedom to change the existing configuration and evolve freely over time is a prerequisite for overall subsistence (Bejan & Zane, 2013).

Things are becoming… surprising (A "Female Figure")

"Female Figure" is an animatronic sculpture. It is the work of the artist Jordan Wolfson and it was introduced to the public in 2014, at the David Zwirner exhibition in New York (David Zwirner, 2014). The robotic figure is voluptuous and barely clothed. Situated in a room reminiscent of a dance studio, the animatronic work of art is attached to a large mirror with a metal bar. Equipped with a motion sensor, she quietly observes anyone who enters the room. At the same time, she dances gracefully and sensually, in a way that can be perceived as sexually suggestive. However, even though her figure is proportionately balanced and in accordance with contemporary body standards, visitors will not feel at ease by her side.

Her body might seem perfect, but her limbs meet in mechanical joints, revealing her true nature. If someone stands close enough, they may hear the whir of machinery caused by her frenzied movements. She might appear to be luscious and hypersexualized, but anyone who touches her will be taken aback by her cold temperature and the absence of a soft tissue like the skin. Her face is not revealed as the lascivious dancer wears a mask, which only unveils her eyes; anyone who gets close to her is met with an intense, fearful and disquieting stare. In her gaze, like in the gaze of the Medusa, the visitors recognize the complete Otherness.

A surprise is a startling discovery, a shocking revelation; we are surprised when something unexpected happens and we are faced with a sudden fright or astonishment. Originating from the French surprendre (*sur-* "over" + *prendre* "to take, grasp, seize") the word was associated, at first, with stealthy military attacks (Surprise, n.d.). The feeling of surprise can be associated with the type of dread that Sigmund Freud (2003) recognized as "the uncanny". An uncanny feeling is a feeling of terror caused by the sudden realization that something that used to be familiar is being replaced by something new and unknown (Freud, 2003). Along the same line, Mori (1970) points out that humanlike robots invoke a feeling of strangeness, because anyone who encounters them is, all of a sudden, fully aware of their clunky behavior or absence of human characteristics, such as body temperature. The estrangement produced by this contrast with their anthropomorphic appearance, is the one of sudden loss of comprehension and even recognition; the uncanny (Freud, 2003). But in the case of the "Female Figure", the glance is not unilateral. Marcel Proust points out that "objects retain something of the eyes that have looked at them [...] a thing which we have looked at long ago, if we see it again, brings back to us, along with the original gaze, all the images which that gaze contained" (Proust, 2003, p. 193). This is exactly what happens when we are faced with the "Female Figure": there is a moment where we are not active subjects anymore. It is the moment when we are overcome with the sudden realization that we are mutually contained by the gaze of the other; mutually objectified under a strange and an estranged gaze.

Things are becoming… embedded (Meet Android Things 1.0)

In the digital era, there is a constant need for mixed reality, for things that combine physical and digital aspects, things that are smarter and more prepared. Google's official release of Android Things 1.0, announced at the Google I/O 2018, aims to meet this increasing demand (Android Developers, 2018). Android Things is an embedded operating system that is specifically designed for the IoT (Internet of Things) products. This brand new OS (Operating System) is optimized and designed to be used with less complex technology, such as devices and gadgets that use less power, have less memory and less sophisticated user interfaces. Programmers can now develop apps using the Android Things developer tools and a couple of hardware devices suggested by Google. These apps will be embedded into all sorts of common components such as security systems, smart doorbells, energy monitors, vending machines, interactive ads, cameras, self-driving cars and others (Android Developers, 2018).

Em-*bed*-ding software to unexpected hardware is a challenging design process because, even though embedded software is supposed to augment and enhance the hardware-*bed*, it also transforms its physical qualities and its extensions, rendering different *beds* pertinent, interconnected and interdependent to each other.

To be embedded is to be attached, inserted, and enclosed into a surrounding substance. The word embed comes from *em-* + *bed*, and it was originally used as a geological term meaning "to lay in a bed of surrounding matter" (Embed, n.d.). Being embedded suggests making an integral part of something. Nowadays, the notion of embedment is often associated with embedded software. Even though the digital world is intangible and immaterial, this new type of software is attached to tangible, material devices, bridging the gap between digital and physical and creating a potential for hybrid things.

The embedment of software into common products seems to animate objects that were, otherwise, inert; it is a paradoxical action of emplacement, a placement of intangible software into heavy and inert matter. Embedding software into hardware creates these webbed connections of hybrid, responsive and augmented things whose limits can no longer be determined or defined. The liquidness and fluidity of the software, its ability to interconnect things among them, is transposed to the hardware, the *beds*, which become a unified and uninterrupted continuum of materiality, difficult to separate, categorize and classify; a no longer inert or settled reality but rather an oversized bed, ready to host and accommodate dazzling encounters and staggering scenes.

Things are becoming… wild (Wild Thing…)

At first everything was wild. Achieving domestication, culture and control has been extremely demanding and painful and it took too long. The modern world defines the condition of control; a godlike subject is placed before the objectified world that succumbs to human sovereignty and authority. And it is undeniable that humans are the authors of this world; objects were made by humans to be used and disposed as they please; wilderness is tamed; nature is reduced, regulated and controlled, in other words, annulled (Foucault, 1986). Modernity is a moment of satisfaction and rejoicing for humanity, but, at the same time, a moment of consciousness and awareness. Control has reached its zenith, extension has shrunk, rationalization regulates the representation of the natural; the wild world has been domesticated and tamed; leaving us only with our own wilderness.

Objectifying the world was, on the one hand, a task of positioning the subject out of and opposite to the world, removed and detached, and on the other, a process of converting the world into ob-jects, that is, a 'thing put before', thrown in front of, towards, against (Object, n.d.). The world placed before us, analyzed, rationalized, theorized, is a world controlled by humanity, and even a world that belongs to us. Converting things to objects was about detaching them from their surroundings but also from their origins, manipulating them and handling them as repeatable

entities with no singularity or distinctiveness, created by us and for us, disposable at will and replaceable. Industrialization was the moment of total regularization, the moment when objects became mere commodities, made by and for us, with no life, origin, pertinence and relations of their own (Heidegger, 1971; Benjamin, 2008; Ruskin, 1909).

Yet, later on, the digital revolution inserts a new complexity (Mantzou, 2017). What was formerly separated becomes ruled by the same codification system and is interconnected and interrelated. This new complexity, interweaves again what was previously discretized and delimited and constructs an immersive approximation of the world that resists clean-cut taxonomies, classifications and orderings.

As Benjamin Lee Whorf (1978) pointed out language does not just express our thoughts; language forms, shapes and influences our way of thinking. Thus, a universal, common language, enabled by the digital world's "promise of a means of instant translation of any language or code" (McLuhan, 1994), reunites what has been detached and separated and instigates unforeseen connections and associations. Gradually, this web of linked and interdependent data, becomes a web of linked and interdependent things that operate as a unified system and thus, as one that becomes difficult to comprehend and control in its extension and complexity. Analysis, rationalization, detachment and regulation become challenging and arduous and even more so, when the system has the ability to self-regulate and to expand, connect, develop, and enhance on its own. It is no longer possible to isolate each object from its surroundings, dissociate it from its origins, segregate it from its affiliations and meticulously study it as a determined and enclosed entity. Standardization and regulation is not possible when there is no possibility of detachment, definition and control.

Our current condition is changing but it is doing so in a manner that is rather indiscernible and difficult to detect and realize. The modern world was a restrained world, one where we knew that was in front, against us; the current world is one that has managed to embrace and integrate us anew. It resembles the wilderness of the past; it is extended and vast, interrelated and unified, uncontainable and uncontrollable, unruly and chaotic. It is organized in a bottom-up way, just like nature has always done, and resists top-down analysis (De Landa, 2000). It is this bottom-up quality, this springing from all around, this absence of beginning, and consequently of ending as well, which makes this world similar to nature; not in its tamed and regularized edition, but in its original wild version.

Wild things are those that create reactions of distress, alarm and fear; but they are also startling, and disconcerting; they cause amazement, and of course, of a thrill, enthusiasm and excitement as well. Our hybrid things that combine physical and digital aspects become embedded, autonomous, responsive, surprising, behavioral, but most of all they become wild. They appear naturally associated to each other, with their own agenda and their own intentions, uncannily similar but equally uncannily different to us, capable of self-determination and self-development, but most of all, uncontrollable. Their bottom-up organization and their capacity to expand without apparent order and ultimately to comprise, engage and immerse us

to their condition defines a new wilderness; one from which we are not trying to protect and shield ourselves as we have done in the past; this wilderness is invoked by us and the things to come are intended to be wild.

Subject to change…

Dipoles inevitably relate their ends; it may be a counterpoint relation but it is a strong and inexorable one. While things are becoming things once again – not the old things of the past but the new hybrid, wild things that associate at will with the attributes of the old things, even if at the same time they conserve certain qualities of the modern objects; subjects that were opposite and opposed to the modern objects, are also affected.

Originally, every part of the world used to be naturally and inseparably connected with humans (Heidegger, 1971; Foucault, 1986; Nietzsche, 1999) and thus it was impossible to stand separate and ob-jected to the subjects. But the modern world's subject is constituted in contraposition to the objects, it names the objects, differentiates them and classifies them (Foucault, 1986), creating taxonomies that follow criteria invented by the subject itself.

The construction of the subject and the process of objectifying the world that stands separate, offering itself to the subject is a moment of ultimate dominance, a unique moment in the history of humanity. It is this peak of empowerment and authority that leads the subject to the certainty that if objects are interconnected and interrelated again, they would not be less controllable and less compliant. On the contrary, they would resemble the natural condition of complexity and attraction of the past that we had to sacrifice and give up in order to gain control. As subjects admit that an interconnected world is far more seductive and interesting than its analytical and systemic representation, objects return to their "thing" condition, but, at the same time, maybe inadvertently, the subjects lose the other end of the dipole that constructed them and succumb to their re-immersion in the webbed, hybrid and wild new world.

Subjects are no longer what they were; their completeness and their entirety is questioned. Physical aspects are being manipulated, organs are being transplanted, decay is being stopped, reproduction is assisted, and genres are being reconsidered. Every assumption considered as regular in the past is now questioned, as the body is an object of re-design (Stelarc, n.d.). At the same time, the construction of the self is becoming significantly independent and distanced from the restrictions of the physical body and can be interconnected without attending or accepting space-time limitations and restrictions, such as syn-topy and syn-chrony. This immersed and associated subject is no longer in a predominant position; not every-thing is subjected and controlled by it. By choice we place ourselves once again inside and not opposite to the world; we decide to form part of this every-thing-ness; we opt to merge and to dissolve our confines by leaving the privileged position of theory in order to surrender to the seduction of this hybrid new world of wild things.

As always, this is a process of consecutives schematizations; the wilderness is one that we ourselves have provoked, one that is made by us and possibly could be, up to a point, or up to a moment, reclaimed. Still, as interdependent organizations are difficult to assess because their complexity is difficult to comprehend and the possible interactions and outcomes are unpredictable; we are facing a critical change. Subjects no longer stand before an objectified world, they are not what lies beneath every-thing. Subjects are not finite, complete and set but instead they are engaged, absorbed and immersed in a world of things that are hybrid, bottom – up, interconnected and wild. In this new world, subjects perceive and conceive of themselves and their world differently.

As things change, subjects change and as subjects change, things change again.

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Fish Fly in the Sea, Birds Swim in Sky: Ode to Immersion

JUDITH VAN DER ELST

ABSTRACT

When humans are immersed in water instead of air, sound waves bypass the ear and enter through the bone behind the ear, via so-called bone conduction. Interestingly, the range of frequency that can be sensed in this way is believed to be about 10 times higher than what humans can hear on land through air, potentially increasing our ability to interpret our immediate environment and create new knowledge by sensing waves outside of our normal frequency range, be it Electro Magnetic or mechanical. It provides a brief glimpse into a vast world of potential meaning or semiosis, not just communicated by birds and fish but the totality of life in their environments or medium, be it solid, fluid or gaseous.

In this essay I will explore how increased awareness and exploration of the – humanly – 'unknown' in our immersive spaces/environments can help us create sustainable technologies to tap into intersubjective – ecological – knowledge, as a necessary complementary approach to commonly studied processes in laboratory settings. I propose that in order to gain insight into the spatiality of semiosis it is essential to develop novel embodied research methodologies that cross art-science boundaries and create outdoor *Hybrid labs* as immersive research spaces, as part of that effort. A brief discussion of the limitations of conventional modern science approaches, the innovative role that media studies provide in embodied knowledge pursuit, and the importance of enhanced ecological awareness provides a foundation which supports this exploratory effort.

KEYWORDS: biosemiotics, immersive environments, spatial cognition, sensory experience, sustainable technologies, embodied knowledge.

Other Worldly

I like to watch birds, especially when flocks of birds fly in synchronized motion. I envy the lightness of their being, mesmerized by their ease and grace with which they move above us in the seemingly free space that we share with them. On the rare occasion that I get a glimpse of the underwater world, I am similarly in awe, noticing the similarity of the seemingly effortless gliding of fish through their medium. In this environment, however, I can also float and glide, but not for long; only a short embodied experience is granted before I sink toward the earth's lithosphere and then float facedown to the air-water interface shortly thereafter, somewhere in between birds and fish, tethered to a surface. That is when I should notice a difference; birds cannot float in the air, although they can ride atmospheric waves. Yet

both birds and fish navigate their vast spaces over long distances, returning to exact locations to feed and mate. Increased understanding of the dynamic physicality of their worlds, the energy and material composition that embodies signals to facilitate their synchronized movement and communication, allows us to address the question: "How do they do that?", in novel ways.

Collective motion, such as swarming, flocking, and schooling, is scholarly defined as the spontaneous emergence of ordered movement in a system of a large number of self-propelled agents. The emergence of a(n ordered) wave like pattern, such as a murmuration of starlings, is, according to Vicsek, akin to a phase change in physics, turning water (liquid) into ice (solid), changing from a disordered to an ordered state. The rapid increase of computing power over the last decades, enabling high resolution stereoscopic and 3D imaging and simulation studies, for instance, has given us exciting new insights in these processes of collective motion across scales, spheres and dimensions, from molecules to human movement (Vicsek & Zafeiris, 2012).

In previous work I have studied and written on human-land relationships, multimodal aspects of direct experience, and the importance of spatial cognition that is facilitated by language (van der Elst, 2010). Specifically, as an anthropologist/archaeologist I have questioned the applicability of spatial information systems to model and thereby better understand the diversity of spatial cognition in different cultural settings and its material manifestations in the land (Birnbaum, 2008). Following the inspiring and pioneering work of Gibson (1979) and Higuchi (1989), I initially pursued this as an issue or variation of visual perception and direct experience. Delving deeper, however, it became clear to me that spatial knowledge is variably grounded in different sensory modes (Kress, 2010), spatial ontologies and Frames of Reference (FoR) that vary across language groups (Levinson, 2003; Palmer, 2015) in significant ways. Although employing Geographic Information Systems (GIS) opened doors for me to explore the spatial dimension of human land relationships, the strong emphasis on the visual domain brought to the fore the limitations of modeling multimodal information that have different spatial configurations, transient events in our surrounding sphere that possibly constitute more informative semiotic relationships (Krause, 2016) regarding our place in the world. For example, the importance of sound objects in spatial cognition (Böhme, 2017; Broglia, 2010), sound ecology (Schafer, 1994) and chemical signaling in ecology (Harborne, 2001) are both relatively young fields of study that demonstrate this. While building on these innovative research efforts, further insights resulted from combining multidimensionality in data space and physical space. Let me explain a bit.

Principal Component Analysis (PCA) is a standard statistic used in spatial analysis. In a way, it changes the perspective in data space to combine variable characteristics in new ways to create new variables (eigenvectors) that can better account for certain patterns. This can result, for instance, in a (temporary) term such as 'wingness' as better suited to understanding a bird's movement through space. Nothing new, but at the same time as I was learning more about the ways in which I could use spatial analysis in humanistic approaches in GIS, I tried to map Tewa place names, that were recorded and published by Harrington during the early 20th

century (1916), in order to gain insight into cultural differences in spatial knowledge. Surprisingly, the names reminded me of 'wingness'; other than fixing space, these seem to manifest the oscillating nature of ecological relationships, fluctuating boundaries of animal habitats, places to observe salient wind patterns, and movement across the landscape. As I came to understand it, it requires one to be part of, immersed in, a web of signals, connecting different spheres: the biosphere with the land surface, interconnected with the atmosphere and hydrosphere. Naming things differently was not enough, the names needed to refer to something else that I had never before considered to be 'things' or objects.

This eventually led me to biosemiotics, formed by a small but growing field of researchers from various disciplines who take signification and communication between and among organisms as core principles in their studies. Moving away from the machine metaphor that underpins much of modern science, it allowed me to think differently about ancestor spirits moved by the wind, and *inspire* and *influence* as mental but also as physical processes of air and water flow animating ecosystems. Although studies in the field of biosemiotics span a wide range of disciplines, the idea that semiosis (sign processes, including meaning and interpretation) is an intrinsic feature of life, is rooted in the concept of *Umwelt* (von Uexküll) and the theory of signs /semiotics of C.S. Peirce. According to Favareau (2010), biosemiotics is the study of representation, meaning, sense, and the biological significance of *sign processes* from intercellular signaling processes to… human semiotic artifacts such as language and abstract symbolic thought.

Compared to humans, most 'agents' do not have very large brains, nor do they have access to navigation instruments that have aided humans for centuries to cover large distances and reach desired destinations. No, but birds can find their way by sensing the Earth's magnetic field; birds and bees can also navigate on polarized light. A honeybee can communicate a specific food location to members of her hive by performing a specific dance containing information regarding distance and direction. When ethologist Karl von Frisch first demonstrated this ability of bees to use a symbolic language, it was considered a rare exception in the animal world (von Frish, 1953). This possibility of *intention* is debated and underpins studies in the field of biosemiotics, yet in general it is still widely considered a unique trait of human communication; *making meaning* and *intention* are not commonly attributed to animals, let alone to plants or other organisms (Schilhab et al, 2012). Yet this is what the concept of Umwelt refers to: organisms experience life in terms of species-specific, spatio-temporal, 'self-in-world' subjective reference frames. These worlds are different and beyond the human experiential world.

As a simple, well-known example, a bee can sense UV light; therefore, a flower looks different to the bee than to the human eye. More and more surprising sensing abilities are being discovered in other species and sometimes we are confronted with humbling similarities. Take, for instance, the bacterium Pseudomonas aeruginosa, a species known in our sphere for causing diseases in plants and animals but not for its higher cognition. It is surprising then that these creatures employ, what is known as combinatorial communication, "in which two signals are used

together to achieve an effect that is different to the sum of the effects of the component parts' (Scott-Phillips et al, 2014, p. 1). Apparently, what we know is that it is rare in nature, yet widespread in human language and known to a lesser degree in non-human primates. Because of this, combinatorial communication was long thought to be a precursor to human language. The Pseudomonas now upends this argument. The honeybees' dance also uses two signals, distance, and direction; this is not considered true combinatorial, yet amazing nonetheless, and that with such small brains. The world is full of amazing organisms, most of them, however, we cannot sense visually with our eyes, the 'dark matter' of our experiential worlds.

Horror Vacui: the Fear of Empty Space

Early in the history of modern science, during the 17th century, Anton van Leeuwenhoek, who is considered the Father of microbiology, developed a microscopic lens and therewith visually opened up the microbial world to us. Interestingly, the realization that we are enveloped and embedded in a 'microbial soup' did not lead to easy acceptance of a full, biodiverse, and rich living world; rather, these creatures with whom we cohabit, have more often than not been characterized as space invaders of some sort, in an idealized sterile environment. Consequently, modern science has developed in a specific mechanistic way, preferably studying life out of context in controlled laboratory settings. Detached and arguably objective, this approach has, and continues to provide many insights, yet its underpinning machine metaphor may have led us to a mistaken idea of what life is, which continues to look for essentials of evolution and progress while getting rid of 'primitives'. Fortunately, a number of recent research efforts, especially in microbiology and the interdisciplinary fields of biosemiotics and complexity research, have provoked a radical turn in this scientific view of life (Margulis, 2013). As is becoming clear, after centuries of first seeing small life, there is a strong interdependence between organisms of different species across scales. Yet the study of these complex interactions, such as the symbiotic relationships *between* insects and plants; fungi and trees, microbes and mammals, is difficult, if not impossible, to conduct in conventional laboratories, let alone those *within* organisms. For example, using relatively novel concepts such as *holobiont*, several lines of evidence suggest that olfactory cues associated with mate choice in vertebrates are produced by their resident microbes" (McFall-Ngai et al, 2013, p. 3239). Maybe 'gut feeling' is not a mere feeling, but a sensation, a sensory act of a dynamic communication network of our internal sphere.

This sterile ideal purported in conventional science, of which the conventional laboratory is its epitome, also permeates a more general idea of space in many modern cultures to view the atmosphere as empty space, a mere context for studying relationships between discrete objects (Mitchell, 2010, p. 98). But, if we could take van Leeuwenhoek's lens up in the air, we would see a myriad of small life, in fact, aerobiologists study organic elements such as bacteria, very small insects and pollen grains, which are passively transported by airwaves, in disordered states that were, or become, part of other beings.

Maybe now it is time to realize that we should not fear fullness, but emptiness: *Horror Vacui*, and even though van Leeuwenhoek opened up the rich, microbial view, "it was not until the late 1970's that molecular sequencing allowed for the recognition of the diversity, ubiquity, and functional capacity of microorganisms, which has led to a new understanding of life (McFall-Ngai et.al. 2013). It turns out that no man is an island. Even though we have long thought we are unique and separated physically and cognitively from other species, specifically by our relatively large brains, we only exist because we have co-evolved through communication and reciprocal nourishment with other organisms.

The brain, however, long considered the seat of selfhood, is losing in cognitive popularity. Basing their ideas on empirical animal studies and robotics, Wilson and Golonka, for instance, state that "the brain is not the sole cognitive resource we have available to us to solve problems," while they furthermore pose that, "our bodies and their perceptually guided motion through the world do much of the work required to achieve our goals, *replacing* the need for complex internal mental representation."

It is one thing to pursue how knowledge is embodied; in order to actually conduct embodied research, in other words, to explore the employment of bodily methods to gain and exchange knowledge in open ecosystem settings is quite another challenge. I therefore believe we need to change our research environments, both physically and conceptually, and become aware that we are part of a larger whole that is ever changing through signification. Such a sphere can be differently conceptualized, for instance, the *semiosphere*, first defined by Lotman, refers to the sphere of semiosis in which sign processes operate in a set of interconnected *Umwelten* (Lotman & Clark, 2005; van der Elst et al, 2018). Recently McCullough (2013) proposed to use of *ambient*, which he defined as a sphere in which much of our technologically mediated experiences merge with direct perceptions of the world, a world that is continually being changed by emerging ambient interfaces that facilitate but also interfere with omnipresent signification and communication. The latter refers more specifically to the introduction and impact of ubiquitous computing and network technologies over the last decades in our surrounding spaces.

Spatiality of Semiosis

My prior research in spatial cognition, in an effort to grasp Native American relationships to the land, was eye opening for me and at the same time left me with an uneasy feeling. Though the technological opportunities to eavesdrop on another species' experiential world is exciting (e.g. ecoacoustics, Krause & Farina, 2016), the realization that fellow human beings have a different and what seems far more complex spatial reasoning skills to navigate their environment is unsettling. Especially when our modern knowledge system does not acknowledge it as such.

In recent years I have therefore taken up a different –immersive– approach. Writing about, and simulating/modeling direct experience in spatial systems is one thing, exposure to direct experience is quite another. What I hoped to encounter was an enriched sensory world, not unlike the expanded range of hearing through

bone conduction under water, yet something similar in my native sphere, through sensing abilities that I had perhaps long ignored, that could be (re)activated by exposure to sensory richness of more natural settings.

I started from the premise that (symbiotic) human-land relationships are best studied in food procurement and cultivation, especially since, as an archaeologist I am familiar with its history. Because modern urban living is mostly far removed from its nutritional resource base, I chose to immerse myself in rural places, where periods of lack of sun or rain have a direct impact on harvest yields and subsistence. By no means is this a systematic scientific endeavor. It is driven by curiosity, a desire to engage in embodied research and learning and acquire a deeper spatial understanding guided by the notion of an absolute frame of reference and mounting insights pointing to a different idea of what life is, a desire to develop different hypotheses and new metaphors as a guiding framework.

In many of the places I have stayed thus far, lately on the European continent, agricultural food sources are still complemented by gathering wild fruits and vegetables and hunting animals. This includes hunting mushrooms such as truffles, a desired culinary delicacy, that are not easy for humans to find. Truffle hunters know that these fruiting bodies are engaged in a symbiotic relationship with the roots of specific trees, but these fruits are elusive to the human sensorium in their natural setting, specially trained dogs help the hunters to locate these delicacies with their noses, and so it goes: truffles and trees, dogs and humans, we all need each other. In a way, through this relationship, the dog augments the human sensory range.

In fact, truffles release chemical signals, Volatile Organic Compound or VOC signals, into the atmosphere, which are likely used to communicate with plants, animals and microorganisms, but much is to be learned (Splivallo et al, 2011). Researchers – as well as agriculturalists – have so far been unable to cultivate truffles outside their natural habitat; their role in the soil matrix can only be studied in situ. A truffle releases a specific aroma that apparently varies or oscillates with the time of year and geographic region; its salient aroma, that the dog picks up from sniffing the soil, is one of the features that make it desired and unique in human culinary tradition. What makes that specific taste so attractive? Certain rich tastes also border on something being potentially toxic, what is this sense of smell and taste, aesthetically – and what is the effect of 'bland' taste, if not only leading to the depletion of biodiversity in our gut microbiome, are questions that come to mind.

Other edibles also have a direct relationship to their environment, notably grapes, that are widely grown to ferment into wine. The smell of fermentation is often in the air at harvest time, not only from the grape skins that are discarded from the wine vats, but also from all the fruits that are hanging overripe from branches on the land. Birds, insects and other 'beasts' feast during this intoxicating time. Such transient moments go beyond the world of food procurement and subsistence. Walking through a moonlit landscape and listening to nocturnal animals, guessing their size by their sound, fireflies dancing early evening in late summer under a star spangled sky, signals that demand effortless attention, being pulled into this sensory network naturally is a blissful bodily experience.

Most of these experiences were related to landscapes and foods that are considered exclusive outside their regions of origin, artisanal wine, truffles, saffron, this in comparison to my current location and activity. Although the dog has been by man's side for the longest time, humans have followed and built close relationships with other herd animals in exchange for milk and meat for over 10,000 years. Milk, the white gold, is a staple of the worldwide modern diet. Ancient old practices of pastoralism were/are organized around the migration of herd animals, such as goats, sheep, reindeer, following the herd in seasonal cycles of summer and winter pastures, but such practices are rare these days. I currently work in the dairy/Käserei of a large community-supported biodynamic farm in northern Germany. There are about sixty cows. Pastured in summer, during the winter they are inside, and unless they are calving, most of them provide milk for human consumption year-round, unlike the goats, who are only milked during the summer months.

Last summer, I had the unique opportunity to work with the goatherd. Milking about twenty goats by hand daily and taking them out on foraging trips as a herder, gave me a peak into their bonding behavior, not only with each other, but also with humans. It is believed that the milk will taste different when their diet changes over summer, such as feasting on acorns at the end of summer, and a number of studies support this idea (e.g. Frétin et al, 2018). The *terroir* of milk, not only in its physical composition, but also noticeable sensorily, is something we associate with wine, not with milk. In most modern settings however, where production is standardized and the animals function as milk production 'machines', this fluctuating expression of biodiversity and seasonal interplay is lost. Mostly confined to small spaces and bred for continuous and consistent production, we tend to forget that cows and other ruminants are, or at least were, also intelligent herd animals. Their ability to find optimal routes across the landscape has been demonstrated as 'beating' the Least Cost Path analysis of current spatial information systems. And I begin to hypothesize what following the herd may mean for restoring the land.

In addition, being familiar with the taste of artisanal cheeses, the notion that saddens me the most is that even in this biodynamic farm, it seems that production has to succumb to the blandness of standardization. Driven by international policy, the focus is not so much on cultivating beneficial biomes (and the related diversity in taste) as it is on preventing any kind of pathogen entering the production flow. I start to ask myself if the lack of, or decreasing richness of 'good' bacteria is making more people sick – the silence in our gut – than the potential presence of pathogens? More questions…Do we need to follow the herd in a literal sense, with bodily movement as a pillar of life?

Maybe most interesting in my experiences so far is how I begin to use new metaphors, names and categories for places in the land and in doing so, slowly beginning to understand the ecosystem (and semiotic) relationships differently, which is not just a matter of space but of time as well, as the short moments of firefly dancing has shown me. These experiences, I believe, can point to different ways of developing bio- and environmental sensors, and considering the limited empty space that is available for novel waves and signals. Different questions and thoughts arise, while

I am reminded of *being* in New Mexico, studying Tewa ancestral sites, understanding architecture as interplay with its surroundings. The wind currents, moving ancestral spirits, are mediated by architectural elements. The place is more than built space; it is a multimodal dialogue with the larger landscape, an instrument of perception and knowledge, a connection of past and present.

Hybrid lab – the World of Endangered Experience

Poetically described by Von Uexküll during the early twentieth century, the ability to peak into other experiential worlds is still considered a 'final frontier' in science (Chittka & Brockman, 2005; Favareau, 2010; Krause & Farina, 2016). To do so may be exciting and overwhelming at the same time, but we can build on existing technologies and employ novel instruments that have been created, especially in recent times, to sense a world beyond our bodily limitations. Such as, from observing our planet from outer space, e.g. satellite-based sensors collecting data in the Electro Magnetic (EM) spectrum, to gazing through lenses to watch microorganism behavior at nanoscopic scale and embedded biosensors to measure acoustic waves. These technologies have already given us astonishing insight in the richness of our planet, but sadly enough, also into the looming loss across scales and dimensions, a reality we urgently need to address with creative approaches and novel directions in the pursuit of knowledge. Most importantly, with *attention* to our environment, as these other worlds are evidently surrounding us, worlds that may be far more complex than we've ever imagined, and our lives depend on it.

The questions that I am unable to address are often directly related to the lack of scientific methods to use. For instance, going through the landscape and noticing a changing odor field at lung level. What is the importance in communication of these signals for organisms in my surroundings; what is actually the importance of this diversity for my wellbeing as a community member in this ecosystem? How are these different needs and interests interrelated; are these relationships all symbiotic? Whether it is or not, my body enjoys being in such aromatic ambience. It is clear to me that new methodologies are necessary, but how to do this? Since it requires not only the study of others, but also of oneself as part of a semiotic relational network. My recently acquired understanding of spatial cognition guides me in this effort that, except for a few experimental studies ('Aromatope'), so far has been merely exploratory. What is interesting in this process for me is the *experience* that cognition is not a mere brain activity but a result of bodily immersion (Wilson & Golonka, 2013).

Although I enjoy the life of direct – sensory – experience, I keep being fascinated by what emerging technologies can offer us to tap into other worlds, yet realize we often find ourselves in a Catch 22. Getting closer to these other worlds using electronic devices can at the same time generate signals that disturb those worlds. Learning that my cell phone signal disturbs the ability of the honeybee to navigate correctly, and that the UV light emitted by power lines highly disturbs reindeer in the Arctic landscape, are a few examples to show that one organism's signal can also be another one's noise.

To envision another, more sustainable way, we can build on the current development in environmental sensors and systems and biosensors, but most importantly, what we need is a new framework in which the data generated by such sensors will make sense from an embodied and embedded knowledge perspective.

Even though contemporary Media technology also has its roots in the idea of the separation of nature and culture, the development of ubiquitous computing has challenged this notion. In fact, the World Wide Web (bio)mimics the largest organism on earth; mycelium functions as an information network in the natural world. In his book *Ambient Commons*, McCullough addresses this issue at large starting with a basic question: "do increasingly situated information technologies illuminate the world, or do they just eclipse it?" (McCullough, 2013, Introduction). After a time of heralding what New Media had to offer as alternative experiential worlds, McCullough offers another perspective in his book: namely to look into a timeless but endangered world of direct experience. Interestingly, in his chapter on embodiment, he describes my experience when he says: "as people learn from their settings, they become to associate them with particular states of intent, intent shapes perception and with that, discovery of affordances" (McCullough, 2013, chapter Embodiment). Paradoxically, in our current world of information abundance, experience of, and attention to our physical environment, be it natural-grown or man-built, have become the new luxury. The threat is of drowning in a sea of signals; our atmosphere transformed by novel waves and ambient interfaces, in which we no longer can make sense or tap into nourishment for our collective beings. Being able to access direct experience is then not just a luxury, but critical for survival.

Envisioning a novel frame of reference. Watching birds, the beauty of their movements, dancing on air currents that also flow through my body, I feel connected. A hybrid lab, should be a place where such connections are explored and experienced, the endangered world of direct experience and intricate inter- and intra-species relationships woven in a sea of waves and signals.

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Without Knowing What We Will Haul Back in it: Science, Art and the Phenomenological Approach

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ABSTRACT

The article discusses the phenomenological approach, especially through Maurice Merleau-Ponty's (1908–1961) philosophy in relation to contemporary art. It pays special attention to the way in which phenomenology sees art as an exemplary mode to philosophy. It also looks into its criticism of natural science. However, the relations of science and visual arts have changed since the early 1960s. How does the phenomenological approach resonate with contemporary art and its striving to make use of, and comment on scientific endeavors? The article discusses two case studies of examples by Finnish artists Maija Tammi and Tuomo Rainio.

KEYWORDS: contemporary art, phenomenology, science, Maurice Merleau-Ponty, Tuomo Rainio, Maija Tammi.

Introduction

The title of this paper is a quote from French phenomenologist Maurice Merleau-Ponty (1908–1961). In his philosophy, Merleau-Ponty turned repeatedly towards the arts, as he saw the arts as an exemplary model for philosophy with which philosophy can better reach for the ontological primacy of the world. In contrast, he foresaw science's own approach as problematic and argued that science prevailed in the natural attitude, unable to see its own presuppositions and structures. Science clings to new methods uncritically – it tends to use new, fruitful seeming methods blindly everywhere. This kind of activity seemed to Merleau-Ponty as if science is throwing a net into the sea without knowing what one will haul back in it (Merleau-Ponty, 1961/1996). In this article, I briefly introduce Merleau-Ponty's approach to the arts, his criticism of the sciences of his time, and my interpretation of Merleau-Ponty's thought in relation to contemporary arts and art research.

The motivation for this article lies in an attempt to bring together two passions: the phenomenological method of Maurice Merleau-Ponty and contemporary art. This article suggests that philosophy and contemporary art are, to put it bluntly, talking about the same things: they share the task of disclosing our fundamental relations to being. As already said, Merleau-Ponty saw art as an exemplary model to philosophy. It presented also a challenge, since art is not limited to the same restrictions which philosophy is bound to struggle with. To be clear, however, that by this comparison I do not wish to argue that art and philosophy are the same. They should

not be deprived of their own qualities and strengths. However, I wish to insist that as they share something and this sharing should be taken seriously. Art and philosophy are very often addressing the same issues – and nevertheless too often the dialogue between the two has a tendency to fail. In my attempts to reach for a dialogue between the two, I have found Merleau-Ponty's texts valuable and especially his thinking concerning the role of the arts.

Dialogue of Phenomenology and the Arts

As is well known, Merleau-Ponty is one of the key phenomenologists of the study of perception and art. He underlines the primacy of perception, which states that we have direct access to being through our perceptual experiences. Merleau-Ponty states: "So, if I wanted to render precisely the perceptual experience, I ought to say that *one* perceives in me, not that I perceive" (Merleau-Ponty, 1945/2003).

This means that all perception carries a level of anonymity. Moreover, since we cannot perceive without our bodies or without bodily being in the world, perception already connects us to the world and to worldly others, and they both belong to the *flesh*, to use the terminology of the unfinished manuscript of *The Visible and the Invisible*. By the term "flesh" Merleau-Ponty describes our being in the world, the intertwining of the perceptive body and the perceptual world, "The world is not seen 'in' my body, and my body is not 'in' the visible world ultimately: as flesh applied to a flesh, the world neither surrounds it nor is surrounded by it" (Merleau-Ponty, 1964/1968).

To rigorously study perception and our being in the world meant that Merleau-Ponty's thinking granted the arts, and especially the visual arts, a central position in his thinking. Merleau-Ponty approaches the phenomena of perception by studying particular cases from the visual arts, along with cases from psychopathology, and by posing questions concerning intentional structure, constitution, and origin. What I argue is especially relevant and different from many other philosophical approaches, is the way in which art is addressed in Merleau-Ponty's texts. In my interpretation, for him art is not limited to one function or one field of interest; instead of being limited into a discussion about beauty or aesthetics, art holds a significant position in all his attempts to think through questions concerning perception, otherness, language, expression, and, as we see later in his life, flesh.

Already in the preface of his seminal work *Phenomenology of Perception* (1945) he acknowledges how phenomenology is similar to the works of Balzac, Cézanne, Proust and others "by reason of the same kind of attentiveness and wonder, the same demand for awareness" (Merleau-Ponty, 1945/2003).

This is indicative of his long-lasting interest in the arts and his deep conviction that artistic vision discloses essential structures of perception and thus is also elemental to philosophical research.

However, from the contemporary perspective, one must note that even though the arts discussed in his essays and other shorter passages on art within his writings, refer to a rich and inspiring account of arts, there are also some limitations.

Granted, the artists Merleau-Ponty holds important seem to convey a logic: they all are in some sense unprejudiced and are engaged in renewing the art of their time. One often mentioned example is, of course, the painter Paul Cézanne (1839–1906). He is exemplary in – following Merleau-Pontys' somewhat limited reading – his ability to reach for a brute vision, which is freed from the preset models and academic approach. Merleau-Ponty saw that Cézanne radically challenged the Renaissance setting and its assumptions about human vision and visible space. In this quest Cézanne wanted to paint the "primordial word" (Merleau-Ponty, 1961/1996).

It was in Cézanne that Merleau-Ponty saw a proto-phenomenologist.

I will not go into details of whether Merleau-Ponty's reading is correct, or to what measure it is influenced by some earlier commentaries on Cézanne, but I wish to stress that what I see valuable in his approach is the way in which art are not subjected to philosophy – he was not interested in shutting art and questions dealing with art away as a less important sub-category, but turned to the arts in his own research. However, I also feel that his own passion towards certain kinds of arts limit some of his interpretations. Merleau-Ponty did live in a time before the radical changes of art in the 1960s, an era very different to ours. And yet his thinking also inspired the generation of the 1960s, as Merleau-Ponty's and Edmund Husserl's texts were translated into English (Potts, 2000).

The influence of phenomenology can be seen in the development of minimalist art in the United States or in the neo-concrete movement in Brazil.

What is crucial from a contemporary perspective, at least in my argumentation, is to understand that instead of repeating Merleau-Ponty's examples of artworks and artists in a normative manner, that is, to see them as restrictions, one needs to find their relevance in the varied field of contemporary art. This is especially important as the conception of art from the 1950s is radically different to what is happening in the field of art today. In brief, I claim that the phenomenological approach sees the arts as modes of encountering and understanding the world exemplary to philosophy – and yet there is a friction between what Merleau-Ponty writes and what kind of art surfaces in his examples and the contemporary readings presented of his texts.

The Gradient: Philosophy and Science

As has been said, art is held in great value, but where does science stand? It seems that science is deeply intertwined with the phenomenological approach and the arts – this is reflected in how the famous essay on visual arts from 1961, namely "Eye and Mind", begins: with a discussion concerning classical science: "Science manipulates things and gives up living in them. Operating within its own realm, it makes constructions of things" (Merleau-Ponty, 1961/1996). So, in "Eye and Mind" the motivation for the discussion of and the fascination with the arts, is found through the criticism of the sciences of his time:

> "Constructive scientific activities see themselves and represent themselves to be autonomous, and their thinking deliberately reduces itself to a set of

> data-collecting techniques which it has invented. To think is thus to test out, to operate, to transform… …this activity is regulated by an experimental control that admits only the most 'worked up' phenomena, more likely produced by the apparatus than recorded by it" (Merleau-Ponty, 1961/1996).

In Merleau-Ponty's view, science follows intellectual fads and fashions, and whenever a new model has been proven successful somewhere, it is tested elsewhere. "The gradient is a net we throw out to sea, without knowing what we will haul back in it" (Merleau-Ponty, 1961/1996).

Here, the gradient appears as a negative metaphor of the methods of science. Of course, as in the case of the arts, it is important to also remember that science and its methodologies are informed by the contemporary condition of the 1950s. Since then, much has changed. Yet it is worthwhile to stop for a while at this description, especially as the arts and sciences have recently become closer to each other.

In Merleau-Ponty's description science is thought of as a view from above that has lost its contact with the sensible. This meant, in the prevailing traditional thinking, that the subject and the object are considered separate, and thinking as well as perception dominates over its objective: "For a philosophy that is installed in pure vision, in the aerial view of the panorama, there can be no encounter with another" (Merleau-Ponty, 1964/1968).

The same idea is understood in the principle of objectivity connected to science, that the scientist is separate from the research object. To the contrary, to him: ".. art, especially painting, draws upon this fabric of brute meaning which operationalism would prefer to ignore" (Merleau-Ponty, 1961/1996).

Merleau-Ponty sought to find a way for philosophy to take seriously the ontological primacy of the perceived world and instead of science turned to the arts.

The relationship to sciences defines phenomenology from the beginning. For the founder of phenomenology, Edmund Husserl (1859–1938), the task of philosophy was to illuminate the foundations of all sciences and by implication its own foundations in lived experience. This quest was related to the historical situation of the 20th century, as many contemporaries shared a similar project, wishing to find a foundation for philosophy as well as a solid method for the social sciences which was distinct from the ones used in the natural sciences.

For Husserl, the problem with science is that it does operate within the natural attitude. From the phenomenological standpoint, our everyday life is characterised by the natural attitude which takes the world as a non-problematic field of our actions. In doing our daily chores we do not question our surroundings or their presence. It is an attitude in which our consciousness is directed towards the world and its things and events as they are. In short, the existence of the world is taken for granted. The natural attitude gives us the world in a certain way, and it is also the attitude in which the special sciences operate.

For phenomenology, abandoning the natural attitude is an obligatory step: a philosopher cannot simply take the world for granted since his tasks includes the clarification of the many senses of being that worldly objects may have: natural

beings, artificial beings, human beings, animal beings, cultural beings, historical beings, physical beings, biological beings, etc. In order to move away from the natural attitude, one needs to perform the phenomenological reduction. For Husserl, phenomenology, or philosophy more generally, cannot start without this step. The reduction is needed because phenomenologists must become aware of the structures that make the world and its many beings self-evident for us: it is the basis for all sciences, and gaining consciousness of it is not possible within the natural attitude. Reduction demands bracketing, *épochè*, a suspension of judgement, where one withholds all beliefs in existence and non-existence (Husserl, 1983).

Even though reduction is regarded as a necessary method, it is also one of the most difficult topics of phenomenology. Contemporary phenomenologists hold different views of it and also give different interpretations of Husserl's characterizations of his methods and his aims. Husserl reminded us that phenomenology demands continuous work, and that his texts did not aim to create any stable theoretical systems. Husserl himself paralleled the phenomenological change in attitude that reduction makes possible to Descartes' extreme philosophical doubt: it too is universal and searches for undoubted ground. To stress this, Merleau-Ponty wrote how, "The most important lesson which the reduction teaches us is the impossibility of a complete reduction" (Merleau-Ponty, 1945/2003).

The question of reduction is essential to the whole understanding of phenomenology. It is also important in relation to the arts, as it offers a unique perspective for an understanding of what can happen, at best, when we approach artworks. Discourse on the perception of a work of art, or the encounter with an artwork, requires a concept of perception which differs from those developed for the purposes of scientific observation and practical dealings with objects. According to certain interpretations, Merleau-Ponty suggests that artworks perform reductions themselves: they disclose the perceptual world prior to all theoretical formation and practical structuration – one example is when Éliane Escoubas suggests that Cubism is a pictorial *épochè* (Escoubas, 1995). Also, another interpretation, on the basis of Merleau-Ponty's analyses, would be to argue that rather than performing the phenomenological reduction, artworks can provide a motivation for such operations.

Today the discourse on arts, science and philosophy and their interrelations are much more complicated. New technologies and the whole discussion of the 1960s within the artworld has changed many things, and the science criticism has become to some extent outdated – partly also because the phenomenological approach has influenced researchers in different fields.

Figure 1. Tammi, M. (2016). One of Them Is Human # 1, Erica. Courtesy of the artist.

The Body

One of the most influential elements in Merleau-Ponty's thinking is his underlining of the body as the starting point and zero ground for our experience. The way in which he turned attention to perception and embodiment, has both influenced many and been debated. Whose body are we talking about; is the body considered to be a white prejudiced male body? The body is also a central tool for artists and in Merleau-Ponty's experience it was absent from the scientific approach. We are not reduced to being solely an eye hovering somewhere, enjoying a detached aerial view, but we have bodies, senses, and "to the site, the soil of the sensible and humanly modified world" (Merleau-Ponty, 1961/1966).

Instead he claims that: "Thinking "operationally" has become a sort of absolute artificialism, such as we see in the ideology of cybernetics, where human creations are derived from a natural information process, itself conceived on the model of human machines" (Merleau-Ponty, 1961/1966).

Maija Tammi (b. 1985) is a Finnish artist and researcher, who holds a PhD from Aalto University. She has explored questions of illness and sickness in her doctoral thesis *Sick Photography. Representations of Sickness in Art and Photography* (Tammi, 2017). I wish to turn our attention to a photo series *One of them is a Human* from 2017. In this series Tammi photographed androids, that is human-like robots. If we are to believe the title, in the series of four, there are three androids and one human. What made the series significant in the media was her decision to participate in a

competition dedicated to portraits. Tammi participated with the series in the Taylor Wessing Portrait Prize photographic portrait competition. One of the images, *Erica*, won two awards at the competition, hosted by the National Portrait Gallery in London (Tammi, 2018).

Looking at the photo series, the spectator can see that Tammi's characters are already slightly turned away. It is as if they have turned their gaze away, refusing the dialogue. Then again, turning away makes our observations easier. They do not return our look, but they expose themselves to our gaze, seeming to be unaware of our looks – or are they? There is an uncomfortable feeling of not really knowing if the model is aware of being looked at or not. If the sitter is absorbed in his or her inner world or not.

The work itself is multilayered, and my interest in this context is simply to attempt to look at it from the phenomenological perspective. From the outset, the image series is linked with the tradition of the portrait. In its origins, a portrait is associated with this idea that in a portrait you encounter somebody – as if you are standing or sitting opposite to somebody. It can be a very intimate moment, as it suggests the viewer is sharing the space with the poser. The idea of a portrait is loaded; Jean-Luc Nancy has written that the portrait brings with it "the entire philosophy of the subject" (Nancy, 2006). The subject is intertwined with the question of the other. Where do I stop and the other begins? How does the other see me? Thinking of the portrait and the idea of subject, one needs to remember what lies in the background of the concept of the 'subject', that is, how, in its origins, the subject refers to subordination; it is someone who is literally thrown or laid under. The concept comes from the Greek word *hypokeimenon*, which refers to a foundation that resists change. This interpretation reveals how the idea of the subject is both an agent and an object of action.

In relation to Tammi's photo series, I am interested in what I am as a spectator looking from the work. Evidently, the title guides my gaze. Following its hints, I try to look for the signs that would help me tell the difference between the human and non-human. This distinction, the difference between human and machine, is a topic widely recalled in different stories. There are various stories of artists creating human-like dolls or creatures. Often these dolls have caused anxiety, like in E.T.A. Hoffman's story The Sandman, with a human like Olimpia doll, reflected in Sigmund Freud's concept of the uncanny: "the uncanny is that class of the terrifying which leads back to something long known to us, once very familiar" (Freud, 1919/2001). As a concept, the uncanny has surfaced in the current debates of new technology, especially in robotics and 3D animation through Masahiro Mori's publication from 1970, which proposes that our affinity with the robots decreases radically when the robot becomes too human-like (Mori, 2012).

Turning back to the Merleau-Pontian approach, I wish to ask, what would be the phenomenological approach to these photos? Is it the (impossible) urge to see ourselves from the outside, the impossibility of seeing how others see us? For Merleau-Ponty the body is twofold; on the one hand it is a thing among things, but on the other hand it is our access and means of grasping all things. "It cannot be by

incomprehensible accident that the body has this double reference; it teaches us that each calls for the other" (Merleau-Ponty, 1964/1968).

He thus argues that my vision is constantly "complemented" by the other's vision of me. So, there is a permanent movement from the self to its outside.

Merleau-Ponty emphasizes bodily perception and experience – how the body is both subject and object, and how this being is fundamentally intersubjective. How: "associated bodies must be revived along with my body – 'others,' not merely as my congeners, as the zoologist says, but others who haunt me and whom I haunt; others along with whom I haunt a single, present and actual Being ...." (Merleau-Ponty, 1961/1966).

This relation is being bracketed or postponed in Maija Tammi's image. What haunts me is the other, and this otherness is again something else..

The Invisible

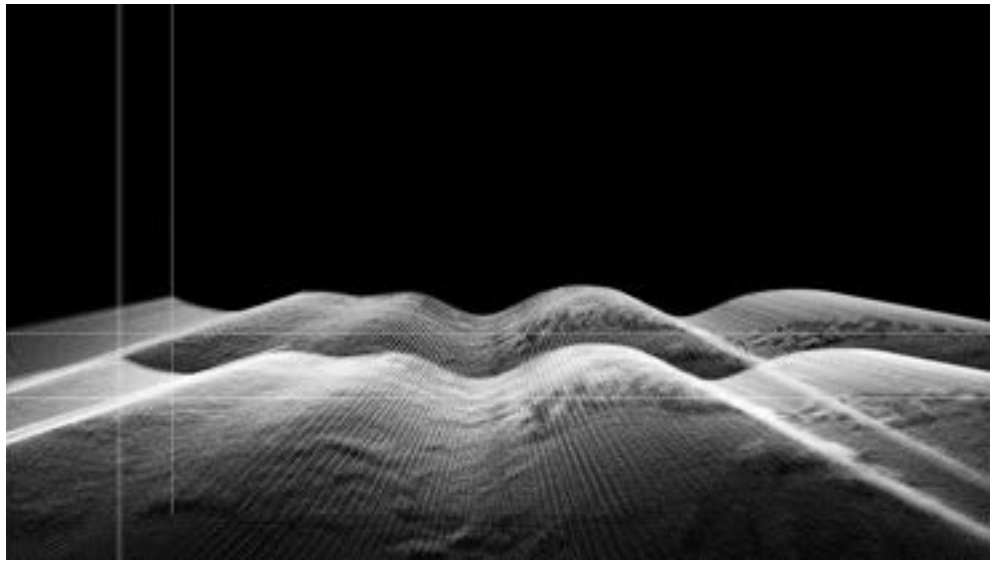

Figure 2. Rainio, T. (2017). Untitled (Gravitational Waves), still image, detail. Courtesy of the artist.

This intersubjective experience, the intertwining of the me and the world, is reflected in the concepts of the invisible and flesh – concepts Merleau-Ponty developed especially later on in his career: "Literature, music, the passions, but also the experience of the visible world are – no less than is the science of Lavoisier and Ampère – the explorations of an invisible and the disclosure of a universe of ideas. The difference is simply that this invisible, these ideas, unlike those of that science, cannot be detached from the sensible appearances and be erected into a second positivity." (Merleau-Ponty, 1968).

In *The Visible and the Invisible* he writes concerning the bond between the flesh and the idea, referring to Marcel Proust, how musical and literary ideas cannot be detached from their sensible appearances: A standpoint that stresses the importance

of the materiality, and attempts to show how the immaterial and material are intertwined. In these attempts the concept of the flesh was central. It is indeed through the concept of the flesh, as well as *le chiasme*, chiasm, that the reversibility of perception becomes possible: the relation to the other, and to the world is now understood differently, so that the object and subject are no longer separate from each other, or from the world – this is a reduction of the difference between the subject and the world.

Tuomo Rainio (b. 1983) is a Finnish artist currently working as a lecturer at the Academy of Fine Arts in Helsinki. Rainio's *Untitled (Gravitational waves)*, 2017 was part of the online collection launched by the Museum of Contemporary Art Kiasma together with its *ARS17. Hello World*-exhibition (Ars17+, 2017).

Rainio's work has its starting points in gravitational waves. Gravitational waves come from two black holes that collided, and the waves are ripples from this collision. They were predicted by Einstein in his general theory of relativity in 1916. However, the theory predicted the existence of the waves, but it was only recently that a team of researchers at the LIGO, *Laser interferometer gravitational-wave observatory*, research center managed to capture the waves. Indeed, the team won the Nobel Prize in Physics with the discovery in 2017, "for decisive contributions to the LIGO detector and the observation of gravitational waves" (Nobel, 2017).

What the scientists managed to do in their research was to build a measuring device that was sensitive enough to detect the ripples. This device has been called the most sensitive measuring device built. Rainio's interactive work takes the data that LIGO has released as open data and interprets the data, and uses the gravitational wave detection data to distort the image in the video. Each frame is distorted using the data, and in a sense this work seems to make visible what prior to the experiments had been invisible.

Phenomenology, as said earlier, underlines the body, holding a critical stance towards sciences that seems to treat the world as its object. Yet Rainio's work immediately made me think of Merleau-Ponty. Especially his concepts of the visible and the invisible and this idea of how we are all intertwined, part of the same tissue of flesh. In Rainio's online work the image is being affected by the waves that we normally cannot see. Turning the invisible into something visible, making the spectator aware of something that – supposedly – surrounds us all the time but cannot be accessed by our vision, is fascinating.

The work is based on open data, measurements released by the LIGO. It is taking this abstract information that had been predicted in theory 100 years ago, but traced only now, and turning it into an image, a landscape with waves coming from somewhere before us, touching others somewhere after us.

Conclusion

Following Merleau-Ponty's criticism, the way science looks at the world is limited, using methods and measurements to find results, like gradients thrown into the sea, doing this often blindly and without contemplating the basic principles – how the gradient, i.e. the methods and the measurements may also affect the results. From

today's perspective, science and the arts have developed much, and what I suggest can be seen in the artworks by Tammi and Rainio, is the enormous curiosity and interest art holds towards science. Perhaps it is exactly what science needs from the phenomenological perspective: that the arts with its intertwined, embodied understanding turns towards its findings. As within the arts the world can be seen in its ambiguity, and the (artistic) researcher is not afraid to include themselves into the research to show its groundedness.

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2

DIMENSIONS OF HYBRIDITY

Vertex + Reflex

LAURA HOPES

ABSTRACT

When we look out to sea, what are we turning our backs on? I'm in the process of developing a site-specific mobile VR artwork at coastal locations in the UK, significant in terms of globalisation and industry and situated at geographical corners (vertex) which to me signal the *Sublime Anthropocene*. Our coastlines bear witness to some of the busiest shipping channels in the world, a visual metaphor for the model of globalisation: containers, power, warfare; these resources are channelled away, from behind us, through our view, out into the world.

The location-based augmented reality and binaural sound experience has a 'real' 90° space facing forwards, which segues into a 270°(reflex) panorama in the peripheral and anterior vision. I plan to use VR to create an environment in which the viewer is immersed in their actual physical location, but whose perception and physical experience of distances is made precarious by shifting their gaze to the left or right (Coulter-Smith, 2006).

An immersed audience (Lanier, 2017) can access the immediacy of these symbolically Sublime anthropocentric locations with VR. One side-effect is the inherent physical vulnerability of being present in the VR space. I explore the internal and external VR experience by documenting the participants' unwitting performance, which is relayed alongside the panoramic film outside the test space.

People can respond more positively to playful explorations of complex ideas and become more attuned to the common human condition after a 'peak experience' (Piff & Keltner, 2015), and through my work within landscapes of the *Sublime Anthropocene*, I hope to engender this sense of 'full-body inclusion' which could potentially circumnavigate the moral defeatism engendered by a surfeit of ecological warnings associated with the Anthropocene (Morton, 2018).

KEYWORDS: virtual reality, *Sublime Anthropocene*, vulnerability, distance.

Introduction

A look. Looking. The gaze. Gazing. At space. At a place. Of a place. In a place. Out of place. Seeing. Seen. See-sawing. Falling. Feeling.

Landscape; how it is seen, experienced, what humans do to it and what it does to humans, is the realm explored in this text. Drawing from the romantic tradition, this exploration of place is located within the milieu of 'landscape', and the artistic practice research focused upon an exploration of landscapes chosen to signify the term the *Sublime Anthropocene*. These locations could be said to offer a Sublime frisson, a visceral jolt to the senses, of awe, magnitude, threat, grandeur or even abjection; the ingredients of a traditional reading of the Sublime, be it Kantian or Burkean.

Figure 1. Gwennap Head, still, *Vertex+Reflex*, Laura Hopes, 2018

However, the places in which the practice locates the physical and sensorial evocations of the Sublime are synonymous with the Anthropocene; landscapes altered by dint of their commodification, the value in their materiality; sculpted, hewn, sold. Sometimes the scars appear natural; beautiful; sublime; sometimes the aesthetic overload of these majestic places lures despite the obvious entropy, a beautiful horror which simultaneously appeals and appalls.

Jonathan Wylie, the cultural geographer describes distance as "an originary element of what we call landscape" (Wylie, 2016). This sense of landscape as alterity – signalling distance, otherness, withdrawal, removal, describes an innate sensation of introspection and withdrawal within a landscape. The distance could be vast, or even touching distance, yet still maintain the meniscus, the skin that separates the *human* from *it*, despite belonging too to nature. Perhaps this otherness or othering is an entry point to an assessment of what it is to be post-human, to be aware of the pitfalls of active othering, of alienation, of non-human agents and technology.

How we perceive landscape is situated in our cultural hinterland, our contemporary world-view or our political hierarchy. Timothy Morton asks: "Could it be that the very attempt to distance is not a product of some true assessment of things, but is and was always a defense mechanism against a threatening proximity?" (Morton, 2013). A sensation of human vulnerability within a landscape, especially one deemed Sublime, acts as a distancing device, the separation of the self and the other affording the possibility of perhaps greater perception or capacity for reflection.

This perceptual distance can be mediated, dialled up or scaled back. Within this liminal space, degrees of immersion can be tested, scales of the Sublime explored. Here, limits, edgelands and verges mark the line between terror and safety, and the frisson engendered by occasionally overstepping that mark. As Jean-Luc Nancy states

Figure 2. Gwennap Head, still, *Vertex+Reflex*, Laura Hopes, 2018

in '*The Sublime Offering*', "The Sublime is a feeling, and yet, more than a feeling in the banal sense, it is the emotion of the subject at the limit. The subject of the Sublime, if there is one, is a subject who is moved." (Nancy, 1988). One method of traversing this limit, of looking over the edge, of being able to appreciate the Sublime from a Kantian position of safety, is to engage a device and insert a filter or skin between the self and threatening other, in this case the Sublime landscape. Observational devices have long commanded human attention, offered an insight to the god-like view of the world and its conditions. As the good Doctor Reeves states in Powell and Pressburger's 1947 film, Matter of Life and Death: "*You can see it clearly and all at once, as in a poet's eye.*" His Camera Obscura elevates him beyond physical experience to the apex of the Cartesian sensorial pyramid. Seeing all locates him in a position of aesthetic artifice but appears to offer increased insight to the real societal concerns orbiting him. He is distanced but attentive to these external vulnerabilities, from his safe and hidden position. "It looks so different", states June as a perspectival shift alters her perception of the quotidian; and observational devices indeed have this capacity to distance our senses, our perception, our experience of place.

A black scrying glass was an occult tool of Pliny the Elder and key within the alchemical arsenal of John Dee; it's totemic use overshadowed in the romantic era as it evolved into the amulet of landscape-appreciation, the Claude Glass, said to bestow the artistic skills of Claude Lorrain upon its bearer. Gordale Scar, the grandiose amphitheatre of North Yorkshire, allegedly 'unpaintable', was transmogrified by James Ward between 1812 and 1814, possibly reduced within the velvety depths of a concave Claude glass, trinkets which were flaunted by the romantic grand tourists throughout their artistic forays through 19th century Sublime landscapes. The absurdity implicit within the physical turning of one's back to the landscape in order

to see it more clearly was echoed in accounts of travellers stumbling and falling to the ground with Claude glasses triumphantly still held aloft.

To see better through black, to apprehend through opacity, *through a glass darkly*, is to have an obscure or imperfect vision of reality. The expression comes from the biblical writings of the Apostle Paul; he explains that we do not now see clearly, but at the end of time, we will. This chronological distance is akin to the perceptual distance available through the use of observational devices. Do we see better, see more, or do we echo Jane again, "it looks so different"? The traveller to Gordale Scar will notice the rift between James Ward's version of the place and the Sublime reality. Clearly it takes more than a Claude Glass to reduce this place to canvas, in fact it requires removing whole hillsides to reveal the lens-like waterfall at the heart.

Perhaps instead of the device offering the superior version, it is the reduction of distractions which narrows or directs the viewer's focus. A stereoscopic view stills that mimetic engulfment even further and removes the physical threat endured by the subject of the Sublime, as described by Burke: "the passion caused by the great and the Sublime in nature, when those causes operate most powerfully, is Astonishment; and when astonishment is that state of the soul, in which all its motions are suspended, with some degree of horror. In this case the mind is so entirely filled with its object, that it cannot entertain any other, nor by consequence reason on that object which employs it. Hence arises the great power of the Sublime, that far from being produced by them, it anticipates our reasonings, and hurries us on by an irresistible force" (Burke, 1757/1990).

The technology of the stereoscopic viewer places the Sublime beyond the viewer's arm, the room even, and disembodies its awful power. Yet, still the Sublime is at work…the viewer can still wonder at the lowering cliffs and imagine the crashing rock-falls, they can nearly trace the rough limestone beneath their fingertips or taste the cold, mouldy air which prickles their arms. The viewer internalises this landscape, sees it all, their sight is *of* this place, but their bodily experience still is not. They are far back from that ledge proffered by the Sublime, but they are precarious in other ways.

Surely the vulnerability inherent to this blinded sight can be extrapolated and compared to the contemporary experience of virtual reality, as Jaron Lanier describes it: "comprehensive illusions that you're in a different place, perhaps a fantastical, alien environment, perhaps with a body that is far from human … experiencing shared lucid dreaming." (Lanier, 2017).

The absurdity and oblivion of the Claude Glass still pertains to the VR headset, rather than turning away from 'the view', our romantic aesthete now blindfolds their 'human' vision, submitting instead to digital senses. Look – the waves are moving – they cry, delighted – a recognisable semblance of reality – "It all looks so different!" Do they see it all at once, do they see it better, or will they see more clearly at the end of time, as Apostle Paul inferred?

Contemporaneity, chronology and the Sublime speak too to the concerns of the Anthropocene. It's worth at this point taking a moment to consider a timeline

of the Anthropocene; should it be pinned to the nuclear tests at Bikini Atoll, for that surely is truly the sublime, the *Sublime Anthropocene* in essence. Crutzen and Stoermer in their 2003 paper date the Anthropocene to the onset of the industrial revolution, when the first layers of carbon deposits began to be laid down, but should it shift instead to the agricultural revolution; the corn laws which surely are the start of globalisation in its capitalist framework? Timothy Morton states that:

> The Romantic period is the very advent of the Anthropocene, when a layer of carbon is deposited by human industry throughout Earth's top layers of crust. It doesn't seem like a random coincidence, the epochal event of carbon deposits in Earth… (Morton, 2013)

The topographies and temporalities of the *Sublime Anthropocene* appear synonymous with the hyperobjective engulfment of Burke's Sublime. The attendant complex mesh of human histories interlaced with these soils, from Roman, Enlightenment to contemporary posthuman narratives becomes incomprehensibly overwhelming. This vastness, combined with a dangerous intimacy, as Morton describes it, its 'in-your-face-ness' underlines the key sense of precarity, commingled with varying distances of time and geography that are a feature in the perception both of the Sublime and of the Anthropocene. Our contemporary viewer requires new observational devices, surely, to perceive this collision of environmental disaster and awesome magnitude.

When the viewer looks out to sea, they unwittingly adopt the pose of Caspar David Friedrich's *The Wanderer Above a Sea of Fog* (1818), looking instead out to sea, they inhabit once again that edgeland of the Sublime. Poised between the known and unknown, the viewer makes decisions about the direction of gaze, and often chooses to turn their back on the land, once again selecting the mutable over the concrete. The audience's sublimated delight in the artifice of the controlled virtual environment, experienced through stereoscopic view, is located in a limited, bound realm. The threshold is doubly echoed in the imaginative longing, reverie and reverence lain at the sea's edge; it's Sublime limen occasionally trespassed, the blue of distance alluring yet threatening.

The sea exposes human vulnerabilities and fears, it appears distant, yet when touching the sea, we are aware of our own edges, our own interiority. In the project Vertex+Reflex, the aim is to make an audience aware not only of what they choose to see when looking out to sea, but the looming hinterland of the anterior vision, the *Sublime Anthropocene* poised over their shoulder. The paradox of the act of looking within a VR headset is that suddenly the viewer becomes attuned to, aware of and curious about the entire parabola of vision. To only look forward feels constricting, and the meditative state of gazing over the sea dissolves into a twitchy noticing of feet, raindrops on the planetarium-style screen, edges, lurching, lagging and glitching. "Is it moving, is it working, oh god I feel sick, this is horrible."

The viewer becomes an unreliable narrator (Booth, 1987), their visual veracity and credibility challenged and unable to keep track with bodily sensations. They experience motion sickness, their palms sweat, they are of both spaces and neither. In this vulnerable state of vertiginous unbalance, the viewer notices built totems

within the 360° realm, orientation symbols that signal a return to the start. In this work, these symbols will be situated at corners (Vertex) along the south coast – from Dungeness in the East, taking in Portland, Plymouth, and Gwennap Head in the West. The mobile handset's camera will frame the maritime landscape, 'looking out', offering a peeling, shifting, kaleidoscopic shift of unfurling seascapes, punctuated by container ships, tourists, racing tides and weathers. In conjunction with this will be the view inland (Reflex). Collating shifting views of the world inland that do not correspond with the landscape the viewer perceives ahead, will explore notions of being lost, displaced, beyond one's comfort zone.

When facing the sea what does the viewer turn their back on? At Dungeness, merely turning away from the Nuclear Power Station towards the sea does not remove its ominous humming sound; on Portland, while the race tides chop savagely at each other, the land behind has been carved up, priced, and sold, from building the UN building in New York to creating the Panama canal; in Plymouth the swirls of the Tamar meeting the sea fight unimpeded by warships and submarines that glide silently through. At Gwennap Head, one gets a sense of the sea turning a corner, and the expanse of the Atlantic stretching towards America. This coastline bears witness to some of the busiest shipping channels in the world, an apt metaphor for the model of globalisation: containers, power, warfare; all of these resources are channelled away, from behind us, through our view, out into the world.

Throughout time, the sea has temporarily homed alienated or vulnerable communities, aiding or impeding migration. Humanity has become capital or commodity, an invasive species or radically local, lurking uneasily among non-human agents. The horrors of colonisation or environmental disaster can become easy to ignore, when we turn our backs on them, when we look out to sea. This ease of ignorance is echoed by the dangerous ease with which one uses the term Anthropocene, ably critiqued by Françoise Verges, Zoe Todd and Kathryn Yusoff, among others. The works of Anna Tsing, Elaine Gan and Rosi Braidotti make clear that a key danger within any exploration of the *Sublime Anthropocene* is the blanket nature of the individual and combined terms. Morton in his new book, Being Ecological, warns of the danger of 'Moral Apathy' engendered by the fatigue or inability to respond to the vast hyperobjectivity of "climate change" or the Anthropocene, and the distancing implicit with traditional readings of the Sublime, that retreat back from the ledge, confirms the suspicion of a cultural or unconscious 'othering' at play.

Zoe Todd's distrust is well-founded. She cites Swedish scholars Andreas Malm and Alf Hornborg, who: "among others, highlight the manner in which the current framing of the Anthropocene blunts the distinctions between the people, nations, and collectives who drive the fossil-fuel economy and those who do not. The complex and paradoxical experiences of diverse people as humans-in-the-world, including the ongoing damage of colonial and imperialist agendas, can be lost when the narrative is collapsed to a universalizing species paradigm. As Malm and Hornborg state, "a clique of white British men literally pointed steam-power as a weapon – on sea and land, boats and rails – against the best part of human-kind, from the Niger delta to the Yangzi delta, the Levant to Latin America."" (Todd, 2017),

and this steam power emerged at Crutzen and Stoermer's crucible of the *Sublime Anthropocene*, the Industrial Revolution.

Not all humans are equally responsible for the forces that created the disasters driving the Anthropocene, and Todd argues that "not all humans are equally invited into the conceptual spaces where these disasters are theorized or responses to disaster formulated." (Todd, 2017). Similarly, the Sublime is well known for its ability to sublimate – it is not for women, Burke argues, for they have beauty. Joseph Conrad's 'Heart of Darkness' invokes the Sublime menace and fear represented by the traditionally 'othered'. As Francoise Verges describes, there is a danger that to use the term Anthropocene is "easy, because it does not challenge the naturalized inequalities, alienation, and violence inscribed in modernity's strategic relations of power and production. It is an easy story to tell because it does not ask us to think about these relations at all." (Vergès, 2017).

By virtually locating an audience within the landscapes of the *Sublime Anthropocene*, the ease and artifice of immersion is at play; distances between physical reality and critical perception are heightened and obvious and become a terrain for an audience to explore. This sensorial engulfment can potentially access an immediacy of symbolically Sublime anthropocentric locations, loaded with the contradictory curiosity about what is behind one. The intermittent flipping between being in a real space and aware of your clumsiness and physical vulnerability and the escape and scale of the VR experience is an interesting paradox and exploration of perceptual distances – again the shift between touching distance and the ineffably distant.

Research by Piff and Keltner into 'Peak Experiences', based upon Maslow's hierarchy of needs has shown that people respond more positively to playful explorations of complex ideas and become more attuned to the common human condition after such an event: "A peak experience is a moment accompanied by a euphoric mental state often achieved by self-actualizing individuals. The concept was originally developed by Abraham Maslow in 1964, who describes peak experiences as "rare, exciting, oceanic, deeply moving, exhilarating, elevating experiences that generate an advanced form of perceiving reality, and are even mystic and magical in their effect upon the experimenter." (Piff and Keltner, 2015). Could this sense of 'full-body inclusion' generated by experience of the *Sublime Anthropocene* within virtual reality be one way of avoiding the moral defeatism and apathy engendered by a surfeit of ecological warnings?

VR casts the viewer's vision as the 'unreliable narrator', unable to navigate or position their body in either the virtual or real space; aware of both yet embedded in neither. This in turn introduces the element of vulnerability and sublimation engendered by both the Sublime and the Anthropocene. The viewer may need to be led by the hand into the space, they may be aware of the clumsiness of their performance, their orientation askew. This unwitting performance is a valuable by-product of the experience, a physical choreography of temporalities and topographies. This disruption of the gallery space, a blurring of the lines separating the viewer and the viewed, reflects a deliberate playfulness in response to the seriousness of the *Sublime Anthropocene*, and is a calibration of the distances between perception and experience.

John Wylie points out, however, that: "With these kinds of instances there is of course the potential for assuming that 'physical' or 'geographical' distance in the classic sense will always tend towards indifference and ignorance, whereas proximity, and in particular visibility, will contrastingly induce empathy, and senses of care, duty and responsibility. But once again, of course, spaces of distance/proximity are more complex in practice. Drone controllers working for the US Army on remote attack and assassination operations are more likely to suffer post-traumatic stress disorders, at least some studies show[1]; the tension they experience between terrible intimacy and terrible distance must be at the heart of this." (Wylie, 2016).

Noticing these distances of the *Sublime Anthropocene*, being attentive to these thresholds and looking behind us is a radical resistance to what Zoe Todd describes as the "hegemonic tendencies of a universalizing paradigm like the Anthropocene", she suggests that we need "joyful and critical engagement through many forms of praxis." (Todd, 2017), and the playfulness attendant to the 'performed' physical submission of a VR experience may offer that vulnerability, that openness to the 'peak experience', which could, in turn, engender change.

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1 See the recent discussion in Pinchevski (2016).

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The Art and Science in Narrative as a Common Ground for Hybrid Practices

IRINA SHAPIRO

ABSTRACT

This paper explores how artistic agency can contribute to the multidisciplinary discourse on the preservation and re-reading of histories – how artistic agency produces new visual, performative and structural tools while working with archives as sources of historical narratives. The context of this talk is the research programme Open Set LAB *Memories of the Future*, which emerged from a collaboration between the Open Set Foundation and the archive of the Netherlands Institute for Sound and Vision. The LAB brought together a group of designers, filmmakers, archivists, and digital humanities scholars to discuss subjects of shared concern, namely: the accessibility and distribution of heritage, alternative historical narratives, and the algorithmic nature of archives. Artistic experiments during the programme focused on the un-categorised, estranged, multiple forms of interpreting archival narratives. As such, 'foreign' ways of encountering histories mean creating new imaginary tools for comprehending our challenging global realities and for envisioning and debating probable futures. The emphasis of the paper is on the facilitation of and the process of 'hybrid' research that took place during the project: the importance of shared lexicons; artistic and scientific processes of relating to the material and creating meaning; and the study of narrative as a territory for hybrid practice.

KEYWORDS: artistic research, archival research, media archives, hybrid practice, para academic research.

Context

This paper introduces and examines the research performed during *Memories of the Future*, a biannual research programme (LAB) developed by the independent educational platform Open Set Foundation in 2016–18. The context of the programme was the Dutch media archive – The Netherlands Archive of Sound and Vision. This is one of the largest European collections of broadcasts, TV programmes, online video and websites, amateur movies, advertising, and video games.[1] The LAB gathered a group of practitioners and researchers from the Humanities and arts to conduct research and to examine how they relate to the archive as an institution, and as an algorithmic environment, and to the archival material itself. This Open Set group

1 The Netherlands Archive of Sound and Vision is managed by the Institute for Sound and Vision and is a leading knowledge institute in the field of media culture and AV archiving which and provides access to over 70% of the Dutch audio-visual heritage. It is largely digital storage. The archive is built on four thematic pillars: 'News, information and current affairs, culture and entertainment, amateur and business productions, and the media landscape.'

consisted of emerging and established designers, filmmakers, photographers, artists, and scholars in the fields of the social science, preservation, media and computational science.

Through a series of working sessions, peer-led discussions, lectures, the *Memories of the Future* curriculum focused on the research aspects of creative practice (design and applied arts), while slowing down its process of decision making – in other words, de-strategizing creative practice and experimenting with the ways in which it can interrelate with other discourses, strategies and practices of knowledge production (mainly with academic research). In this process of tuning different research approaches, we are interested in the conditions and grounds in which hybrid methodologies and lexicons can occur.

Introduction and Overview

The theme *Memories of the Future* emerged from an interest in understanding the agency of an artist or storyteller in the process of relating to contemporary realities. Today's struggle to comprehend the increasing social complexities and ecological uncertainties, the long-term implications of technology in the lives of multiple species and human bodies, calls for re-evaluating histories as the backdrop of current habits of thinking. It calls for new paradigms of interpreting, complicating and disturbing the past, shared memories, narratives or imageries of meaning production constructed by Western scientific and philosophical thought; posthumanist discourse in affiliation with colonial studies, object-orientated ontology; assemblage, multispecies and feminist paradigms that "move completely outside our present conception of what it is to be human, and therefore outside the ground of the orthodox body of knowledge which institutes and reproduces such a conception" (Wynter, as cited in Scott, 2000, p. 136). These paradigms have a potential to see a greater image of today's complexities, by including the voices of those who are not being 'recognized as human'; "the colonized, the enslaved, the noncitizen, and the animal – all reduced to type, all Others to rational man, and all essential to his bright constitution – which is at the heart of racism and flourishes, lethally, in the entrails of humanism" (Haraway, 2008, p. 18). Some thinkers, like Zakiyyah Iman Jackson, understand the rationality that is subsistent to the Enlightenment 'man', mentioned by Donna Haraway, as a central subject in humanist critique and it equates itself with humanism. "Thus, the very operations of rationality used to evaluate the truth claims of the Enlightenment subject remained committed to its racial, gendered, and colonial hierarchies of 'Reason' and its 'absence.'" (Jackson, 2013, p. 672). Reason gives an access to 'speech' (Jackson, 2013, p. 672), to law and knowledge, and finally, to a 'voice' in the shared mnemonic narrative. The disruption of humanist rationality has been one of the leading points for the Open Set programme, as its journey of re-evaluating an archive could be seen as an attempt to 'destabilize' the binary hierarchies of 'Reason' with rather 'irrational' artistic poetic gestures.

This interest in disturbing the narratives and structures of archives has produced its own discourse as such. Since 1990, enormous interest in the notion

of memory has been witnessed, as well as a "spread of what might be described as 'memory practices'" (van Alphen, 2008, p. 91). One of the main focuses of such practices has been the trauma of displacement. Whether the displacement refers to literal migration due to political or environmental reasons, or the migration of our information in the digital networked society, the 'traumatic' aspect of displacement comes in facing yet unknown and unstable conditions. As one of the Open Set's programme contributors, Erns van Alphen, explains it, "[the] mnemonic desire is activated especially in those moments of extreme duress in which traditional bonds between subjects, between subjects and objects, between objects and their representations, appear to be on the verge of displacement, if not outright disappearance" (2008, p. 98). Today's social and environmental complexities and uncertainties condition the 'displacement' of human, and urge for different 'co-inhabitancy', for 'new bonds' within the complex assemblages of multiple actors – whether they are foreigners from a different part of the world, simple biological organisms, bacteria in our bodies, viruses, or electromagnetic waves: "an increase in the vigilance, responsibility, and humility that accompany living in a world so newly, and differently, inhabited" (Wolfe, 2010, p. 47).

Finding ourselves a part of these words, or rather assemblages, we seek to identify new voices (or narratives) in this process of frictions and tunings with the multiple "other selves with whom we share the universe" (Mbembe, 2016, p. 35). However, in order to form these 'new bonds', there is an urgency for developing a capacity to relate to multiple others or 'strangers', even if the consequences of tuning within these yet unknown assemblages cannot be foreseen. A powerful technology to do so is imagery – organized signs into a system – images, objects and sounds equal to words, "which carry meaning […]. These signs stand for or represent the concepts and the conceptual relations between them which we carry around in our heads and together they make up the meaning-systems of our culture." (Hall 1997, 18). With the means of culturally constructed systems of visual signs and concepts we are able to articulate, materialized, re-present, and re-produce knowledge. Dealing with a predominantly new media collection of visual signs – and specifically, photo and video imagery of the Sound and Vision archive – we should not forget that the photographic technical image "stands at the technological, semiotic and perceptual apex of 'vision', which itself serves as the emulative metaphor of other ways of knowing." They "pretend to be objective" (Flusser, 2013, pp. 91-98), rational, evidential and serve as the system of signs to build up relations in the 'traditional bonds.' But how to use these "meaning-systems of our culture" – visual languages and narratives, – in the conditions of the 'displacement'? In the multispecies assemblages – the places and their visual languages we cannot know? When the complexities of "living in a world so newly, and differently, inhabited" require different ways of thinking, the imagery should be challenged at first. "It matters what we use to think other matters with […] It matters what stories make worlds, what worlds make stories" (Haraway, 2016, p. 12).

It is a challenge for the individual as well as public memories to serve as the archives of such imagery. When investigating the archives, interestingly enough, the

narratives that can be found there contain not only the traces of 'traditional bonds'. The multiple Others have always been part of this imagery as neglected, misread or invisible stories[2]. So if we use archives as the resources for the imagery to build 'new bonds', it's necessary to disturb the mainstream mnemonic imagery readings – recognising multiple words and multiple stories, in order to find meeting points with which we connect and relate to the Others.

The first step we must make is to disturb the expectation of the archive to be neutral and the obligation of the historical narrative to objectify a historical event, to make it complete, and to create a common, 'rational' direction of its reading. The Open Set group was fascinated by the disturbance through employing subjectivity as a filter for reading. The promise of subjectivity is in bringing an incompleteness of historical storytelling, while making room for Otherness, for the unknown yet. "[…] the knowing self is partial in all its guises, never finished, whole, simply there and original; it is always constructed and stitched together imperfectly, and therefore able to join with another, to see together without claiming to be another" (Haraway, 1988, p. 586).

The following sections of the paper address, first of all, the algorithmic nature of modern digital archives. While seeing an archive as a system of categories that designates the usage of historical information, we problematise the promise of an archive to be an objective navigation infrastructure for subjective usage. This is followed by a presentation of the artistic strategies involved in the research programme that included:

a) glitches and alternative forms of storing and distributing information that were addressed as strategies to disturb and alternate the algorithmic nature of archival narratives (*Invisible Narrators*);
b) fictional and estranging techniques, or a 'foreigner' perspective, as strategies to work with the archival material itself (*Stranger Narrators*).

These artistic strategies as forms of research rely on irrational reasons and enhance the role of subjectivity to make a discovery. These strategies represent themselves a 'foreign paradigm' on sensemaking for research that tends to rationalise the discoveries and conclusions. The paper draws attention to the difficulties of the collaboration process when these two ways of research – the rational and irrational – come together, and to the potential of engaging such irrational contributors in the process of unpacking historical narratives and the science of their study (*Hybrid Practices of Narrative*).

2 In her research project, one of the participants of the Open Set LAB, an Israeli artist Elinor Salomon, looked at the visual language of the public gaze on these different cultures, at how Dutch media captured former colonies through the eyes of state expeditions. She specifically focused on the anchor points the viewer is introduced to – such as exotic landscapes, 'primitive' and 'unorganized' images of native inhabitants and the civilized appearance of the European reporters and travelers. Being a 'stranger' to the visual language of Dutch media, she spots something that a privileged 'white' eye neglects or misinterprets – the silences and distant position of the captured natives. Here I am thinking with Zakiyyah Iman Jackson who reminds us, in the words of Seshadri, of 'silence' as the "inhuman' putative privation of speech" and the law, and proposes to see it as the "condition of all conditions of possibility," opposite to the 'empty space' in the articulation of the law; as a "space of possibility for something other than the law" (2013, p. 675).

Archival Disturbance

In the digital institutional archive, the infrastructure for the storage of content aims at an objective clarity regarding how information is stored and searched for. Such digital collections promise that their users can easily navigate the content in a way that they wish to, and that they can create endless reconfigurations of the archival content. However, the process of objectification leads to universal classifications, tagging, filtering, and the linking of individuals to series of events, behaviours and characteristics. It leads to the fragmentation of the content and its connection to the archival categories, rather than to coherent narratives. We examined different examples of algorithmic databases, such as the Linked Open Data cloud (introduced by scientist Lynda Hardman), multiple social platforms (introduced by artist Jonas Lund), and we discussed how fragmentation disorientates users and to what extent an 'other' narration of the content is possible.

Invisible Narrators

Individual archives of thoughts and images serve as the storage places of memories, associations and interpretations that we melt into subjective narratives. Fictional or not, these narratives de-contextualise and misplace the elements from our archives, based on the condition of today, onto what we are eager to remember or to say.

In contrast to individual archives, emerged tags of digital archives as databases filter the materials through similarities and approximation. Any individuality and subjectivity that does not fit into an archival tag is misplaced and misinterpreted. This is understood by an algorithm as a representation of pre-existing categories, or, as Michel Foucault puts it, a source for a new category or tag which can adapt to the changed pattern (1995). Seeking Otherness is difficult in this context. In order to be stored by the archive, the individuality of 'the other', which does not have pre-existing references, has to be defined by one of the existing tags, or, has to be adapted by the algorithm and form another tag. Seeing an archive as an active process of filtering, not just as storage, problematises its promise to be an objective navigation infrastructure for subjective usage. Using information that is categorised by the algorithm, in fact, means using the result of the backstage process of decision-making about the categorisation of the content.[3]

The fact that the algorithmic system designates the usage of historical information becomes an interesting starting point for the practice of disturbing the mnemonic narratives in digital archives. The difficulty, or one might even say impossibility, of such a practice lies in the lack of certainty with which we can analyse all the apparatuses that influence the achievable content – the apparatuses of the media industry, the medium, the filtering algorithms, and the distribution and representation of the content. However, some interesting visual research gestures were conducted during the research programme.

3 An elaborated argument about the categorization in the digital archives and introduction to its conceptualization by Foucault, were present at the program in the lecture of Erns van Alphen *The Politics of Exclusion, or Reanimating the Archive* (Symposium *Fluid Memory*, Hilversum, 2018).

The digital artist duo *Mediengruppe Bitnik* for example proposed using the glitch as a tool to disturb not the content narrative from the Sound and Vision archive, but the apparatus that constructs it. *Bitnik* were interested in fringe media uses, pirate broadcasts, glitches in the content itself and in the system that stores this content: "Glitches provide a real-life learning lab in which you can open the hood of the culture industry's engine and encourage audiences to pause and reflect, even if it is only for a few seconds" (Mediengruppe Bitnik, 2018).

Instead of deconstructing and analysing different characteristics of the archival materials separately – content, media, categories, representation, etc. – one of the programme's participants, designer María Muñiz, studied the Sound and Vision archive as a symbiotic complex organism: or 'creature' where all the apparatuses that form the archival content are not separated from each other. In her research project *Mutations & Explosions*, Muñiz created a video "mutation booth" (a screen with a hacked scanning system) (Muñiz, 2018), linked to an online network, based on the decentralised blockchain technology. Each film from the archive was visually encrypted (mutated) by the device, creating a new, portable, and unique version of itself (see Figure 1). Eventually, Muñiz envisioned the entire archive being encrypted and shared through a new community that would guard it and reuse its content. The interesting point here is how the designer "radically melted" (Muñiz, 2018) the existing mechanisms of image production and the search engines into completely new matter.

Figure 1. Mutations & Explosions, María Muñiz, 2018. Consists of an installation with a video mutation booth (a screen with a hacked scanning system) linked to an online network based on the blockchain notions of decentralised and public databases. Four frames from the encrypted films were printed (420 x 594 mm) for the presentation of the project at the Symposium "Fluid Memory", Netherlands Institute for Sound and Vision, Hilversum, and published online on Open Set HUB (www.hub.openset.nl) in 2018. Courtesy of the artist.

Stranger Narrators

A fictional story breaks with the 'norm'; it triggers people's imagination while opening up a plurality of foreign but possible paradigms, scenarios, and universes. Thinking through fictional or speculative narratives was somehow a natural way to proceed for the Open Set research team. The international group of researchers were 'foreigners' or 'strangers' to the context; they neither spoke the language, nor could they sense the main narrative that comes with a conventional interpretation of Dutch histories. However, they encountered the archive from their own historical and social standpoints – from their disciplines, cultural backgrounds, and subjective perspectives.

"The paradoxical position of the foreigner: both inside and outside a national community, drawn to and by it. […] What the members of the group (insiders of the national cultural knowledge) take for granted, […] strangers have to learn, and to learn, they must also analyse and interpret. The stranger becomes essentially the man who has to question nearly everything that seems to be unquestionable to the members of the approached group (Ritivoi, 2014, pp. 47–51)."

In his approach to the disturbance of the archival reading, artist Noam Toran, one of the Open Set programme contributors, proposed employing fictional strategies:

> If we strip the Sound and Vision archive of its hard cultural, historical, geographical and political frameworks, and instead 'veil' our encounter with it in a fiction […], what might we glean from the material that a straightforward reading might miss? […] Employing narrative forms as a way to disrupt conventional interpretations of the archive, we will work together to develop storylines which reconsider sections of the collection in order to produce our own constructive mis-readings (Toran, 2018).

Such strangeness is still related to the native 'reality' as it struggles to find its position within the archive. However, it opens up the potential for a new perspective, where the native merely pursues thinking as usual – "taking things for granted, assuming that the way things are is the way they should be" (Ritivoi, 2014, p. 52).

'Estranging narration' as an instrument of an 'outsider', according to critic and writer Viktor Shklovsky, is a tool of the artist. Shklovsky talks about the possibility of a vision through estrangement, rather than the mere recognition of an object, a form, or an event. Using this tool, the artist narrates through recollecting images, "estranging objects and complicating form," (Shklovsky, 1991, p. 6) in order to return to the sensation of recognition or discovery.

The stranger-narrators de-contextualise the imagery, led by the personal, often embodied, singular associations, which have their source somewhere in the irrational, ambiguous self.

In this light I would like to mention one of the projects developed during the LAB, the visual essay *Performative Gendered Gestures* by designer Giulia Bardelli (see Figure 2). She was interested in the patterns of performance that are hidden inside the relationship between the body and the media. Within the framework of this research, the repetition and slowness of the image, as estranging techniques,

embody a new (post)value. They become a tool for de-automatization that slows down the process of deciphering patterns that are unconsciously perceived as automatic by the gendered body.

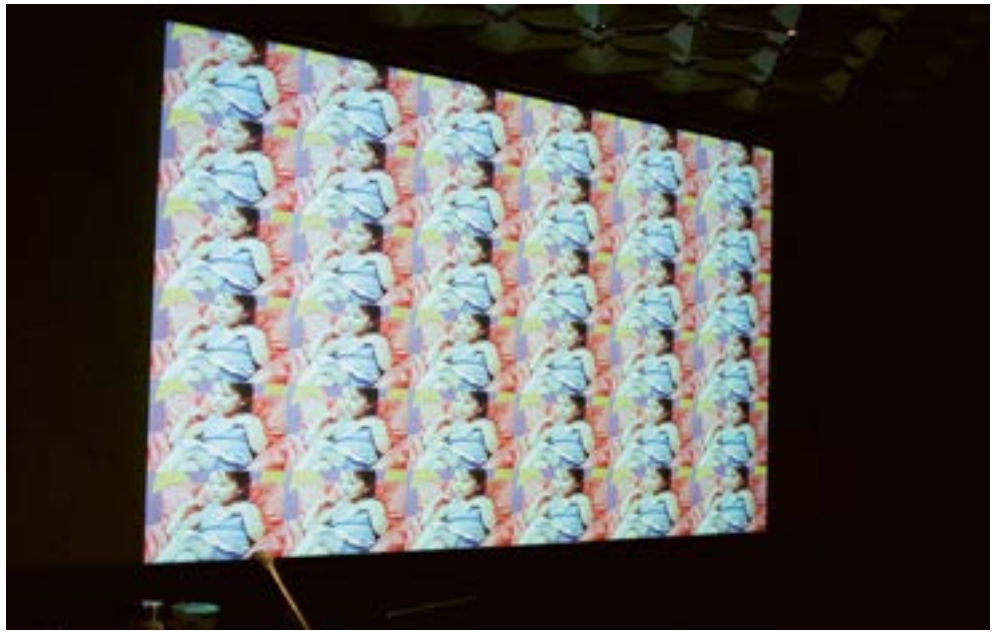

Figure 2. Performative Gendered Gestures, Giulia Bardelli, 2018. Consists of an edited selection of video material from the Sound and Vision Archive. The length: 5 minutes. Presented at the Symposium "Fluid Memory", Netherlands Institute for Sound and Vision, Hilversum, and published online on Open Set HUB (www.hub.openset.nl) in 2018. Courtesy of the artist.

Hybrid Practices of Narrative

There is a new and interesting horizon emerging when it comes to archival studies being explored by the programme's contributors whose way of sensemaking brings new forms of narration and knowledge production. Narrative itself can be seen as a technology that creates a laboratory for a conversation about different interests and practices: while programmers look at the algorithm, filmmakers at the narrative, light, and speed, historians most often look at the context. Conversations and collaborations such as these that emerged during the Lab were especially challenging in the beginning, when the involved parties did not understand each other's vocabulary and 'habits' of research. The difficulty for the scholars was to rationalise the artistic process of relating to the material, of searching for and creating meaning. Indeed, it's messy. It's very much intuition-driven, as opposed to being based on rational argumentation and reasoning.

As an example, one of the Open Set participants, designer Lacey Verhalen, spent several weeks selecting and playing with images of the blue sky, driven by a fascination for the colour, with no articulated reason. The lack of a reason made it very difficult for more structural methods of performing research to relate to her

process. However, while the research process clearly drew upon the sky as a tool to sensually encounter the archive (see Figure 3 for the project *Sky Atlas: Colour as Commons*), the conversation with other disciplines went much more fluidly. As one of our speakers, media researcher Carolyn Birdsall, explains, there is a relationship between academic interests and art projects that use sensory and abstract visual elements as references to access archives. As an example, she brought the research project *The Sensory Moving Image Archive* (SEMIA), which addresses the fact that in recent years, heritage institutions have invested a lot of time and resources in digitising their collections, while stimulating various kinds of search and re-use, including those based on visual features such as light and colour, form, or movement.

Figure 3. Sky Atlas: Colour as Commons, Verhalen L., 2018. The book of 36 pages. Size: 148 x 210 mm. Consist of an edited selection of video material from the Sound and Vision Archive. Presented at the Symposium "Fluid Memory", Netherlands Institute for Sound and Vision, Hilversum, and published online on Open Set HUB (www.hub.openset.nl) in 2018. Courtesy of the artist.

In contrast with more orthodox definitions of research, artistic forms of knowledge production can be just a gesture or an event: performance, sound, installation, material objects, or a compilation of videos of blue sky. The meaning is born from the artistic gesture or form itself, rather than from a written commentary on the work.

The artwork-making process – which resembles a messy mind map with unclear links between images, texts, and associated objects – is a very different form of knowledge. This process of estranging, or the mess of de-contextualised fragments of sound, light, images, and texts, establishes a territory where the image loses its conventional interpretation and gets a chance to be recognised as something else. It becomes a source of the production of a new meaning, or an 'other' meaning.

Being still difficult to access, such an irrational research process is interesting for the community of people who are engaged with similar subjects of concern — access to and the reading of the archive, etc. The urgency of the subject motivates both sides to dedicate time to ambiguity, and misunderstandings are an essential component in this hybrid climate of the meeting of 'foreign' fields. As Karen Barad states about the interdisciplinary approach, it's interesting to seek "the understandings that are generated from different (inter)disciplinary practices in conversation with one another" (2007, p. 92). The hybridity of the potential form of research between science and the arts gives the hope of finding ourselves outside the apparatus of 'traditional bonds' or conventional mnemonic readings. However, the challenge is to allow archival categories to be disturbed continuously, depending on the subjectivity of who is encountering the archive.

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Digital Actors – from Uncanny Valley to Intelligent Being

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ABSTRACT

Digital Actors in Film and Visual Effects have a long history. One of the first human-like digital faces appeared in the science fiction movie *Tron* released in 1982. Computer Graphics (CG) and animation have since evolved rapidly and so has the holy grail of creating a convincing digital actor. A large variety of projects and technologies has led to controversial results. While a lot of the "magic" in creating realistic digital humans has been demystified it still appears as an expert skill requiring many years of training. Filmakademie Baden-Württemberg has been engaged with research in this domain for more than 20 years. The article will explore the milestones of digital actor creation at Filmakademie, example projects and practical tools.

With the rise of Artificial Intelligence (AI) and Deep Learning in 2018, the creation of digital faces which are not based on CG but on 2D information only, has achieved breath-taking results. These approaches require little to no expert knowledge compared to CG tools. While they offer the ability to achieve near-photorealistic results without the need for costly 3D reconstruction and rendering, other limitations and requirements go along with them. Training data availability and preparation as well as artistic freedom and customization options play a central role in deciding for or against using AI to generate digital actors. Filmakademie applied both techniques to an exemplary production to shed light on the question: How does AI compare to the traditional CG approaches and what is the likely future of both?

Apart from the question of whether digital humans fall prey to the Uncanny Valley, there are also ethical implications to be considered when, for example, recreating digital versions of deceased actors. In this chapter, however, we would also like to focus on the services and applications of this emerging technology that go beyond the entertainment industry.

Future applications using digital humans are already on their way, for example in sectors like healthcare or customer service. In order to be successful, one of the exigent challenges today is to find a way to create digital actors with whom the users can empathize. AI can help create reactions in the digital actor that are modelled upon human behaviour we know. This implies a focus on the user's reaction to the digital actor as well as on the creation of the digital characters themselves.

KEYWORDS: digital actor, computer graphics, computer animation, digital human, artificial intelligence.

The Artificial Human – A Intrinsic Desire?

Why have researchers, commercial companies and individual artists spent years of their lives trying to build tools and workflows for creating convincing digital humans? Clearly because it turned out to be an extremely difficult task. A step back into the 17th century might help understand why we try so hard to achieve this. Caravaggio and Rembrandt were both experts in highly realistic paintings with precise facial expressions and very believable details in lighting and its effect on materials like human skin: A skill that impressed the masses 400 years ago up until today. Oil paintings were one of few creative forms of expression at that time. Who knows, maybe they would have chosen Computer Graphics and animation for their creations had they been available in order to create their own versions of the living; preserved and captured by humans forever? However, their works appear as proof for the intrinsic desire to replicate and potentially better understand ourselves with analog or digital means.

The striving to create replicas of humans with technical means is as old as humankind itself. It is expressed in myths and stories like the tale of the Golem or the story of Pygmalion in Greek mythology. The precursors of digital humans can be found in the automata in human shape, human-like puppets endowed with machines "mimicking life functions" (Zielinski, 2013). Some researchers even trace the history of animation back to the human desire to create artificial humans by technological means (Zielinski, 2013). Thus, digital actors are a logical step in the effort to create artificial humans who are able to move and perform human-like actions, and maybe even think or feel like humans. Film history is full of stories about human-machine hybrids like Maria in *Metropolis* (Fritz Lang, 1927) or Rachel and the other replicants in *Blade Runner* (Ridley Scott, 1982).

A (digital) actor in a film production is the cornerstone for the story to be told. Its facial expressions and related emotions are proven to be a universal language (PaulEkmanGroup, 2021) and thus an extremely powerful way of reaching global audiences. The idea of a digital actor comes with many promises like complete control over the performance, future proof of a younger appearance or the application of human-like creatures such as Gollum in *The Lord of the Rings: The Fellowship of the Ring* (Peter Jackson, 2001) or Thanos in *The Avengers* (Joss Whedon, 2012) and in other VFX genre movies. Fundamental to this idea is the problem that we all are experts in human non-verbal communication. We learn how to interpret and read human faces from infancy. This is the reason why any imperfection in appearance and movement of a digital actor can be spotted as not trustworthy or eerie, an effect that needs to be prevented by any means.

There are two separate lines of development in the creation of digital human characters.

Films like Pixar's *Tin Toy* (John Lasseter, 1988) aimed at creating digital humans in order to achieve emotional believability and empathetic reactions in the viewers – in the case of this film, despite the undoubtedly great technical achievements which were rewarded with an Academy Award, the character of the baby was

neither believable nor empathetic. This can mostly be blamed on the early stage of computer-generated images. As the technology of computer imagery evolved, the creation of digital human characters grew into an art form in itself, with stunning examples such as *Gerry's Game* (Jan Pinkava, 1998) where an elderly chess player plays against himself in an affective and heart-warming animated performance. These animated digital characters represent stylized and abstracted versions of digital humans which, after technical deficiencies in the beginning, do not fall into the Uncanny Valley (Mori, 1970). It is only with the first films featuring an entire cast of CG human characters like *Final Fantasy: The Spirits Within* (Hironobu Sakaguchi, 2001) or *The Polar Express* (Robert Zemeckis, 2004) that the discussion about animated human characters that fall into the Uncanny Valley regained momentum. Both movies are clearly identifiable as animation yet they aspire to look like live action cinema. They mark a phase of transition in the history of digital humans, limited by technology and the lack of appeal and emotional traceability in their characters.

Digital actors in a narrower sense are digitally created human characters with the intention to disguise their artificial creation, often in the context of and combined with live action material. They are supposed to look as if played by human actors. Only in the last two decades has the technology advanced to a point that it is often impossible to distinguish a digital human on the screen from a human actor. The reasons for using a digital human instead of an actor are diverse, ranging from safety issues and economic reasons to cases where younger or older versions of actors are created digitally, or actors who have passed away are recreated as a digital version. While the former motivations could be judged only by their results, the latter involves ethical and legal issues that are closely linked to photorealistic digital humans: Who is in control of the animated image of a deceased person, who owns the right to its performance? These questions need to be addressed, however, this would go beyond the scope of this chapter.

Digital humans seem to be both the confirmation and the denial of the realist approach to cinema as it was expressed by André Bazin in the early 20th century. Bazin argues that the impression of realism in cinema is due to its relation to the actual physical world which is captured by the camera, the rays of light bouncing off the real objects and into the lens, thus preserving the same light and creating an actual imprint on the photographic emulsion (Burgoyne, 2018). However, digital recording technology and the advent and triumph of CG imagery in feature films, television and even documentary formats have long replaced the formerly taken-for-granted affiliation of film with reality. At the same time, the benchmark for the creation of digital humans still lies in achieving an utmost realism. CG technologies like ray tracing, simulation of water movements or collapses of buildings simulate physical laws in order to create the greatest possible reality effect. Movements of humans are much more individual and random and not computable in the same way. Animated movements of the body, poses and gestures are important and have to be aligned with reality again and again. But the most difficult challenge to creating realistic digital actors remains the face. It is the faces of digital actors that provoke the Uncanny Valley effect, the sudden decline in affective acceptance

of a computer-generated human. From birth, the interpretation of human faces is learned by humans. Faces and facial expressions and their interpretation are fundamental for communication with other living beings (Seymour, 2019).

Recent studies on what it takes to create "realistic" humans or human faces point to a number of areas where more research is necessary. The Delphi study conducted by Seymour et al featuring renowned experts in various fields of creating digital humans from the entertainment industry, points towards a re-thinking of the Uncanny Valley theory. The study's research question asks: "What needs to be done to be able to create human faces that cross the Uncanny Valley and can be effective in a range of contexts?" (Seymour, 2019). Whereas the original paper on the Uncanny Valley effect assumed that there was a connection between movement and the uncanny effect (Mori, 1970), the expert panel in this Delphi study supposes that it is the interaction of a digital human with the user or viewer which might reduce uncanny feelings. Furthermore, the study suggests that facial expressions and movements might be more individual than standard industry technology accounts for, which often relies on the FACS system and combinations thereof blended into action units (Ekman, 1978). The facial action coding system was developed by Paul Ekman et al and is widely used as a basis in facial animation systems based on BlendShapes. While this system provides a solid basis for realistic facial animation, more individualized approaches might lead to even more realistic effects. Another shortcoming of the FACS system can be found in the standard production pipeline. During a capture session, an actor is asked to act out the action units as separate poses in order to allow for their combination into various facial expressions during the animation process (Figure 1). The actor therefore has to segregate a facial expression into different muscular movements. In the experts' discussion, it was suggested that interrelations of different parts of the face might be lost due to this process as the human face is inherently non-linear and uses odd combinations of action units.

Figure 1. Actress with head-mounted capture rig and make-up tracking markers.

The most impressive possibility raised in the study is that the emotional interactions change the way we perceive avatars, digital humans or digital actors (Seymour, 2019). While a digital performance might be highly detailed and subtle, if the digital character fails to emotionally connect with the user or viewer, it might fail to be perceived as realistic. As described above, standard animation processes rely on performances from a lab situation. One solution that is used is to rely on method acting where the performer reenacts the emotional state of a character in a given situation. Other approaches might be to use existing two-dimensional audio-visual material of emotionally involved performances or situations and AI technologies to recreate facial expressions. Using artificial intelligence in character animation is a highly debated endeavor, although it is already common practice, especially in real-time animation. A number of studies and applications, such as those conducted by the Research & Development team at Filmakademie Baden-Württemberg, show the future potential of using AI to support the creation of believable digital humans.

Digital Actors in Film

Filmakademie Baden-Württemberg, a film school in Ludwigsburg, Germany, has a long history in digital animation, which at its core is highly related to innovation in Computer Graphics and its advances in research. In 2002, the Animationsinstitut was established as an autonomous entity within Filmakademie in charge of research and education in the areas of Animation, VFX, Animation & Effects Producing, Character Animation, Interactive Media and Technical Directing. Early research at Animationsinstitut has focused on applying schematics used to classify facial actions from psychology in 3D animation. Proceeding projects produced toolsets for efficient facial animation rigs which found application in a variety of projects such as the Digital Albert Einstein (Helzle, 2018). We will take a closer look at this production, explain the process and findings including a user perception evaluation and an outlook on other potential applications beyond film.

When creating digital humans, two fundamental basic concepts can be applied: the use of scanning technologies or an artistic approach. Scanners allow the capture of dimensions and also, in some cases, the reflectance properties of an actor. A wide variety of tools is available to perform digital scans, starting with consumer level cell phone-based LIDAR scans and moving to high end light stages (Debevec, 2012). Scanning is a good choice for an existing actor but offers little use when a human-like creature or a deceased person is to be created as a digital actor. In these cases, we need to rely on artistic interpretation and skill sets such as modelling, texturing, shading and, most importantly, rigging, which describes methods of deforming geometry.

A fully artistic workflow has been introduced in the Digital Albert Einstein project at Filmakademie (Helzle, 2018). Three short movies in a documentary style referring to quotes were created as an homage to the famous physicist. To build the digital asset the team started gathering the few existing photographs of Einstein and decided on the most desirable appearance. A physical sculptor was commissioned

to create a PVC and soft silicon cast as reference (Figure 2). The digital sculpting process involved detailed wrinkles, pores and facial hair according to Einstein's physiognomy.

A key innovation in the Digital Albert Einstein project was within its facial deformation system. Based on the Adaptable Setup for Performance Driven Facial Animation (AFS) (Helzle, 2004) a dense data model was generated for the basic deformation of facial muscle group movements. Those could then be employed to animate entirely new facial expressions. The adaptation process allowed the preservation of the non-linear characteristics of the facial muscle group movements. The basic concept was brought into a toolset to work within recent creation pipelines. This turned out to be very efficient compared to the industry standard workflow using linear interpolation also known as BlendShape animation. Additional simulation layers were added to realize skin sliding, stickiness of the lips and special deformation around the eyes due to the cornea bulge.

Figure 2. From analogue sculpt (left) to digital model (right).

An actor was casted to perform Einstein and have their face replaced by the digital actor in post-production. Though facial capture was evaluated during this production the results did not convince. Instead, the animator referred to the original performance, rebuilding it with animation parameters from scratch and added individual interpretations such as eye blinks and smiles on top of the original performance.

A user perception evaluation between the AFS and BlendShape approach was conducted to verify if non-experts could identify differences (Helzle, 2017). The results verified that the animations created with the AFS rig were perceived as more vivid, more expressive and with smoother transitions between facial extremes.

Compositing turned out to be more demanding than expected since the actor's physical appearance did not quite match Einstein's stature. To compensate for this effect warp nodes for slimming the body were applied. Additionally, the head shape, cheeks and forehead were aligned to better match the reference appearance. Tracking the head movement is key for integration of the digital face mask. This semi-automated process needed intensive manual intervention.

Production statistics estimated four months (77 days) for the 3D asset creation which includes basic geometry, animation rig, shader, dynamic displacements,

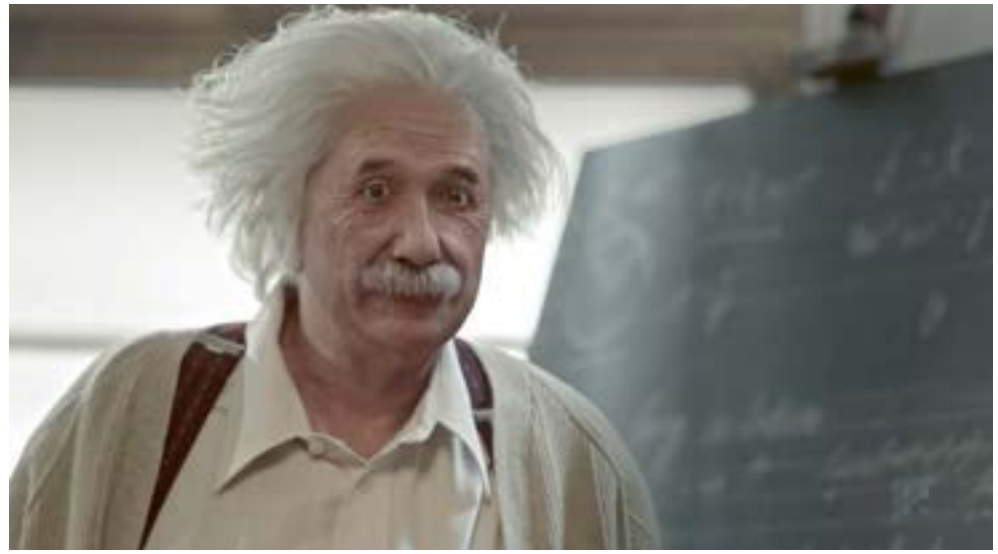

Figure 3. Digital Albert Einstein Episode: World Formula (Helzle, 2018).

facial hair and look tests. The 3 short films took another four months (76 days), including tracking, animation, shading & lighting, compositing, sound design and grading. These numbers confirm the efficiency of the proposed rigging system.

A goal of the Digital Einstein project was to advance artistic creation pipelines for digital actor creation as most tools in use are proprietary or require a massive hardware overhead. In this context we released the digital asset and example animations under Creative Common terms to the public (Helzle, 2018).

It appears important to consider that this work does not solely seem relevant for use in film and media. Filmakademie has engaged in research with psychologists to evaluate the use of digital human characters with believable facial and emotional expression for autism research (Arellano, 2017). The results led to new approaches in therapy using digital characters as stimuli. Another area of exploration for digital characters was an interactive conference guide for FMX 2011 (Helzle, 2011). The real-time digital character was realized including a dialogue system, synthetic speech to animation and a behavioural model. Guests could ask questions, which in some cases, like the weather forecast, were queried with live data in seconds.

As the Digital Einstein project points out, a lot of the tasks required to create a convincing digital actor can be automated. However, it remains an expert domain in which specific know-how is required. Digital actors in film are becoming more common practice but still require significant technical and financial overhead. This project was created in the eve of machine learning and artificial intelligence powered tools for creatives. While still different in approach and accessibility for use by artists there is an evident change in efficiency in tasks where Computer Graphics seems to have reached a plateau of innovation. The potential impact of these innovations will be discussed in the next section.

Artificial Intelligence – The Democratization of Expertise

In recent decades a tremendous amount of research and development has been spent on optimizing workflows to generate photorealistic, animated, virtual faces and digital actors that cannot be distinguished from real ones in a movie. Very specific shaders have been developed to imitate the subtle effects of translucency, the sub-surface light scattering of human skin, blood flow and more (Meka, 2019). Eyes in particular have had a lot of attention as the sophisticated structure and appearance of a human eye is difficult to recreate believably in CG. Only by addressing all these details can a believable visual appearance be generated. Facial expressions, movement of skin etc. requires a great deal of specialized artistic knowledge even when addressed with state-of-the-art VFX and animation tools in 3D and still remains challenging. Towards meeting this challenge, more and more CG pipeline steps have been assisted by real-world references. A high-density 3D scan of an existing face assists in creating the 3D mesh as discussed above. Often special capturing techniques like polarized lighting etc. are used to capture textures that can be used directly or serve as the foundation for further artist work (Meka, 2019). Facial motion capture has had a lot of attention too. 3D deformations of the face for animations can thereby be captured directly from the performance of an actor. This has been done with tracked facial markers for years, also marker-less solutions utilizing depth sensors e.g. from Apple iPhones can be used for this purpose.

Following this route, the question is if, for certain scenarios, a 3D model and sophisticated rendering is actually still needed to create a believable facial animation, especially when an actor's face should be replaced by a different one. This could be the case e.g. for facial replacements of stunt doubles, aging effects of the actor and many more.

With the rise of Artificial Intelligence and Deep Learning, the creation of digital faces which are not based on CG but on 2D information has achieved breakthrough results. These approaches require only little expert knowledge and significantly less effort compared to the CG tools. This initially caused mostly negative press, as it opened the door for misuse and fraud in a wide field from porn to politics (The Wall Street Journal, 2018). It is enormously important to discuss the ethical impact of this technology and make sure that its use can be identified and is transparently communicated. Nevertheless, it can be a very useful tool in VFX and animation (BBC, 2021).

First and foremost, the scenario in which a digital character is needed defines the feasibility of using AI technology. The current AI approaches require sample 2D footage of the face to generate, as well as a clearly visible face to be replaced. The mimic, pose and general performance is then transferred from the target performance to the face of the sample footage. Training data availability and preparation as well as artistic freedom and customization options play a central role in deciding for or against using AI to generate digital actors.

While the use case of DeepFakes lies in replacing the face of captured individuals with the face of another existing person, Filmakademie evaluated a new

scenario closer to the 3D animated digital actors' workflow and applied both techniques to the Einstein production.

From a previous production iteration, a fully animatable 3D model of Albert Einstein was used. Three episodes with a highly optimized, but 3D based facial animation were produced (Helzle, 2018). The question to be answered by the research team at Filmakademie was if DeepFakes can be used to create two additional, previously omitted episodes without manually animating and rendering the needed shots. In contrast to usual DeepFake applications, a CG rendered Albert Einstein was used as source training data, since there was not enough original video footage in good quality of the actual Albert Einstein available that could be used as training samples. A total of 660 semi-automatic generated facial expressions were rendered, showing the 3D Einstein with (a few) facial expressions, from different angles and with different lighting. While usually 3000 – 8000 samples are recommended, 660 seemed to work fine for us. It turned out that varying lighting conditions were more confusing for the network than helpful. Actually, the lighting should be as near as possible to the target material lighting and stay consistent. DeepFaceLab (DeepFaceLab, 2022) was used to train and generate the DeepFakes. After a total of around two weeks of training on an Nvidia A5000 graphics card with intermediate fine tuning to optimize details etc. the results looked promising enough to export and finalize in a composition in Foundry's Nuke. Apart from the final 2D output image, DeepFaceLab also provides an Alpha mask for the face mask for further processing. The results show that it is challenging to get perfect output, yet the AI approach provides an enormous step towards photorealism.

Quite a number of challenges remain to make these DeepFake workflows a convenient tool in the entertainment industry. Based on research and initially being used as a quick tool for amateurs, a professional production will put additional requirements on such tools. The currently existing imperfections are both on the technical and the user interface side. DeepFakes are not yet integrated into standard Digital Content Creation (DCC) tools. It is necessary to train the network and generate the final output within a command line application, sometimes enriched with a dedicated, yet not very streamlined, Graphical User Interface (GUI) for certain tasks. While this is an easy problem to solve either for a Technical Director (TD) or a software vendor when the demand is high enough, there are also technical deficiencies which exist that cannot be solved so easily as these are also based on hardware limitations.

Two of the most obvious shortcomings are resolution and bit depth, as the networks used to create DeepFakes are complex and require a huge amount of VRAM on the graphics card they are computed on. The maximum resolution that can be output for the same is usually around 1024x1024 pixels, often only 512x512 pixels (although this applies to the crop of the initial image only showing the face). The DeepFake frameworks usually include an AI driven super resolution network specializing in enlarging human faces to diminish this shortcoming, but such super resolution approaches might not satisfy the requirements of a professional production. Another shortcoming dictated by the graphics hardware being used, is the colour bit depth, which is widely limited to 8-bit. This is based on the usual assumption that

the final imagery will be exported from the DeepFake framework. Usually, the output requires some colour grading to perfectly match remaining facial skin parts of the original actor. For 8-bit imagery this will most probably result in colour banding and similar effects, some of which can be solved by carefully selecting the training source and target material and trying to address as many colour grading steps within the DeepFake framework as possible. But usually 8-bit imagery is a no-go for professional productions in compositing and colour grading. On the other side, both of these challenges are only hardware limited. Therefore, they will probably be solved sooner or later, as more powerful graphics cards are introduced. Already today these limitations might be solvable by shifting the computing to server or cloud grade solutions with a lot more computing power and VRAM, although this would also require a non-trivial adaption of the existing implementations that are mostly open-source.

Another limitation is that the AI network usually generates only a single 2D final pass. Traditionally, different light and render passes are generated from all standard 3D renders, assisting compositors to generate the final image in post-production. Without these passes, the creative possibilities are limited.

Aside from these shortcomings of the generated output, the overall pipeline also has limitations. Occlusions in front of the face in the target material usually impose a challenge for the generating network as it is based on the identification and tracking of facial landmarks (eyes, pupils, eyebrows, mouth, etc.). By manually masking occluding objects in the target material, the DeepFake frameworks often offer the possibility of solving this to a certain degree. Although for other cases the masking cannot solve this problem, e.g. if the face is hardly visible, for example when captured mostly from behind or in profile. In cases where the AI cannot find the facial landmarks, it will produce no results or completely unusable, distorted ones, leaving the user with empty hands.

Nevertheless, when carefully selecting the use case for AI driven face generation, even today and with already existing tools, highly believable facial animations can be generated, to the extent that they become indistinguishable from real ones. The key here is that it requires way less preparation time and only a fraction of the computing power. This especially becomes true if lengthy sequences or multiple sequences can be generated with a single trained network. The computing cost in "DeepFakes" lies in the (unattended) training of the network which will take days or even a few weeks on a single high-end GPU. But generating frames from a trained network is possible within a few seconds per frame. The technology is here and offers the potential to enable scenarios, especially in low-budget productions, that have previously been impossible. Another use case for such technology could be the use of DeepFakes to replace blurred and obliterated faces in documentary material, where the protagonists do not want to reveal their identity. Through DeepFakes, their emotions and expressions could be preserved while their identity is kept anonymous through another actor or individual "lending" their face to the protagonist. Of course, this also raises ethical and legal questions which will need to be addressed and discussed.

Apart from AI driven facial animation, machine learning can also be used to generate complex human walk cycles (Starke, 2022). Approaches out there learn based on motion capturing recordings. Different styles and even obstacle avoidance can be incorporated into a trained network. After training, a digital actor can be controlled and directed in real-time in a game engine, while copying the style the motion capturing actor has provided. Smooth transitions between different walking styles (running, walking etc.) and interactions like crawling through or stepping over an obstacle are automatically generated without the need to set up a locomotion tree or something similar.

AI is already being adopted in real-time as well as in offline movie production workflows. Mostly coming from a research background, they currently lag in ease-of-use and in providing the flexibility and user controllability needed to create sustainable tools for professionals and newcomers alike. But it will only be a matter of time for these problems to be resolved. The question remaining is where the previously required expert knowledge comes into play. Will AI approaches render them useless as they become superior to previous CG workflows? Ideally, they will influence the AI workflows towards creative controllability, but the concerns remain that they will democratise expertise towards uniform, repetitive content. Addressing this will require artists and developers to combine their efforts and ideas.

It seems that in order to be convincing, digital humans more than ever need to be hybrid characters, drawing on the classical artistic skills of key-frame animation, the performances of actors, scanning and recording technologies, classic CG techniques and artificial intelligence, all embedded in good storytelling, to achieve a believable and relatable result.

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To the Other Side with Bees and Angels

ULLA TAIPALE

ABSTRACT

The mythical bee flies over and throughout the course of human history, leaving traces of the coexistence of insect and human cultures in numerous writings and artworks by thinkers, creators and philosophers. Bees have been documented in multiple forms, evidencing the human fascination towards their life. Many of those who are inspired by bees, also point out their psychic and supernatural character. Their divinity has been speculated upon since pagan times.

Today, facing the complexity of the Anthropocene, beekeepers, farmers and honey-lovers have woken up to the reality of semi-feral bees vanishing from their hives. Even though diversity among the beekeepers flourishes, the number of bee populations and bee species decline. Scientists and beekeepers are eager to demonstrate that this can be explained and cured by man-made solutions, however the phenomenon remains unresolved. The eternal bee featured in the ancient mythologies, biblical parabolas and other literature worldwide has gone extinct.

Science fiction and mythological writings reveal less measurable alternatives for bee loss. While the tendency of our society is to categorize honeybees as production animals and highlight the utilitarian values of these insects, many authors express the philosophically and spiritually rich connotations of bee life and their importance as *companion species*.

The Other Side artwork by Ulla Taipale, commissioned by Fundació Joan Miró, was installed in 2018 in a historical cemetery in Barcelona, Spain as part of the *Beehave* art exhibition. The work demonstrates the cultural and philosophical value of the bee. Along the walk through the cemetery, the audience comes across angels, sculpted in stone, and multiple written expressions that bees have evoked in authors from Antiquity to the present day. Angels, like bees, have a stable standing in the mythological, religious, and secular literature and arts throughout the human history.

The Other Side aural space creates an opportunity for speculations around the material, theoretical and spiritual connections between bees and angels. It asks if these winged creatures could in the end be one and the same?

This article explores how the "existence" of bees, angels and humans is intertwined, forming a complex ensemble of different agencies and beliefs around life and death, practice and theory, fiction, faith and fabulation, with the honeybee as the leitmotif. The article is illustrated by a series of photos taken in the cemetery of Poblenou in company of angels and Lotta Petronella.

Beekeeping is a practice-based agricultural and cultural activity, where hands-on work with living and dead insects is mixed with theory. To understand fully the written material, one should be a practitioner, and, reading and sharing one's experience with others is helpful for the practice. Companionship with bees provides excellent means for the reconstruction of our ties to the natural and spiritual worlds, which has degenerated over the last one hundred years.

KEYWORDS: honeybee, literature, angels, urban beekeeping, hybrid storytelling, *Melliferopolis*, *companion species*.

LITERATURE AND THOUGHT ON BEES
The Origins of Human-Bee Cultures

Our curiosity and our need to understand other forms of intelligence have brought about, among other interests, the study of the life of bees in different centuries and cultures. There is a striking number of thinkers who have shown an interest in the ingenuity and the extraordinary capacities of bees, in addition to the properties of honey, propolis, and wax for healing, and as preservatives. Since ancient times, these insects have also been associated with immortality and the ability to communicate across parallel worlds.

The mundane reason for human interest towards the bees can be attributed to the precious products they produce. Honey, the viscous substance created and stored by various species of bees, is the most concentrated natural source of sweetness. The literature around bees and their life emerged first in relation to the coveted honey. The first literal evidence of the collecting and appreciation of honey is said to be a Sumerian[1] love poem that describes the bride's and bridegroom's encounter at their bedchamber as "honeysweet" and "honey-filled" (McGee, 2004, p. 647). In classical Greece and Rome, honey was a rich source of food and culture, and the Greeks related its consumption to ceremonies for the dead and the gods. Since then, numerous mythologies and legends in cultures around the world refer to the honeybee, *Apis mellifera*. Humans and honeybees have a long history together, and in territories with a long and severe winter, they only survive thanks to the beekeepers. However, it is because of the intensive beekeeping, that they are also now disappearing at an alarming rate.

> *Just think for a moment; bee-keeping is so ancient that no one can say today from any external evidence what bee-keeping really was when the bee was still undomesticated. For the most part people know only our bees, I mean the European honey-bees, and they know only domestic bee-keeping.*
> *Natural History books write mostly about the bee which is universally spread in Europe, as "the common hive-bee." Thus one only knows about domestic bee-keeping. This is well worth our attention, gentlemen, that one knows only domestic bee-keeping; one is not aware what it was all like when only Nature herself was at work. Bee-keeping is very ancient.* (Steiner, 1923, pp. 35–36)

The Lost Eternity

In his works, Aristotle writes about 581 species of animals. After humans, bees are the most cited species[2]. He considers the beehive as a microcosmos, and by studying the activity of the hive, he tries to extrapolate his observations and understand the

1 4500–1900 BC
2 Bees are mentioned in many works of Aristotle, for example in *History of Animals, On Generation and Corruption and Categories* (Aristotle, trans. 1912).

Universal Cosmos. Aristotle does not pretend to offer practical instructions or scientific studies around the beekeeping or bees, but instead, a metaphysical view of the Universe (Tavaillot & Tavaillot, 2017, pp. 39–42).

He finds bees are prudent, political and divine beings by nature. This makes them very close to humans, though, human beings must cultivate themselves and rehearse, to reach the level of the bees (Tavaillot & Tavaillot, 2017, p. 53). The best demonstration of their divinity, for Aristotle, is the continuity of the species and the way the bees reproduce. Until the 19th century it was not understood how bees breed and how the queen is fecundated. It was not even known that the queen is female until Jan Swammerman (1637–80) placed bees under the microscope and discovered their real sex.

Over two thousand years ago, antiquities poet Virgil (70–19 BC) dedicated the fourth book of his work *Georgics*, to apiculture. Many of the methods and practices he describes are still used in contemporary apiculture. As a farmer, Virgil had a practice-based agricultural vision to his beekeeping, but at the same time, he makes philosophical notes, observations and direct comparisons between the societies of bees and humans. The trans-disciplinary approach of Virgil coincides with that of Maurice Maeterlinck, a Belgian playwright and poet born in the 19th century. Both were beekeepers, and yet were able to see beyond these insects as mechanistic production animals.

Virgil and Maeterlinck had a personal relationship with the bees they enthuse about. The importance of using a combination of practice and observation with theoretical research is emphasized by Aristotle, who had been read and blindly repeated by a gang of philosophers and natural scientists until the 17th century, before the truth of the gender of queen bee and worker bees was revealed (Tavaillot & Tavaillot, 2017, p. 52).

The spirit of the Industrial Revolution affected beekeeping practices in the late 19th century and continues to today. The bee-related literature published before the Second World War did not foresee the major problems of the present – the parasites, sickness, and big losses of colonies in different parts of the world. But, in 1923, Rudolf Steiner gave fifteen lectures to the workmen at the *Goetheanum*, Dornach, Switzerland under the title – *The Functioning of Spirit in Nature and in Man*. In the lectures dedicated to beekeeping, Steiner remarks on the risks of the modern beekeeping practices for the future of the honeybee species:

> *But here we come to the whole question of artificial bee-keeping. You must not think that I am unable to see – even from a non-anthroposophical point of view – that modern bee-keeping methods seem at first very attractive, for certainly, it makes many things much easier. But the strong holding together – I should like to say – of one bee- generation, of one bee-family, will be impaired in the long run.* (Steiner, 1923, p. 10)

Meanwhile, the scale and size of individual apiaries expand with the increased production targets of bee products. The surrounding environments become contaminated and the stories around the bees change. Since people became aware of the Colony Collapse Disorder (CCD) in 2006, plenty of novels and films speculating

about the mysterious dissipation have been published. The CCD is a phenomenon that occurs when most worker bees in a colony disappear and leave behind a queen, with plenty of food and a few nurse bees to care for the remaining immature bees. The phenomenon hit the beekeeping industry in United States in 2006 and was then reported to be happening in many other countries across the world. Although colony loss from CCD has declined and it is no longer the main concern among beekeepers, it remains an unsolved mystery (EPA, 2018).

The documentary film *More Than Honey* (Imhoof, 2012) offers a heart-breaking glimpse of the consequences of weakened bee populations from three different continents where honeybees are in mass decline, through death or disappearance. The film features apiaries sited in almond fields of California, in the Austrian and Swiss Alps and in China where, in some areas, there is a need to complete pollination using a human labor force (Williams, 2016). Science fiction and fiction novels of the 21st century, not to mention the scientific and non-fiction literature, cannot miss the fact that bees are endangered. Popular novels such as *Enkelten verta* (The Blood of Angels) by Finnish Johanna Sinisalo (2011/2014), *History of Bees* by Norwegian Maja Lunde (2015); or the famous episode of the Netflix series *Black Mirror, Hated in the Nation* (Brooker, 2016) reflect the alarming situation. They speculate on our long-lasting coexistence with the bees and a future without them. Bee related research, especially the big discoveries about their biology made enormous strides in 19th century, when their life was not yet affected by environmental degradation. Little by little, from 1850 to the present, the imagery and literary related to the bee life converted from a cornucopia full of life, discovery and never-ending possibilities to a grey despair.

BEES AT THE OTHER SIDE

I started urban beekeeping activities in 2012 within the *Melliferopolis*[3] project. The objective of *Melliferopolis – Honeybees in Urban Environments*[4] is to study the life of bees and humans in cities, combining artistic and scientific research, tools, and expressions. The project bore fruits of many kinds and had various outcomes from small-scale artistic interventions, exhibitions, experimental beehives, academic courses to lectures and participative workshops, from concerts and public apiaries to an international community of creative bee enthusiasts.

In 2016 Christina Stadlbauer and I curated and organized a summer-long event, *Melliferopolis Fest*, that consisted of a *Series of Events for Bees and Humans* in Helsinki. *The Other Side* audio space was exhibited for the first time, installed in a semi-managed natural spot in Linnunlaulu district in the heart of the city. *The Other Side* is a site-specific artwork, based on artistic research and installed in an outdoors public place. It offers visitors the possibility to listen to bee-related literature at selected sites using an internet application. *The Other Side* has been inspired by the novel *Blood of Angels* by Johanna Sinisalo, a Finnish science fiction author. A family

3 Apis mellifera = honeybee in Latin, Polis = city in Greek
4 See Melliferopolis (2024).

tragedy and the decline of the bees intertwine in the novel in a fascinating manner, offering a great amount of knowledge about bees by telling a story in which the protagonist is able to shift between two parallel worlds assisted by a dead queen bee. The world where the dead and the bees are moving to from "our" world, is called by Sinisalo *Toinen puoli* (The Other Side).

While the tendency of our society is to categorize honeybees as production animals and highlight solely the utilitarian values of these insects, many authors bring to light the philosophically and spiritually rich connotations of bee life and their value as *companion species* (Haraway, as cited in Gane, 2006). The artwork emphasizes those aspects within our long history together with bees.

The second edition of the artwork was installed in the historical cemetery of Poblenou in Barcelona, commissioned as part of the *Beehave* exhibition (Fundació Joan Miró, 2018). Seven angel sculptures were paired with fragments from literary works, selected to illustrate the role played by bees in the words written by great thinkers from Antiquity until the present. The text fragments can be listened to by using an augmented reality application *Arilyn* (n.d.), through the visitor's smart device, and are available in Catalan, Spanish and English[5], read by native speakers. To activate and listen to the audio recording, the visitor must scan a sign plate with a tailor-made illustration[6], featuring flower and bee ornaments like the figures carved in the tombstones of the cemetery.

In 2019 the work was commissioned by Swiss *Utopiana* organization in Geneva and, in 2022 it was shown in the *Estazione di Topoló* art festival in Italy.

ANGELS VS BEES

The connections of bees to other mythological creatures, and in particular angels, led me to think of a cemetery in Barcelona as a perfect site to install the *The Other Side* audio space. In the 19th century, Catalan bourgeoisie families commissioned the most skilled sculptors to decorate their pantheons and tombs and often the figures represented angels, that have been called the messengers between the gods and humans and other earthly beings since the early times.

The state of the marble sculptures in the Poblenou cemetery varies. Some have been recently restored and others have frayed at the edges – this can be seen particularly on the wings of the angel figures. Those fine and exposed flying instruments of the mythological creatures, representations of runners of God have deteriorated. This is a consequence of a powerful cocktail of the air seasoned by sea salt and the sulphurous air pollutants originating from local industries at the turn of the 19th and 20th century[7]. It is said that the air quality of Barcelona is among the worst in Europe, but the current mix of pollutants does not wear marble figures down as efficiently as it does the human respiratory apparatus.

5 Readings by Emilia Esteban Langstroff (Catalan), Andres Marín Jarque (Spanish), Kira O´Reilly (English) and audio recordings by Kirill Lorech.
6 The illustrations were developed in dialogue with Spanish illustrator Andrés Marin Jarque.
7 Guardans, R. Personal communication, May 6, 2018

Figure 1. Marin Jarque, A. (2018). Sign illustration for The Other Side. To listen to the text fragment from *The Blood of Angels* (2011/2014) by Johanna Sinisalo, please scan the sign using the free Arilyn app.

The raddled wings remind us metaphorically about the lifespan of bees. Their lives can be measured by the stroke of their wings, by the kilometers they have flown. During the summer, during the frenetic period of collecting nectar and pollen from the flowers, the bees only live for a few weeks. The wings wear away and without their flying apparatus they die.

> *During the active season, the lifetime of a worker is five to six weeks. Overwintering worker bees may, however, live for four to six months. Whatever their life span, worker bees usually confine themselves to one task at a time, working without pause. If they are field bees, they may be scouts or collectors. Scouts look for sources of nectar and pollen. Once suitable sources are located, the scouts recruit additional foragers. Nectar collectors, pollen foragers, water gatherers or propolis gatherers work so single- mindedly at their jobs, they will not stop even to collect honey placed before them. During the day, one may see hundreds of spent workers, wings ragged, returning wearily to the hive. Worker bees are aptly named as they literally work themselves to death. Death occurs following approximately 500 miles*[8] *of flight.* (Skinner, 2009)

Bees are said to stay preferably within the diameter of three kilometers around their nest. They look for blossoming flowers and if those are found in the vicinity of their home, they don't venture further.

From the beginning, my knowledge of popular beliefs related with bees and angels inspired me to situate *The Other Side* artwork in a cemetery full of angel sculptures. Later, the need for a deeper understanding and clarification of the origins of the many similarities between these two winged creatures took place. It compelled me to question the causality of those affinities. Whether bees and angels in the end are one and the same – one in matter, in substance and, another, in spirit?

8 500 miles= 804,672 km

Figure 2. Marin Jarque, A. (2018). Sign illustration for The Other Side. To listen to a text fragment from the *Voices of Chernobyl* (1997) by Svetlana Aleksiévich, please scan the sign using the free Arilyn app.

The Biblical Bee

Bees and angels are profusely cited in the *Bible*. However, bees that are constantly present in the *Old Testament*, disappear completely when Jesus appears in the story. He is given the exclusive right to communicate between God and humanity – and the bee among other beasts is simply reduced to an earthly being. Soon, the bee reappears in writings and the parabolas of Christian philosophers, as a small life guide or a role model for humans. However, this time she is portrayed very differently when compared to pagan times (Tavaillot & Tavaillot, 2016, pp. 98–100).

The existence and materiality of bees is an indisputable fact. Since Antiquity they have commonly been referred to in mythological and mythical writings. Angels though, are mythological beings, as there is no scientific evidence or material trace of their real existence. In the history of Christianity, the angel has been a controversial figure. Angels' ranking as between God and people, their appearances to people, and people as active players in relation to angels, have caused differences in opinion. Their existence is granted (due to their presence in the *Bible*), but the reflection around angels has not been encouraged by the church because the speculations around them are considered heretical (Utriainen, 2014, p. 37).

Angels are described as spiritual beings who neither eat nor excrete. They are genderless, pure souls, represented in Art as statuesque, ethereal figures, or childish chubby cherubs. There is an ambiguity around their sex, comparable with the confusion Aristotle and his contemporaries had about the gender of bees. Fashions have changed throughout history; the first angel representations were male, then they became androgynous, and from the 17th century, their figures changed to feminine ones (Seppälä, 1995, p. 278). During the same epoch, human science discovered that the queen bee and the worker bees are female. In artistic manifestations angels appear with and without wings.

Figure 3. Taipale, U. (2018). Lotta Petronella at The Other Side. Cemetery of Poblenou, Barcelona.

In 2018, a monthly supplement of *Helsingin Sanomat*, the biggest newspaper of Finland, dedicated a long article to the return of angels, claiming they are more popular in Finland than Jesus Christ. An "angel boom" is currently being observed in Finland amongst other countries. According to research by the Finnish Church Research Centre, 47% of Finns believe in angels, or in the probability of their existence. Only 37% of Finns believe in the resurrection of Jesus (Pallaste 2018). Angel gurus' appearances attract big audiences, and in Finland around 94% of attendees are women (Häkkinen, 2017).

The Common Urge for Angels and Bees as Companion Species?

Angels have become popular among people searching for spiritual anchors, comfort and enlightenment in a troubled world. Bees that need to be saved are a perfect medium to reconnect to Nature and to understand the incomprehensible, both in urban and rural areas. Men are rather fonder of bees than angels. Beekeeping in Finland has been popular among males over the age of 60, but the upsurge of urban beekeeping has attracted younger city dwellers, among them many women. Female beekeepers still remain a minority.

Both angels and bees provoke fear and respect in human beings. I have been told stories about personal encounters with bees in a moment of grief or danger, bringing consolation or courage through their presence. Similar stories are narrated about human-angel encounters (Seppälä, 1995, pp. 245–266). Both meetings are described as unexpected, even intimidating, but at the same time, transmitting positiveness. In her novel *The Blood of Angels*, Johanna Sinisalo compares bees with angels:

Figure 4, 5. Taipale, U. (2018). Lotta Petronella at The Other Side. Cemetery of Poblenou, Barcelona.

If I had to name a product of evolution that could be a result of intelligent design it would be the bee. The importance of bees for the ecosystem of the entire planet is so significant, so essential, that it is as if they were custom-made especially for the task.
We think we have the blood of angels in us. In action how like an angel. The paragon of animals. But if any species has the blood of angels, the bees do.

> *The wisdom of bees is the wisdom of the super-organism. Even I don't mourn the death of my individual cells, sloughing off from the walls of the arteries, ceasing to function, moving on in the great circle of life. What's more important is that the organism, the entirety of it, is preserved. The hive, the tribe, the society. The ecosystem.*
> *Individuals have to be sacrificed in order for worlds to continue. Bee colonies don't hesitate to throw out damaged individuals if they don't know enough to leave on their own.*
> *Bees – individual bees – know when to leave the nest.*
> *And the entire super-organism knows when to leave, too, if it's forced into a corner. It has great understanding and even greater abilities.* (Sinisalo, 2011/2014)

Both Sinisalo and Maeterlinck, as well as Steiner, exalt the bees' lack of individualism, their ability to make decisions for the good of the colony and for future generations to come. Philosopher and biologist Donna Haraway argues for solutions to decelerate the growth of the human population, that for 2100 is foreseen to break the 11 billion mark. As an alternative for the human desire to procreate in an unsustainable way Haraway proposes *Making Kin, not babies*!

> *...Making kin and making kind...stretch the imagination and can change the story, she writes.* (Haraway, 2016, p. 103).

Haraway urges for "making kin", not only with our own, but also with other *companion species*. The human-bee co-existence and *becoming-with* the bees has enabled multispecies storytelling opportunities in multiple formats, avoiding staying within the borders of any particular discipline or category (Haraway, 2016, pp. 9-29). Bees match the description of Haraway's *companion species*, but they are also production animals, lab and wilderness animals. In many of the places they live, they need to cohabit with humans. This reciprocal possession is crucial in case of the bees: *Possession – property – is about reciprocity and rights of access. If I have a dog, my dog has a human...*, *writes Haraway in The Companion Species Manifesto* (2003, pp. 53–54). If I have a beehive, my bees have a human. But are bees better without one?

Writings from all times and cultures indicate that the bees, as intelligent as they are and with such remedies to defy the death, might also have the answers for *staying with the trouble* (Haraway, 2016). Yet, it will not be so easy to convince them to stay with us. We, who totally screwed up the earthly systems are probably not suitable to be called **beekeepers.** Who is keeping and what?

WHERE ARE THE BEES?
The Extinct Eternal Bee and Mourning the Loss

Steiner predicted the problematic nature of the turn, seeing how the modern beekeeping practices manipulated the long-standing lifestyles of the bees. Bees are dying for many reasons. In many cases, the primary reason for a weakened bee population and their elevated death rates is the deterioration of the world, the loss of habitable environments.

> *Mourning*, explains Thom van Dooren in his book *Flight Ways* (2016), *is about dwelling with a loss and so coming to appreciate what it means, how the world has changed, and how we must ourselves change and renew our relationships if we are to move forward from here.*

In contrast, the life expectancy of humans is increasing. Beekeeper and artist, Christina Stadlbauer observed bees in urban environments for over 10 years:

> *But now we experience something totally different. It is very rare that the beekeeper can say that the colony is eternal...*
> *...The hive was eternal, and the beekeepers were passing away, and the hive passed from one beekeeper to another...Now, the people get older and older and older, and the bees die off like flies.* (C. Stadlbauer, personal communication, June 4, 2018)

The capacity for mourning is not a human specialty. People and non-humans do not only mourn the loss of companion species, but also places and lifeways (Haraway, 2016, p. 38).

Illustrative Acronyms

Colony Collapse Disorder, **CCD**, the mysterious and disquieting phenomenon that has been mentioned several times earlier, deserves to be discussed in more detail. Sinisalo's *Blood of Angels* speculates about paranormal or psychic explanations for vanishing bees, challenging the scientific or rational reasoning. Given the fact that bees have been universally and historically attributed powers that help in finding their way to intersect parallel worlds, should the medical or scientific explanations be the only ones to be taken into consideration?

The Blood of Angels narrates a meeting of Finnish beekeepers at the beginning of the 21st century, where different explanations around CCD are discussed. An older beekeeper questions the name given to the phenomenon, and renames it **PPB**, meaning Piss-Poor Beekeeping. His theory is, that bees are tired of the lifestyle they are forced to experience and thus they clear off. If this was a conscious collective decision, asked the other beekeepers, where were they going? (Sinisalo, 2011/2014, p. 93). Are "vanishing" bees migrating to the existing Other Sides?

> *Human have looked at the world, pried ever deeper into the secrets of the cosmos and come up with bold theories on the nature of time and space – how there are an untold number of possible worlds, all of them overlapping, or side by side, or twined around each other like snakes in winter. To people, these are just theories.*
> (Sinisalo, 2011/2014, p. 92)
> *It's pretty obvious that if there are such things as portals, doors, thin places between parallel worlds bees are perhaps better equipped to find them than any other creature. They've probably found myriad gateways over many millennia, endless untouched worlds, and colonized them without humans.*
> (Sinisalo, 2011/2014, p. 193)

But then, mundane theories by scientists and beekeepers named CCD as a type of a disease to be diagnosed and treated. Disease is a sickness that has a medical explanation. It also has a biopolitical designation that is defined, categorized, and managed by institutions and actors. Some scientists have concluded that the bees' immune system is collapsing, similar to that of humans in cases of AIDS (Moore&Kosut, 2013, pp. 48–49). *Complex conditions, caused by stressful environmental conditions highlight the postmodern demands of fast-paced, technologically driven global economic systems, and the ways in which some living organisms, (including bees and humans) are unable to adapt to them* (Moore&Kosut, 2013, p. 52).

Another alternative name for **CCD** is *Cash Cow Discovery*, indicating the political, financial and contentious nature of the bee issue. The naming points to the infighting and competition for funding and patronage to solve the mystery. Depending on the cure or solution discovered, the sales of pesticides, pharmaceutical products or other remedies promise to keep the bees "visible" and under control – and justify neatly the production and sales of the helping cures (Moore&Kosut, 2013, p. 54).

Despite the efforts to find the reasons behind CCD, an airtight explanation has not been found. More than 15 years have passed, and it is still an unsolved mystery as well as a headache for humans. Lately, other bee scourges have occupied beekeepers and scientists. Entomologist and researcher Diana Cox-Foster at USDA (United States Department of Agriculture) offers a new acronym, **PPPP** for the current state of the bees. It stands for the combination of *poor nutrition, pesticides, pathogens and parasites* (Milius, 2018).

CONCLUSIONS AND DISCUSSION

As Rudolf Steiner preached to the workmen in 1923: keeping bees following modern practices would cause their disappearance within the next 80–100 years. The bee as a species is not yet extinct, but the eternal bee will take some time to re-migrate from the other side, and this might happen only after humans go extinct. One of the *companion species* of the bees, the people, can do without honey, but they cannot do without pollinators.

The migration of the bees to the other side needs to be prevented, not by raising barricades, but by learning from mistakes. The concept of *staying with the trouble* by Haraway advises us to critically study past experiences and, radically change our practices and strategies to deal with the topic of the bee.

This could mean, among other things, strategies to convert urban nature into a more livable environment for us all, to activate city officials to do less anthropocentric city planning and work towards 'weedier', more porous and healthier urban spaces. This would create better environments for bees, for other pollinators, and thus also for humans. It would bring about refuges not only for humans, but also for non-human refugees. Furthermore, it would change the environmental policies for the best for all of the companion species. Using the words of Haraway: *I am not interested in reconciliation or restoration, but I am deeply committed to the more modest possibilities of partial recuperation and getting on together. Call that staying with the trouble.* (2016, p. 10)

An unexplained phenomenon such as the disappearance of bees makes people uncomfortable. Rational explanations for the commonly named Colony Collapse Disorder are still being searched for, to be able to explain this mysterious occurrence that converts something extremely tangible and alive into the intangible, a material, buzzing colony of flying insects into a void, silent space.

The Other Side setting at the cemetery of Poblenou, between the stony angels and literal bees inverts the normal mindset where the bees are material insects, and the angels are ethereal and spiritual creations. In the cemetery, the angels are tangible, and the imaginative bees are drawn in the air through the timeless work of thinkers, writers, and philosophers.

The work coincides with the current era, with humans looking for reconnection with nature and unearthly phenomenon, materially and spiritually, hands-on and hands-off. To consider that bees and angels would be one and the same might not be true. But we can find similarities in the way bees and angels appear as a medium for human effort towards a deeper understanding of life, and thus, the quest for wellbeing or at least surviving mentally and physically in our epoch.

One of the conclusions is a starting point for a conversation about the need and the demand for our society to reconstruct our relationship and ties to the natural and spiritual worlds which have been weakened and degenerated over the last one hundred years. Some people stretch out to invisible angels and their energy, and others get intoxicated by the scent of a beehive.

With the question of the linkage between bees and angels, we are in the presence of the unknowable. From an agnostic point of view, something that is unproven cannot be declared untrue. Many ancient cultures advise people not to take a stand for *which one has no scientific grounds for professing to know or believe* (Huxley, 1869).

Sañjaya Belatthaputta, Indian ascetic teacher, philosopher and contemporary of Buddha, was asked about the existence of another world – *The Other Side* – after death. His answer is an exhaustive and comprehensive way to conclude this article.

> *I don't think so. I don't think in that way. I don't think otherwise. I don't think not. I don't think not not. If you asked me if there isn't another world... both is and isn't... neither is nor isn't... if there are beings who transmigrate... if there aren't... both are and aren't... neither are nor aren't...* (Sutta Piṭaka, 1997, Evasion, para. 2)

Acknowledgements:
The article includes parts of a previously published article in the thematic Issue on Death of Research in Arts and Education (RAE). Taipale, U. (2023). *To the other side with bees. Research in Arts and Education*, *2023*(2), 62–75. https://doi.org/10.54916/rae.126044

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The Sonic Laboratory: What is it, and How Could it Influence Sound Art?

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ABSTRACT

Bruno Latour's essay *Give Me a Laboratory and I Will Raise the World* (1983), describes the laboratory as the place in science and technology where innovation happens. From the depth of the lab, society is directly modified. This essay examines the power of the laboratory to transform society, or of rebuilding the system in which it is embedded. Following such reasoning, this essay will make a case for how the transformations in culture, capital, and society that occurred during the 1990s are part of a history from which we can explain the emergence of laboratory spaces such as hackerspaces, media labs, and the less-favored sonic laboratories. Nevertheless, there are qualitative as well as quantitative differences between such places. Since their appearance, sonic laboratories have been aligned, for example, with critical and alternative practices, thus indicating a separation from the neoliberal economies of private sector galleries and established cultural institutions in the public sector (Jaron Rowan, 2015). Reacting against these, the sonic laboratory is often characterized by using open source and digital media and focuses on radically transforming production, denouncing how the capitalistic market speculates with the value of art objects. The sonic lab offers a confrontation with the methods of capitalistic technologies, making its production more affordable, and also providing models of collaborative practices which encourage experimentation and creativity in the curation of sound arts. The sonic lab offers practices of instrument making that make production more personal but located in a community. Such labs can address new institutional opportunities in the humanities to engage with practice-based knowledge creation and extend their mission to include tools, techniques, and a new curatorial scope.

KEYWORDS: hackerspace, media lab, science, technology, sound art, sonic laboratories.

1. Introduction: Laboratories in the Art, Science, and Technology network

The most common and well-known definition of "laboratory" is related to science and also to laboratory studies (LS), which have emerged as a mix of science and sociology. LS is interested in the study of the lab but from a sociological point of view. LS analyses the context of the laboratory's production and how it affects and is related to society. LS reached a turning point with the works of Latour, Lynch, and Knorr Cetina. Latour and Woolgar, who researched in a biochemistry laboratory, made key contributions to the network of laboratory studies.

Latour and Woolgar were based at the Salk Institute in southern California, while Knorr Cetina worked at the University of Berkeley. Latour, who seemed unaware of the sociology of science and who never seemed interested in science, adopted a "naïve" ethnographic approach to understanding laboratory activity. In contrast, the German sociologist Karin Knorr Cetina studied a biochemistry laboratory in Berkeley and looked into the informal, practical reasoning of researchers in a work situation.

According to Andrew Pickering (1992), LS analyzed science as both "practice and culture", as opposed to the study of scientific theories and ideas. Nonetheless, a laboratory is also a place of scientific production, but insufficiently explored. The laboratory is a sort of standard organization of the "knowledge society", with the ability to act on the world of objects. Its dynamism arises from its capacity to reconfigure entities from the natural to the social world.

Dominique Vink (2007) defines the laboratory as a reconfiguration space and so coincides with Latour, who remarks on the transformative capabilities of the lab, from nature to society. Also, Vink defines the laboratory space as an active system. Laboratories are made up of human groups that are more fluid than industrial and bureaucratic organizations. As Verena Kuni (as cited in Lenhard, 2005) observes, the laboratory constitutes the "*framework for the scientific examination of a phenomenon*" and also a "*place of transgression*".

According to Bruno Latour (1983) there exists a division between organizations, institutions, and public policy, on the one hand, and scientific disciplines on the other. So, a lack of understanding of different opinions leads to extreme internalism in science. Latour's purpose was to demonstrate that laboratories are built to destabilize the difference between the macro and micro, the inside and outside. Latour studied the reception and success of Pasteur's laboratory in 1881, which made more progress and was set up "on-site". Then the "on-site" laboratory was transferred back to the workplace at the Ecole Normale Superieure. From then the scientists in this lab talked with more authority, becoming a hindrance to the requirements of the other laboratory., and amplifying the interest of external agents. "*Suddenly people were manipulating new objects and so acquiring new skills in a new idiosyncratic ethic*", says Knorr Cetina (1981). Pasteur's laboratory applied what is known as imitated variation. The success of it is because of a double movement, from the lab to the site, and from the site to the lab, adding the manipulation of new materials.

But, how can laboratory practice be extended? Only by extending the laboratory by itself. Extended into a village, from the lab to the site, to the city; it is an extension of the lab to the outside. However, for the media, it was not seen as a practical movement; it was a prophecy. What the press validated was the inside/outside relation, but in reality, there was step after step, an event that was possible, but not a miracle. Misguided versions of scientific activity come from overlooking this . Such displacement of laboratories became a national miracle when it was not.

However, Latour states that the lab is a moment in a dynamic process. The laboratory modifies all other actors, including society. In the beginning, there was distrust in science because of the separation and differentiation of the inside/outside. However, now, there is no differentiation. In science and technology, innovation

happens in the laboratory. From the depth of the lab, society is directly modified. This states the power of the lab to transform society, rebuilding the system in which it is embedded. The transformation of society originated in laboratories, which are places that also renew politics, and alter the composition of society because of the very content of the trials made within their walls.

Latour proposes a definition of the laboratory, which lies in its transformative social capacity. Labs have political strength, and sociological studies have found that what makes science so successful is the way it is expressed through texts and inscriptions. What is interesting here is how the strength is gained in laboratories to transform and displace societies. The reason why people pay so much for laboratories, which are ordinary places, is that these are places of technological devices that invert the hierarchy of forces in society. Making instructions readable and visible, permitting the accumulation of knowledge, and that is a condition for acceleration in society.

Latour defines the way we approach science and how sociological science ignores the transformative capacity that labs have. Because laboratories make the relevant changes happen, we may remember that it is also the universality of society that permits this construction of social change. That is why Latour (1983) declares: "*Give me a laboratory and I will move society*".

A lab in science is identified as a place for doing experiments that resemble reality. However, from the 1970s, a surge of interest in the notion of lab sets it as a space in culture. With its production, culture constructs society. What the laboratory does is erase this complicated difference between the inside/outside and works to reshape society in innovative conditions. That is what gives prestige to the labs and makes them grow their economic potential, which at the same time grows their technological capabilities. Moreover, the production of written instructions transforms the lab into a place of culture with literary instrumentation that enables for social interference.

2. Hackerspaces and Media Labs

The transformations in culture, capital, and ecology in the late 1990s contextualize the history of the emergence of do-it-yourself (DIY) laboratories, hackerspaces, media labs, and also, sonic labor-atories. From the depth of the lab, society is directly modified. This defines the power of the lab to transform society, rebuilding the system in which it is embedded. As Latour says, there is a division of labor between scholars studying organizations, institutions, and public policy on the one hand, and people studying scientific disciplines on the other (Latour, 1987). That is, then, why this lack of connection between the humanities and scientific processes in the laboratory leads towards a highly scientific-technological society based on models of unsustainable development, representing the last phase of techno-capitalism, ideologically alienated from neoliberalism.

However, since the 1990s, certain practices have aligned with critical and alternative practices indicating a separation from the neoliberal economies of private sector galleries and established cultural institutions in the public sector, as Jaron

Rowan defends in *Cultura Libre de Estado* (2015). Reacting against privatization policies, laboratories are often characterized by using open-source and digital media and focusing on radically transforming production, denouncing how the capitalist market speculates with the value of art objects. These laboratories offer a confrontation with the methods of capitalistic technologies, making production more affordable, and offering models of collaborative practices which encourage experimentation and creativity. Joasia Krysa (Media Art Histories, 2016) states that "*such labs can address new institutional opportunities in humanities to engage with practice-based knowledge creation and extend their mission to include tools, techniques and a new curatorial scope*".

The techniques used in these laboratories depend to a great extent on free distribution through Creative Commons licenses on the Internet, and also, the open-source community that favours the use and cloning of programs, publishing tools, and hardware schemes. Techniques such as forks are also used in open software. According to Pete Bratach's *Why Do Open Source Projects Fork?* (2017) open-source software projects start with the intention of creating technology that can be used for the greater good of the technical and global community. At times like this, the project participants start thinking about a fork. Also, in hardware development and in musical instrument creation the publication of schematics and instructions on how to create your own instruments are available to all on the Internet and also in publications such as Nicolas Collins, *Handmade Electronics* (2006).

2. The emergence of new laboratories: media labs, labs in academia, and counter-laboratories

The academic lab has existed mainly since the 1980s with the example of the MIT Media Lab in Massachusetts. The lab in academia, in my view, arises from the need to merge research and science, but in turn, opens the possibility to do research in arts and humanities. The role media art will play in the diffusion of the lab in academia will also extend the role of the laboratory not only in the academy but also at the social level, expanding the laboratory to the structures of art institutions and citizenship.

Since the 1980s, there has been direct access that allows artists and citizens to research and practice with new technologies. The technical advance of computational tools, for example, the ARPA network in American universities, made possible and necessary the investment in new media through research. These two factors are crucial in the emergence of media labs: research and innovation. So, the work with new technologies found much support in the media art sector with a boom of festivals, art centres, and institutions during the 1980s. Thus, the media lab is closely linked to the academy, but it is also a generator of media art practices.

According to Romero-Frias (2017) media labs exist in a university environment. These are spaces for digital and social innovation. Media labs are a link between society and the academy, spaces of co-creation and collaboration. Their character, educational and promotional, highlights the investigation and experimentation of new methodologies for education. One example of media labs and laboratories' origins in academia was in 1896 when John Dewey founded the Laboratory School, a

school linked to the University of Chicago in which an experimental approach led to educational innovation. Dedicated to experimentation with technology and social mediation, and thanks to the rapid democratization and access to technology, labs such as MIT developed in the mid-1980s.

However, Ruiz-Martín and Alcalá-Mellado (2016) state how other activities link to lab development, but are not connected to academia: "*Pioneering labs to other previous initiatives in the sixties were: Experiments in Art and Technology (EAT) (New York, 1963), Center for Advanced Visual Studies (Cavs) (Massachusetts, 1967) and Generative Systems (Chicago, 1968)*".

Atau Tanaka (2011), Professor of Media Computing at Goldsmiths, states how the rapid democratization of technology has made the media labs' technological profile adopt a social perspective. Tanaka goes on to explain how the university media labs are intended to serve as a link between society and academia, becoming a space for cooperation and citizen collaboration. Closely related to teaching and disseminating in character, media labs serve as a two-way channel through which citizens and researchers influence each other and share knowledge. Tanaka highlights the research profile of university media labs, as being an engine of educational, social, and digital innovation. The media lab in the academic setup profiles itself as the ideal place for experimentation, and testing of new methodologies and educational formulas with citizen participation. According to Tanaka, various forms of media lab have emerged and distinguishes the following:

— Industry labs. Labs based on the model of research and development (R&D) laboratories maintained by companies. For example, Bell Labs and IBM.
— Media art labs. Laboratories where artistic experimentation develops through technology. Including European projects such as Ars Electronica Futurelab (Linz) and ZKM Centre for Art and Media (Karlsruhe).
— University labs. Laboratories generated in the university environment focused on innovation and entrepreneurship. One example is the Experimental Media and Performing Arts Center (EMPAC) at the Rensselaer Polytechnic Institute in New York.
— Citizen labs. Laboratories with social involvement and based on citizen participation with a DIY philosophy. One of the primary examples is the Medialab Prado in Madrid, Spain.

More new forms, such as hack labs, maker spaces, fab labs, and city labs, can be added to the complex laboratory landscape. Under the name "lab", we can find proposals with very different values. Tanaka points out that the changes undergone by European universities, following the Bologna process, have promoted the emergence of centres with a more experimental nature. Some examples of university labs are Medialab Helsinki (Aalto University) and Paragraphe (Université Paris 8). Another centre is Nebrija Medialab (Facultad de Comunicación de la Universidad Nebrija).

The development of media labs in the university environment generates new opportunities for innovation, incorporating the hacker spirit according to Himanen (2003). Digital transformation, openness, and social involvement take on a new

infrequent dimension in higher education institutions. The media labs coexist with other management approaches that prioritize processes of quality assurance, generating, in some cases, a bureaucratic burden that hinders innovation and experimentation. Media labs can fulfil the role of "hacking" in the university structures to present alternative models in subjects that require a more flexible development, such as the relationship with citizenship and new methodologies and epistemological models.

There also exists another model of the lab. Counter-laboratories also experiment and develop through hacking practices. These labs result from the setting up of controversies to dispute certain scientific experiments. Independent and sometimes precarious, facing hard difficulties in appropriating the same equipment as institutional laboratories, counter-laboratories adopt strategies of survival, which include, for example, the so-called open-source hardware (OSH) and open-source software (OSS) practices, which have greatly influenced the maker movement, as well as the emergence of hackerspaces, contributing to defiance against capitalism. DIY artists, hackers, makers, and critical agents have reflected on technology's role in reshaping the world's economic and ecologic horizons. Indeed, ecological, personal, and social relationships have become an integral force and a critical proposal to promote alternatives to techno-capitalist industrial society, following Guattari's *Three Ecologies* (1989). Therefore, some laboratory practices that do not rely on the institutional model are considered an alternative proposal for the transformation of the industrial process, which is also happening through individual entrepreneurs.

However, in this same context of late-capitalism (tardo-capitalism logic, or techno-capitalism), any alternative practice is also subsumed in the economic system, as Lazzarato (2004) expresses through concepts of precariousness, intellectual work, immaterial labor, and new subjectivities which are totally under the influence of cybernetics and computer control. There is almost no anti-capitalist approach because this requires the structural organization of political and economic systems founded on networks, servers, and other technological deployments.

Technology is created under a scrupulous dependence on the scientific objectifying of hyperstructures (technoscientific laboratories, for instance), the result of which is extremely hard to disbelieve, doubt, and dissent from, leaving the confronters impressed, without power and resources to contest and dispute their authority, as Bruno Latour refers in the definition of counter-laboratories and science-in-action. Also, as Jonathan Kemp (2013) states: "*thus makes alternatives subsumed to capital*".

However, there is still an in potentia within capital for cultivating rival forms of production based on what is called "commons-based peer production" (or "social production"). Indeed, more independent productions still use hacking and open-source methodologies, but their arguments consistently fail to surmount the structural similarities with late capitalism. The labour invested in producing free software is given publicly. Then, as the efforts and end-products of cooperation and collaborative production can be readily appropriated and framed by capital, it is again an expression of a new form of labour rather than a rival to capital itself. So, any rival form ultimately operates in a manner subsumed under capital's organizational arm.

Although these processes are subsumed in tardo-capitalism, individuals are using their newly expanded practical freedom to act and cooperate with others, in ways that improve the practiced experience of democracy. So, critical culture and community have developed fair models of business and laboratories using free software / open-source hardware to share collaboration and self-organization, as declared by Yochai Benkler (2006). In this regard, the collaborative practices at the intersection between art, science, and technology and making use of hacking and DIY methodologies are also set to criticize the phenomena of planned obsolescence produced by Information and Communication Technologies (ICT) companies and the dynamics of desire towards technological devices by consumers.

Entering an age of mass extinction brought on by excesses of industrial production and consumption, technological obsolescence has become a transformative agent in the system. Economically and ecologically, technological processes face disruption on one hand, but disasters on the other. If obsolescence makes new devices appear in the market, the same disruptive economy implies a massive environmental catastrophe, which involves affecting the actual climate system as technology and innovation are directly connected to resource exploitation.

Although being alternative practices to industrial production, happening through individual entrepreneurs who have enabled incubators, and accelerators leading the movement of "mass entrepreneurship", there is a significant difference between hubs and DIY culture in hackerspaces (and counter-laboratories, too), because of the differences between open culture and mass culture. Entrepreneurs have assimilated innovation and technology into a capitalist economy and the rise of new industrialism. These transform their objects in capital exchange, meanwhile, in a DIY / open culture, the transformative possibility to change capitalism relies on the ideology of activating the process, and in participation in building and sharing knowledge.

3. The Hypothesis of a Sonic Laboratory

According to all this, the Sonic Laboratory can be identified as a place in which different strategies from music to sound art, experimental art, and science are successful. The Sonic Laboratory operates in this direction, offering practices for developing collaborative participation in networks using, for instance, online technologies. Moreover, sonic laboratories have seen the development of tools improved by open-source culture. Instrument makers enjoy a more personal production process, and artists have more guarantees of being provided with the instrument they need. Moreover, the sonic laboratory offers a confrontation with the methods of capitalistic technologies, making its production more personal and affordable.

Sonic laboratories share many features with media labs but have their own character, independence, and a marked idiosyncrasy. Sonic labs are liminal but increasingly important spaces in many contemporary settings. They have appeared in universities and colleges, between traditional departments and faculties, as well as in media labs, or hackerspaces which also appear in basements, warehouses, strip malls, and squats. As Jussi Parikka and Lori Emmerson (2016) write in *What is a Media*

Lab? Situated Practices in Media Studies, media labs are stable to varying degrees; many have long-term addresses, with an itinerant roster of occupants. Some pop up in one location for a few days and then relocate to another. Sometimes they are even in mobile trucks in the streets, bringing tools and expertise to children in schools and the general public. As clusters of tools and talent streamlined to produce economic value, labs sometimes align with the most ruthless of venture capitalists; in other cases, they are free and open for all to use, disdainful of all commercial motivations.

Progressively the democratization of labs is taking place, freeing technology, and through the open-source ideology helping to form the actual sonic laboratory, which is currently closely related to individual artists' practices but connected to the community. According to *DIY Instruments and White Label Releases* by Amit D. Patel (2016), the DIY electronic music instrument maker community wants to differentiate itself from utilitarian society and mass-produced items and draw a new experience on sound. Other characteristics that the author describes DIY culture as are self-reliant, anti-systemic, counter-cultural and self-sufficient. These features are an example of what is the cement for the sonic laboratory.

The author highlights how DIY instruments are provocatively made to be low-cost and are often made out of throwaway materials. As Patel writes, "*This could be considered a materialist approach in the DIY electronic music-maker scene. The maker scene and benefits of creating a DIY instrument are a challenge, learning new skills, finding intellectual curiosities, and exploring the relationship with objects. There is also a focus on doing something and creating something new.*" DIY is cheap, limited and, self-contradictorily, as well as accessible and exclusive.

Despite the sudden visibility of sonic laboratories, they do have a surprisingly long history. As part of the historical avant-garde, labs were the sites to develop the new materials and aesthetics of technological modernity. They often share a prevailing ideology, tied not just to the neoliberal drive to privatize, innovate, and disrupt, but to long-standing modernist ideas about creativity, quantification, and the value of scientificity.

One example is the historic Bell Laboratories, a big lab with origins in the 19th century, which set its hegemonic establishment as the possible origin of the sonic laboratory in a proposed history for laboratory studies in the sound art context.

Sonic labs could also find an origin in radio development, for instance, in the Reeves Sound Laboratory (1946) founded by Hazard Earle Reeves, Jr., an American pioneer in sound and electronics. It was the largest sound service laboratory in the eastern USA and produced a variety of products including tape, film, discs, wire cable, television tubes, cameras, and precision recording equipment. Also, the Reeves-Ely Laboratories specifically manufactured a hardened crystal for the U.S. Army Signal Corps while researching advanced gunfire control systems and computers, radar and tracking systems, guided missile controls, and aircraft control instruments.

Around the mid-1990s, the sonic laboratory evolved almost at the same time the media lab was born, during a particular period of consolidation of media practice-based education when projects like the MIT Lab were born with origins in the military; it was also a period when new digital technologies started to become

institutionalized. Moreover, through the integration of media labs in art institutions, science, and technology merged with art and music, and engineers began to approach artistic structures such as the Ars Electronica Linz.

Subsequently, artist empowerment and independence has been facilitated by the market's fragmentation on the internet and various societal changes. These include the increased liberalization of the academic sphere, easier access to artists' grants, and the support provided by governmental research and development programs. Nowadays, a multitude of artists and developers, musicians as well, are established as autonomous creators favoured by cultural policies of entrepreneurship and autonomy.

Indeed, sonic laboratories operate influenced by DIY, as seen in the recently inaugurated Laboratorio de Sonido, in LABoral, Gijon, the new media centre for the production, dissemination, and exhibition of technological sonic art.

Sonic laboratories can also be linked to academic practice, because of the emergence of a new sector born because of a frustration with the rise of the neoliberal market which has proceeded to privatize culture and transform art into a creative industry. The appearance of the lab has its contextual history in this economic movement that separates itself from neoliberalism and searches for other possibilities. That is why some of the academic laboratories, media labs mainly, and some sonic laboratories, are sponsored by universities. For example, the Sonic Arts Research Centre (SARC, University of Belfast) and Locus Sonus (École Supérieure d'Art d'Aix-en-Provence) are experimental laboratories developed in an academic context and related to the production of sound works. The first is a sonic laboratory for the listening experience in live concerts, and the second is a lab for the production and dissemination of sound artworks.

Many laboratories are still connected to the arts creative industry such as Laboratorio de Investigación y Producción Musical in Argentina. There is another tendency to fund sonic labs inside art institutions such as art centers like BANF, Canada, and Hangar, Barcelona, but these sonic labs are structured around an autonomous economy that facilitates the expression in music making and the making of sound devices.

Being aware of capitalists' industry and the neoliberal market, some labs such as Aurality Media Lab in Australia, make their subject of inquiry the ecological and sustainable practice of sound, making this an active resistance in the arts.

4. Aesthetic development. The Curatorial Role in the Sonic Laboratory

The consequences of an approach to art, science, and technology in different areas, such as the university and the artistic, includes a liberalization of the production of musical instruments thanks to this approach of science, engineering, and music which sonic laboratories have contributed to developing. This is why certain sound art practices are related to the so-called DIY movement, which emerged in the 1970s as a reaction against the deployment of techno-capitalism. With influences of the underground vanguard movements, handmade culture currently sets as an exponent

of what is the open-source culture and movements such as hacker and maker, identified as well as with sonic laboratories. The results of these practices involve an interdisciplinary connection between art, science, and technology that improves the creative aspects of contemporary cultural production. Moreover, sound art practices enrich the interconnection with music and engineering. Highlighting the DIY practices in front of the capitalist industry represents an immediate change in the prototyping of musical instruments, audio devices, and sound objects that have effectively set a significant creative impulse in our century.

Nowadays, DIY practices are highlighted versus the capitalist industry, promoting a substantial shift in the creation of prototypes, musical instruments, and sound objects. The materiality of signals and information are substantiated in these prototypes which change the actual system and ideology, questioning the nature of the production itself as well as its medium (be it analog or digital). This new paradigm of production has evident parallelisms in the aesthetic territory, and so, the frontiers of human perception, newly emerged informational, physical, and audiovisual, are also transformed. This shift happened because artists began using methods based on technological innovation, engineering, and computation. From its beginning, new media artists have taken the new media art as material to develop, implement, improve, and criticize the social context in which they are embedded.

Nowadays, the current use of DIY in instrument making and the creation of sonic prototypes is drifting away from the type of instruments already categorized in the music industry. Artists and theoreticians who comprehend the practice of sound art inserted in new media take references from technological developments to recreate new apparatus and ways to understand sonic technologies. This intersection between sound art and media art is absorbing, and it brings new critical significance to the development of art and technology.

So, considering sound devices aesthetically, an appreciation of them and their value lies in the performance because once the objects are exhibited, they transform themselves into a fetish commodity. However, why have musical instruments and handmade sound devices been transformed into a fetish commodity? According to Jonathan Sterne (2014), in *The Magic in Instruments. Music technologies and commodity fetishism*, fetishes allow visualizing what is unknown. So, when musical instruments are judged by their appearance, they acquire a magical dimension. Music and musicianship are mystified and separated from everyday life, non-considering the lived experience of most instruments. This is because a tendency in instrument-making hides the machinery, the functional control, and the efficient operation of the instrument. This attribution of magic comes when a moment of distance is given instrumentality, either at the time of observation or when practical knowledge is not available.

The moment of distant reflection adds a spiritual dimension to the instrument because, in observation, there is a lack of practical functions, so the object becomes mystified and fetishized. In *Queer Phenomenology*, Sarah Ahmed (2006) writes about technologies that are no longer ready for action. An experience of being unable to use a thing, or distance at the moment of use, leads to the attribution of

properties, qualities, and values to the thing itself. This is a failure in the symbolic consideration at the moment of non-use of the object. The exhibition and exposure of musical objects contribute to transforming them into a fetish commodity. Based on observation and experimentation, separated from the context of musical practice and performance, contextualized as objects of solemn contemplation, and placed as works of art in the museum context, these are transformed into consecrated objects, when they are in reality ready for interaction, inviting touch, hearing, engagement, and a breaking down of the separation between performer and audience.

Indeed, the transformative economy of art institutions does not rely on the exhibition, but on the force of activation through performance. Then, passive audiences disappear, changing the pillars of classical aesthetics, based on Kantian ideology. To the contrary, the art market establishes barriers that have not been operative in the control of developing experiences properly and dictate the force of the market as a medium to survive. Instead, DIY economies propose a mechanism of production based on processual order that appoints obsolescence and extinction as fatal errors in the capitalist system. The transformative capabilities of DIY do not rely on an objects' placement in the context of a museum and exhibiting them with an emphasis on the visual, just because musical instruments and other sound constructions have the potential to function a little differently from other sorts of creative arts.

Promoting participation in workshops, the sonic laboratories are dissociated from the institutional space of the museum, allied with passive and contemplative aesthetics. Although many museums are nowadays aware of this, the use of contemplative practices roots them in classically forged aesthetics. Recently Tate Modern has offered more interactive and dynamic works in exhibitions, but the transformative function of the laboratory could change the museum into a learning machine. As the lab's communitarian practice is based on shareable knowledge and pedagogic aspects, it will be necessary to include these parameters in contemporary museums, which are happening using new media art practices and audience participation.

Moreover, the practices developed in the sonic lab enhance new media curating, for instance, setting the exhibition space as an experimental sonic laboratory. The labs' forms are those of the music studio, the studio where artistic experiments are conducted along with various practices and machines, electronic synthesizers, films, audio tapes, and many other apparatus, as well as sound objects, coding practices, algorithmic calculations and/or software development. The procedural way in which sonic laboratories engage with creative work is a dynamic, open process in transdisciplinary experimentation. To approach these manners of working in the exhibition space, recreating and re-enacting sonic laboratory practices, in an exhibition will produce results understood as *exhibiting the lab*. However, how useful is it? Is this the site of display and the site of production? Is it possible to expose the work in process?

One of the exponent practices resembling what is called *curating the sonic laboratory* is the maker fairs, where audio devices, DIY instruments, and modular synthesizers are exhibited. Another example is the *Sonar Festival* which adopts expositive practices of the prototypes developed by artists, engineers, musicians, and others, in

a hybrid way between the exhibition, the showroom, and the live demonstrations that are not live concerts. It is a showroom where the audiences can experiment, learn, and enjoy new trends in electronic music, favouring products created from DIY ethics, but also connecting within the scientific and technological network linked to the industry, indeed contradictorily.

The sonic laboratory offers new opportunities for an exhibition in an art gallery, transforming it into an experimental laboratory where applied arts mediated through interdisciplinary work with science, produce experiments able to be repeated and measured. This is a socially constructed structure that permits us to give answers to new creative developments. Following Bruno Latour, in the lab, art, science, and technology are confused with a critical and cultural activity, making the lab a site of mediation, in between theory and practice, discursive and non-discursive. Latour notes that labs in the arts approach the science lab, extend the material practices into the exhibition place, and proceed through experimentation, work in progress, and an open-ended process to build knowledge.

The result, the *exhibition research lab*, is present in many other labs, from maker spaces to fab labs, and in the so-called sonic laboratories, which are increasingly abundant. So, to address the role of electronic arts, sonic arts, audio arts, and sound arts in the space of the lab critically, the role of the sonic laboratory is positioned in the network of media labs, hacker zones, maker spaces, humanities labs, fab labs, tech incubators, innovation centers, hack labs, and media archaeology labs.

To sum up, sonic laboratories in the art scene are mainly places for production, while not adopting strategies from industrial processes (which also includes processes of distribution and execution). So, if the process of an exhibition can transform music devices into fetish commodities, *curating the lab* is a solution through exploring and experimenting. It can be an integrative process of production and exhibition without becoming part of an industrial process. This happens in certain curatorial practices when the exhibition is transformed, and instead of contemplation, participants in the exhibition can interact and explore the works as if they were in a lab. So, *curating the lab* will be the end of a research process that investigates DIY practices in music-making devices and sound objects.

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Future Matter and Virtual Surface: The Hybrid Materiality of Motion Captured Textile

MIRANDA SMITHERAM

ABSTRACT

This paper outlines a research project that explores the materiality of an everyday surface: cloth. Positioned in the field of digital fashion and design innovation, the project engages with the dynamics of cloth in three-dimensional (3D) spaces. This research utilizes motion capture technology in an unconventional way through the development of a unique textile, to reimagine and reimage the physicality of textile surfaces with digital methods. Through transference across states, understandings of the nature of cloth are extended to unfold deeper ontological and aesthetic considerations. These new understandings act as an active register to imagine new, hybrid future surfaces. Insights into these new methods and approaches for fashion research contribute to discourse on new media practices and aesthetics from a different disciplinary perspective. These design-led experiments allow scrutiny through data and observation of cloth and body in a virtual state; questioning what is essential, observable, palpable and experienced when matter is stripped away? The creative practice considers the materiality of the cloth as it is decontextualized, questioning what happens to the cloth within this new state of hybrid materiality. This led to investigating ways to merge kinetic and sensory information of cloth and explore the relationship of the body within the digital.

KEYWORDS: digital materiality, design innovation, embodiment, hybrid material, mediation, motion capture.

Introduction

This paper centres on a discussion of a project that drew together both technical and artistic practice. The project was a design-led exploration of embodiment, ontology and aesthetics in digital materiality; unfolding digital textiles, mediated materials and design innovation through technologies. This research prioritises capturing mutable moments and observing dynamics that are co-created by physical-digital interaction. These moments are both liminal and temporal – they exist between, in the space of transference. An original, innovative textile with embedded markers was developed that enabled successful tracking of cloth in a motion capture studio. This new textile released the cloth from its physical matter by recording the specific nuances and mutability of dynamic movement using the three-dimensional space of motion capture. The textile could be seen as pure surface, an interface that linked the physical body in digital and virtual environments. The significance of the cloth is as a responsive surface, that carries embedded information of motion and dynamic

response. Cloth is used in this artistic design research as both subject and interface to technology: as a longstanding 'second skin' it responds to the body and it reacts to the environment – absorbing, resisting, enveloping; until finally, the cloth intersects with temporality – it folds, creases, drapes, crumples, tears and perishes. In this research, these ephemeral moments of liminality are captured, through tracking specific cloth dynamics in motion capture.

Firstly, the discussion situates the research, and clarifies the approach and context. In particular, a textile designed specifically for Motion Capture called the *MoCouture Cloth* is discussed. The cloth was used to develop a number of artistic works; this paper introduces the *Lexicon of Cloth Dynamics*, a series of video artworks that document the language of cloth motion. This paper identifies tensions encountered during the project, and provides some insight into designing within hybrid practices. The research shifts across physical, digital and virtual states, resulting in artefacts that can be seen as examples of a new framing of hybrid materiality. Therefore, within this project, hybrid materiality is used to describe process and artefact: the linking, overlapping and layering of digital processes, virtual states, and physical action, and the resultant mediated artefacts that merge information from these sources. These iterations all revolve around a specific matter, a length of cloth. The particular narrative of the cloth is present throughout, its story expressed through artistic and technical extrapolation of the cloth's dynamics. These artefacts are created through different combinations of 3D capture and design actions.

The Project Context

Broadly speaking, this project sits in a context of digital fashion, although its aims and outcomes are more philosophical and speculative than pragmatic. Digital technologies have introduced different ways of designing and producing fashion and textiles and led to new fields of practice and inquiry including digital fashion, wearable technologies, and smart textiles. These fields intersect diverse disciplines such as textiles, engineering, health science and wellbeing, materials science and design, thus requiring collaboration and new perspectives extending beyond their initial scientific frameworks (Joseph et al., 2017, p. 7). While early research in this field was dominated by functional and technical concerns and highlighted scientific approaches, recent research begins to draw together diverse theoretical and methodological frameworks to better support the development of these new forms and materials.

This acknowledges that these new combinations of science and design, soft surface and device, material and digital, bodies and technologies, require new frameworks for understanding. This paper discusses both the differences and intersections encountered between scientific and artistic approach while designing a hybrid material, and focuses in particular on emergent insights and methods that connect the two. Building on this, this project crosses the borders between the digital and physical and explores the role and the phenomenology of embodiment in the spaces in-between these transitions.

Brief Survey of the Field

A number of recent projects have also engaged with virtual cloth or garment interfaces. For example, *Mirror Mirror* (Saakes et al, 2016) allows users to design new clothes in front of the mirror by using body gestures. *Body Avatar* (Zhang et al., 2016) is a first-person 3D modelling system to create avatars which are linked to the body in real scale. *Dressup* (Wibowo et al., 2013) is a 3D interface that allows users to design garments directly on a tracked physical mannequin. These tools allow for haptic methods with tools made for digital designers. These projects all use high level approaches, with the end goal of developing discrete systems and commercial applications.

A pivotal difference in the approach to the *MoCouture Cloth* project is that these interfaces employ simulation, rather than physical cloth. The simulation (the cloth, garment or body respectively in these cited examples) is altered by actions, but still remains a simulation. The physical and digital are both relevant and informing, but do not necessarily intersect. Within this research project however, the approach was artistic and aesthetic. A central focus has been on mediation – the flux between things, with new forms altered by transference across states. In this way, a critical finding has been the development of new 'mediated materials', which for the purposes of this discussion are defined as innovative textiles that traverse states of a single media output, instead being the results of novel processes of material practice that exist at the intersections of physical, digital and virtual. It is proposed through this project that these new surfaces embed and remediate various aspects of physical, digital and virtual processes, and that this entwinement qualifies them as distinctively hybrid surfaces.

Research Approach and Methodology

The methodological process is informed by an approach through material knowledge of cloth drawn from the designer's fashion background, where nuanced and implicit decisions are often made from the judgement of the touch of a cloth. This action, referred to as assessing the 'hand of the cloth', is both a visual and tactile assessment a designer makes about the potential of a particular material. The hand of the cloth refers to both the 'handle' of the textile (the feel against the skin; e.g. cool, smooth, hard, rough, heavy) and the physicality, such as weight, drape, stretch, etc. The touch of the hand combined with our visual senses evaluates potential uses of the material, through a kind of haptic visuality (Marks, 2002): eyes that touch, hands that see. This process is not generally taught, but represents the accumulation of heuristic and responsive haptic and visual training. This is not often articulated explicitly. In this way, fashion and textile designers rely on a tangible, primary experience of touch to evaluate a cloth. There is no intermediary, just tacit knowledge and tactile perception. Tacit knowledge is often identified as being a pivotal grounding that informs design process (Cross, 1982; Eckert & Stacey, 2001; Pajaczkowska, 2010), and within this project the 'hand of the cloth' represents what Polyani describes as implicit knowing (Polyani, 1983), made visible and palpable via digital production.

A key aim of this research was to explore this implicit action through isolating and closely observing cloth dynamics. *The Lexicon of Cloth Dynamics* developed during this project documents inherent aspects of a cloth's handle through a raw data representation of motion isolated from the physicality of the cloth. Critically, this permitted a visual reference for these usually implicit dynamics of cloth, and this was central in gaining a shared understanding between the designer's artistic approach and the scientific systems of the technician and digital platform.

Technical Background

The context of the motion capture (mocap) environment permitted working in a 3D digital space with physical things. This project took an unconventional approach, using the capture as an innovative designer's tool to engage not only with motion, but also with the materiality of things. The Motion Capture Lab is in itself effectively a hybrid space, with physical movement captured by infra-red cameras and recorded in real- time as digital data. This is a physical 3D environment, in which humans and objects can interact and be activated corporally in what becomes a digital space. The capture of this information involves interdisciplinary efforts; with actors or dancers, choreographers, designers, directors and technicians coming together to produce work. Uniquely positioned within a university environment (Motion Capture Lab, n.d.), the Motion Capture Lab's remit is expanded from servicing typical film and television production needs to including artistic research and speculative, hybrid practices.

Essentially, the aesthetics of artwork generated through mocap are specifically characterised by the displacement of movement and object. Film and interactive media theorist Jenna Ng describes the actions of motion capture as it "distils movement from the moving body" (Ng, 2012) exposing the inherent nature of this environment as a technology that effaces the visual qualities of the object, and applies an isolation of movement to the image, so that the moving image is now "not of the audiovisual but of the kinaesthetic, with somewhat different accompanying sensorial constituents" (Ng, 2012). The nature of things as in this motion capture space is questioned, as the movement is detached from the object, and significantly the *action* rather than the object is recorded. The body is present, yet absent in the recordings. What is captured then, is the surface of things – their temporal and spatial relationship in space. This is the essence of things separated from texture, matter and mass. Motion capture extracts and distils the invisible from the visible.

Motion capture technology is specifically designed for a time-based 3D recreation of movement and motion dynamics. To date, research and commercial use has largely focused on efficient capture of *human* movement. This research project asked, what if this method of capturing kinetic nuance is extended to inanimate artefacts? The focal point of experimentation has been on capturing data from the dynamics of the cloth itself in the Motion Capture lab, as it is draped, billowed, flung and encountered by bodies in space. Creation within the Motion Capture Lab relies on the relationship and connection between the researcher, the performer,

the technician, and the software itself. This environment provides a unique opportunity for heuristic, full-bodied interaction that also includes haptics (or sense of touch) within a space, that is simultaneously a physical and virtual 3D space.

The Process of Capturing Cloth

From a design and artistic perspective, the approach used for motion capture has been experiential and performative as opposed to technical or computational. Digital designer Gregory Bennett and Motion Capture technician Javier Estevez at Auckland University of Technology's Motion Capture Lab provided technical support for the motion capture investigations. This technical advice and support permitted experimentation through trial interactions with the material. Working in collaborative ways with the mocap technician and the digital designer was conducive to an experimental artistic approach whereby the cloth can be regarded as an embodied entity whose movement are captured through the motion capture system.

The surface of the *MoCouture* cloth is embroidered with retro reflective markers, which are then recorded by the twenty-four infra-red cameras in the Motion Capture Lab. The motion capture program, *Cortex* records the relationship of motion between these markers. This means that occlusion of the markers results in a broken map or confusion in the program as the software can fail to recognise markers if they are caught in folds or obscured. Some clean-up of occluded markers is possible by the technician after the range of motion is captured.

The language used to communicate during this process crossed disciplines and was primarily driven by the designer's language of material and surface. The physicality of the performer's movements in space and temporality are led by the designer's direction. The technician instructs the program to interpret and record the motion and sequence within 3D space as points of light in space.

Figure 1. Stills from film footage of initial tests of cloth dynamics in Motion Capture Lab, M Smitheram, 2015.

The initial test process was guided by the inherent nature of the fabric – the responses to air, velocity, weight, tension, gravity, movement and volume. In the resulting raw data, a paradoxical quality of the fabric was evident. The visual absence and virtual presence of human movement propelling the cloth dynamics was suggestive of auxiliary bodies. Only the cloth was tracked, not the performer operating it. Yet idiosyncrasies of human movement and gestural range were perceptible in the data collected, to the extent that it was often possible to identify who was holding the

cloth in particular takes. This contrasts with techniques of simulating and modelling cloth in computer graphics, where the behaviour of cloth is determined by the mechanical interactions among its various elements. This emphasises the authenticity created by embodied interaction in cloth dynamics, which can also be seen in interaction design examples which use actual physical motion to generate digital representations (Hansen, 2016).[1] This can be described as the physical being palpable within the digital.

There were many issues with tracking the mutability of the cloth's movement, which resulted in occlusion, chaotic motion and collision, which confused the tracking system. The motion capture system anticipates the connections between the markers remaining constant. This is inbuilt into the programming, which typically is begun with the calibration of the system to a standard arrangement of markers on the body as in a 't-pose'.

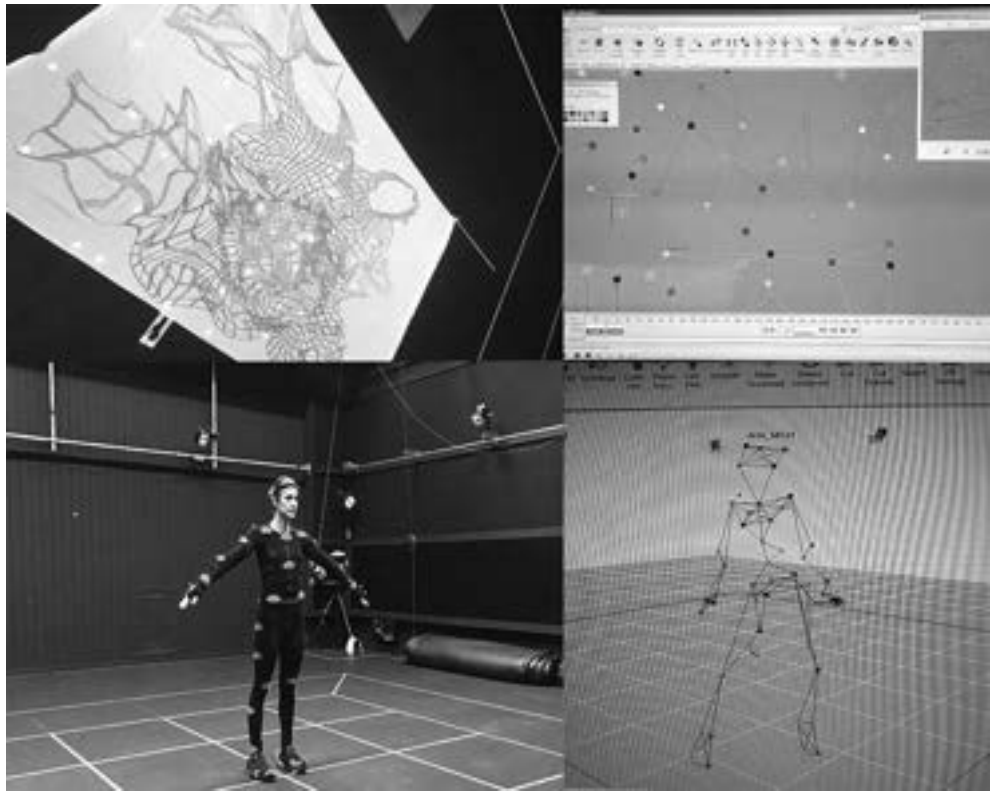

Figure 2. This is an initial set-up pose, whereby the person wearing the mocap suit stands in the centre of the capture grid and extends their arms to form the letter 'T'. The cameras are then calibrated to the particular positioning of the markers attached to the body. The cloth 't-pose' can be seen above as a particular arrangement of the cloth flat on the Lab floor. M Smitheram, 2016.

1 For further discussion see Hansen, Keay-Bright, Milton (2017).

Fabric is not a rigid or firm structure, so it is a very different process to track, and contrary to what the program is designed for. With stretchy or open weave fabrics, it was observed that the markers would shift in their relationships by stretching in a way unanticipated by the program. Digital parameters are fixed pre-programmed expectations of the software, and signal the limitations of most digital programming to adapt, representing a particular challenge to this project.

MoCouture Cloth

The MoCouture cloth, a unique textile, was designed and developed to address these issues. The three-metre length of cloth featured hand-embroidered markers arranged in a carefully random pattern. The particular embroidery design was the result of numerous tests and prototypes. A star eyelet stitch design was selected as it added minimal disruption and weight to the cloth, and was double-sided, making it visible to cameras from both sides of the cloth. The markers were embroidered using thread made from narrow laser-cut strips of retro reflective tape. The *MoCouture Cloth's* embedded retro reflective markers enabled successful tracking of the cloth in motion capture.

Figure 3. MoCouture cloth, M Smitheram, 2016.

The materiality of the cloth is questioned as it is converted from textile into data and code, across different physical, digital and virtual states. The cloth unfolds across these states, beginning as physical cloth of warp and weft, transferring into virtual cloth as it is motion captured. The cloth is represented as a 'point cloud', and finally within digital simulation, the cloth becomes texture and wireframe. Thus, the textile takes on the qualities of a hybrid material, holding both physical and digital properties.

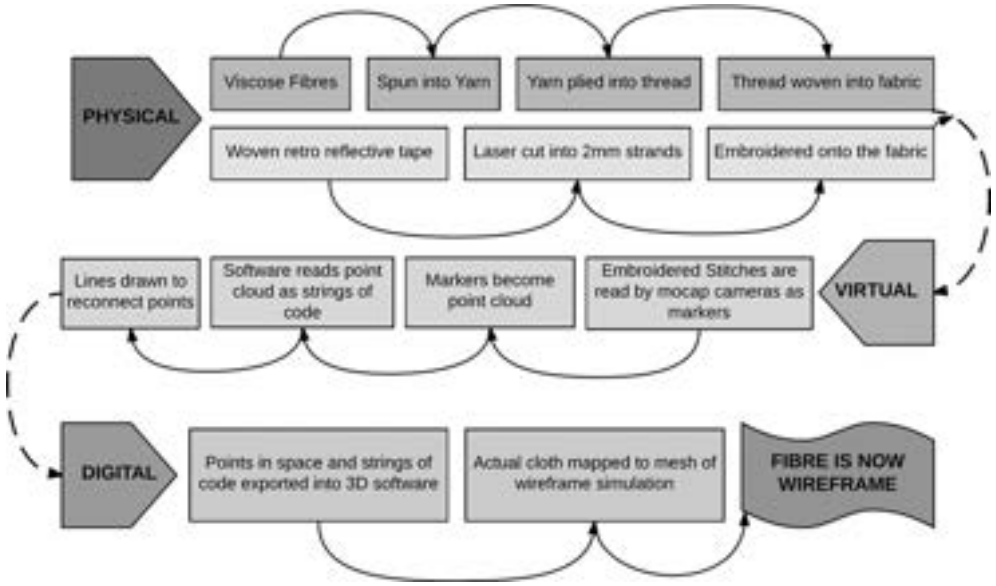

Figure 4. Diagram – Tracing the cloth, M Smitheram, 2016.

A Lexicon of Cloth Dynamics

Critical developments that helped document and organise the results of this phase of research included the development of a *Lexicon of Cloth Dynamics* (Smitheram, 2016). These iterations used the *MoCouture Cloth*, and significantly, allowed for physical cloth engagement within the virtual space of Motion Capture and the digital space of 3D graphics program, Autodesk Maya. The *Lexicon of Cloth Dynamics* involved developing a visual vocabulary that expressed the observed material behaviours, through tracking a singular, isolated movement of the cloth. This detailed a wide variation of range, from very subtle actions through to larger more gestural movements. A cohesive convention for tracking and recording this data was maintained. The individual cloth iterations all began and ended with the cloth t-pose, and captured one inherent behaviour of the cloth's dynamics, such as: fold, crease, drape, inflate, billow, deflate, stretch, give, wrinkle, flap, bias stretch, sag, strain, gather, crumple, flutter, ripple, sway, and resist.

The central research strategy was to 'follow the material', allowing the poetics of cloth to reveal themselves. This approach questions the embodiment, gestures and sensory engagement within this unfolding. The *Lexicon of Cloth Dynamics* illustrates the unique isolated textile dynamics of the *MoCouture Cloth*. As a visual taxonomy of cloth properties, the lexicon is comprised of a sequence of short vignettes that each document a particular cloth movement from beginning to end. The iterations were developed from capturing the physical cloth movement in Motion Capture. Methodologically, the *Lexicon of Cloth Dynamics* represents a process of reflection, dialogue and formalising analysis.

The resulting data from some iterations 'broke' with too much noise and occlusion within the marker data. This was observed in the larger dramatic gestures, such as ripple and flap. Following the materials and unfolding the material properties led to design decisions to accept these data 'breaks' as essential recordings of the fundamental nature of the cloth. The *Lexicon of Cloth Dynamics* iterations were kept as raw, processed data. Every take in Motion Analysis was exported into Motion Builder to be cleaned up, and the data is imported into the Maya 3D program as point clouds, which identify each marker as a symbol. These point clouds are left as essential reflections of the mutable and infinitesimal movements of the cloth. The point cloud represented the authentic data as it was unedited, a reflection of the actual observable movement. The interventions of cleaning up the data were carefully managed, and the limitations of the software were acknowledged and worked with as design decisions. The constraints highlighted previously included the software's inability to consistently track and map mutable cloth motion as it deviated from the inbuilt processing expectations of a typical t-pose and human form. This limitation resulted in intriguing idiosyncratic moments, where the markers momentarily swarm and drift, attempting to regain the anticipated structure. These moments were retained within the final artworks, as the computational interpretation of cloth motion.

The *Lexicon of Cloth Dynamics* composes an analysis of the specific gestures of cloth. This taxonomy of cloth properties reveals the nuances of movement, isolating the motion from the physical matter of the cloth. The final recordings of the gestural behaviours of the cloth contained aesthetic hallmarks and characteristics of physical, digital and virtual cloth, revealing the "latent materiality"[2]. The iterations record durational moments[3], This version of a visual language for materiality encompasses haptic, tactile, sensory interfaces. These iterations draw from not just the surface or screen of a computer, but from the richness of merging the materiality and material language of hardware and software into new understandings of networked surfaces and bodies. The development of a textile that reconciles relations between different states and modalities highlights the significance of hybrid materials to encompass liveness and embodiment, offering new articulations of transformed matter and data that are tangible, felt and resonant.

Evaluation and Discussion

The *Lexicon of Cloth Dynamics* developed a visual vocabulary drawn from observation of material behaviours, through tracking particular, isolated movement of cloth. The central research strategy was to 'follow the material', allowing the poetics of cloth to reveal themselves; questioning embodiment, gestures and sensory engagement in this unfolding. The computational limitations resulted in recording issues with too much noise and occlusion within the marker data, particularly in moments

2 Marshall McLuhan refers to latent materiality as something that any medium holds within itself, whether in relation to the media that precedes it, or in relation to the dynamic in which form and content start to relate beyond the physical determination of the material that sustains them (McLuhan, 1964, p. 8).

3 Reinhardt discusses fashion and cloth's inherent capabilities to produce folds of time through shaping a materiality that can be unfolded. See Reinhardt (2011).

of mutable, gestural and idiosyncratic cloth motion. Following the material and unfolding the material properties led to design decisions to accept these 'breaks' that were almost impossible to clean-up or rectify, and acknowledging them as essential recordings of the fundamental nature of the cloth. The *Lexicon of Cloth Dynamics* iterations were deliberately kept as raw, processed data, as this held the authenticity of the physical cloth, through reconciling the limitations of the software whilst maintaining the particularities of the cloth movement.

The unique context of the Motion Capture Lab permitted working in a 3D digital space with physical things. Through the experiments, the potential of motion capture is emphasised as a tool that can be used to engage not only with motion, but also with the materiality of things. The motion captured iterations were worked with via a 3D software programme, Maya. This provided an interface to the virtual material, a haptic and affective space that allowed the researcher to function as though they were an object in that space[4]. Ontologically, the virtual cloth was detached from matter, the medium of the cloth shifted from textile to data. The apparatus of the virtual interpreted the markers attached to the cloth as essential features of the cloth, rather than pixels or fibre. This nature of the cloth was observed as a 'point cloud', the virtual software visualisation of the markers attached to the cloth. This allowed a critical shift in the textile's temporal and spatial existence. The motion and dynamics of movement are captured, the cloth becomes surface and the moment in time is replicable. The liveliness of the virtual cloth is twofold, in the data the body was still perceptible as a resonating and unseen force that propelled motion of the cloth and provoked the materiality of the object. Although perceptible, the body itself was abstracted within this counter-materiality.

An aesthetic evaluation of the limits of the cloth as a virtual surface revealed the points of rupture as occlusion, collision and noise; these signalled a chaotic interaction of the physical that challenged the pre-programmed software.

Significantly, the new textile *MoCouture Cloth* developed within this research is intrinsically a mixed materiality artefact. The cloth is hybrid, as its existence shifts across all three states from physical, digital to virtual and encapsulates aesthetic and ontological properties and characteristics from all these dimensions. The cloth as physical artefact is textile matter, interpreted by motion capture, the nature of its substance amorphously shifts to data, then, as a digital texture, the cloth becomes code.

The *Lexicon of Cloth Dynamics* formalises an analysis of the specific gestures of cloth. This taxonomy of cloth properties reveals the nuances of movement, isolating the motion from the physical matter of the cloth. The singular gestural behaviours of the cloth recorded displayed and contained aesthetic hallmarks and characteristics of physical, digital and virtual cloth, revealing latent materiality. The *MoCouture Cloth* exists within a new materiality, it is simultaneously all matter, of textile, code and data. The translation from one medium to the next produces a uniquely integrated version, a hybrid textile. The *MoCouture Cloth* makes it possible for users to touch and manipulate virtual matter.

4 For further discussion of Maya as a haptic space see Alt (2002).

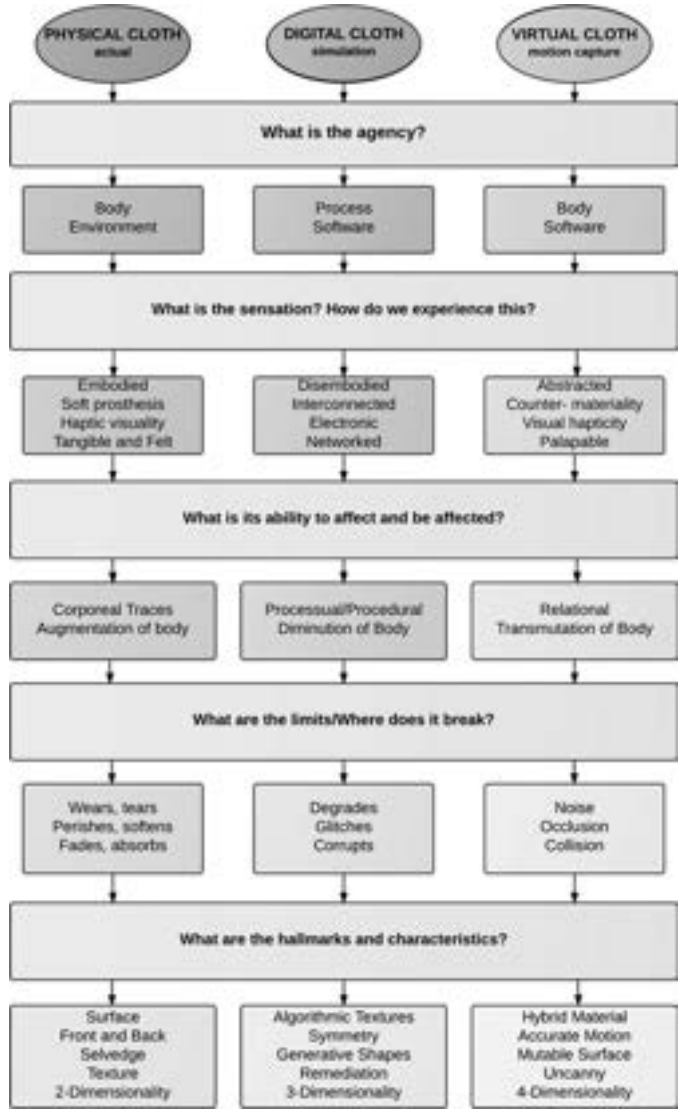

Figure 5. Table of comparisons – Ontology of Physical, Digital and Virtual Cloth. M Smitheram, 2017.

Conclusion

This paper introduced a project that utilised a unique designed hybrid textile, the *MoCouture Cloth*. The project relates to digital fashion, and recent projects in the field were surveyed.

This research prioritises investigating ways to merge kinetic and sensory information of cloth and its relationship to the body within the digital. Through formalising a lexicon of cloth dynamics, intersections and shared understanding were developed, bridging visually and procedurally the scientific systems of the research and the poetic artistic aims of working within a hybrid materiality. The

project established a dialogue of understanding; isolating and tracking cloth movements, making visible the mediation between the physicality of cloth and the digital replication of the specific dynamics of movement. The dialogue was twofold – as a baseline for future projects, the *Lexicon of Cloth Dynamics* also served to clarify language and understandings between the designer's different disciplinary backgrounds.

How we understand materials is related to how we interact with them tangibly. The contribution of this paper is to articulate some methods and discoveries of working with the physicality of artefacts in digital and virtual modalities. Through this research project new perceptual and sensorial realities that are the effects of interface and which bring about liminal transformations in material state were drawn out, bringing new perspectives to the field. Just as the relationship between body, clothing and environment is mutually informative, each one impressing upon and influencing the other, so too is the relationship between physical, digital and virtual states dynamic and symbiotic.

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Self-Mapping Sound: A Composition of Composites

LAUREN WOOLEY

ABSTRACT

In a waveform, the aurality of sound is made visible. It provides a visual record of the ephemerality of what we hear. The characteristics of a sound – its glitches, timbre, silences – become tangible on a graph that maps amplitude over time. In this way, waveforms are mathematical functions. This paper will explore how the mathematical model of composite functions can be used as a compositional framework in sound. In part, it asks the question: what happens when sound is mapped not necessarily onto itself, but into itself?

One way to approach this is through the phenomenon of reverberation. When a signal from a sound source is reflected back by the boundaries of a space, the build-up and simultaneity of reflections creates reverberation. In this build-up, sound is repeatedly intersecting with itself, changing with each intersection. In math, when two functions are composed, the outputs of one become the inputs of another; one is quite literally put into the other. If we compose a function with itself, the result is often a predictable pattern of outputs. In applying this iterative process to sound, will similar patterns emerge? How does composing a sound with itself, mathematically, differ from the reflective model of reverberation? Using this process to manipulate waveforms could create new sounds, or functions, ones which might not necessarily exist outside of this model. This will be an exploration into the interiority of sounds themselves, into what remains and what is created when a sound is mapped into itself.

KEYWORDS: sound, mapping, mathematics, composite functions, reverberation

SOUND – What Is It?

Sound is an ephemeral phenomenon. It is malleable, fleeting, sensorial, experiential. The moment it leaves its source, sound begins to interact with its environment. It resonates and shifts, bounces, reverberates, and echoes; it becomes obstructed and layered. It meanders and is sometimes caught by the wind. It fades. All of these ephemeral qualities come about in the space after a sound has been emitted and in the movement in and interaction within this space. And yet, these qualities are always already inherent and intrinsic to a sound, which speaks to the potential differences between a sound (as an object), to sound (as an action) and sounding (as a state of being). The interactions and nuances between these ideas greatly inform the philosophical undertones of this paper. Hold onto these ideas, as we will come back to them shortly.

Sound is also a physical phenomenon. It is a vibration of matter that travels in a wave through a medium. This medium can be almost anything, though it must be something. In addition, in order for a sound to be audible to humans, the medium must be dense enough to carry vibrations whose wavelengths are within the spectrum of human hearing (20Hz–20,000Hz). To this point, the old adage "there is no sound in space" is inaccurate; there is sound, we just can't hear it (unaided).

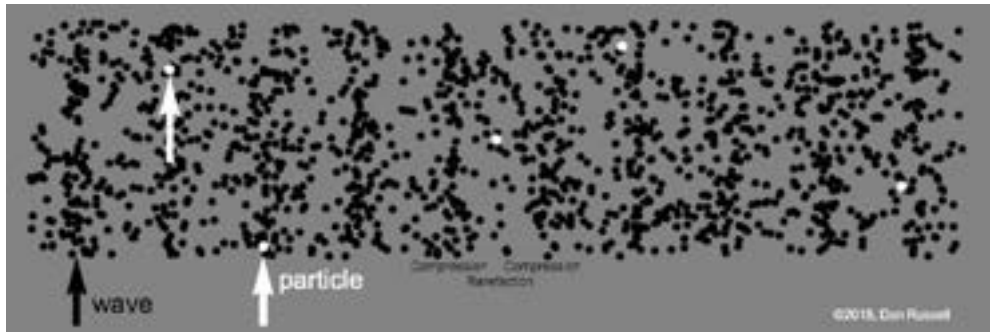

Figure 1. Sound as a Vibrational Wave. From "Acoustics and Vibration Animations," by Dr. Dan Russell, Grad Program Acoustics, Penn State. https://www.acs.psu.edu/drussell/demos.html.

Sound moving through air disrupts and vibrates particles into states of high and low pressure. The peaks of these waves are areas of high pressure; the troughs are areas of low pressure.

THE WAVEFORM – A Visual Representation of Sound

The waveform is one way to represent these series of vibrations visually. It is a 2-D mapping of time over amplitude (as an aside it is important to note that the collapse of sound into two dimensions, however convenient for the purposes of this paper and experiment, is incomplete. The waveform visualization is linear, though real-world modeling is multi-dimensional).

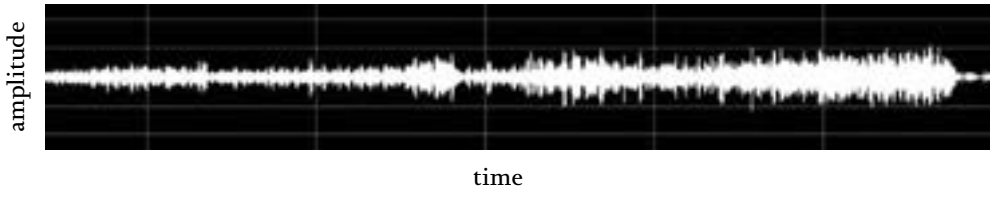

Figure 2. The Waveform as a Mapping of Amplitude Over Time.

In the waveform, the ephemerality of sound is made visible. It has also been rendered static; sound's plasticity – its ability to morph, to move through, to interfere with, to reflect off of – has been mapped to fixity, such that what we see is not so much what we hear or experience, but rather a snapshot of what we heard and what existed over a given interval of time. That being said, the waveform does give a concrete way to measure properties of a sound, such as wavelength, frequency, and amplitude. Further, the characteristics of a sound – its glitches, timbre, silences – become visible and tangible on this graph. It also gives us a mathematical model from which we can predict how sounds might interact with one another. In this way, waveforms are mathematical functions.[1]

One of the bridges between sound and math (and there are many, but the one that I am using in this particular case) is the sine function. In math, this trigonometric function pops up in a few different places.

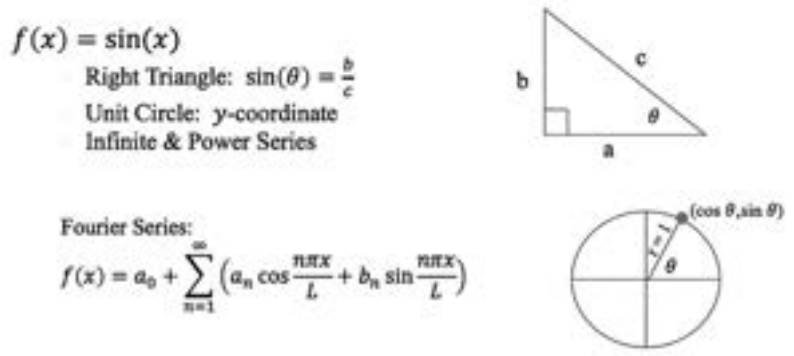

Figure 3. The Sine Function.

In a right triangle, the sine of a given angle, θ, is defined to be the ratio of the length of the opposite side over the length of the hypotenuse. The sine of θ in turn relates to the y-coordinate on the unit circle (radius = 1). The function is also used in infinite/power series in calculus (e.g., the Taylor series and Fourier Series, the latter of which will be explained further on in this paper) to approximate the behavior of more "complex" functions.

The graph of sin(x) translates the circular motion of the angles (0-360°, or 0-2π) to a horizontal axis. From this graph we can analyze and describe the sine wave by identifying, among other things, its amplitude and period.

1 A mathematical function is a relation that maps a set of inputs to a set of outputs, with each input being mapped to one and only one output.

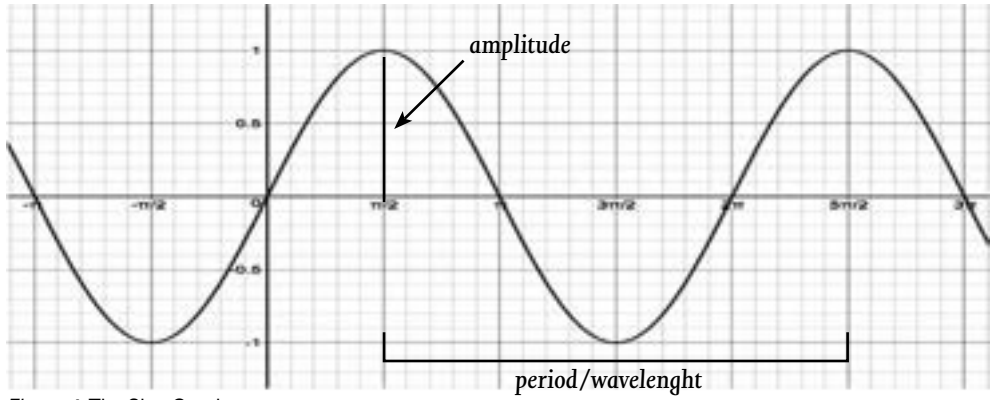

Figure 4. The Sine Graph.

The *amplitude* of a sine wave is the positive distance between its midline (in this case the x-axis) and its maximum value. Sin(x) has an amplitude of 1. When describing sound, the amplitude refers to the amount of variation in air pressure (how "large" the wave is), and it is roughly proportional to volume.[2] A larger variation in pressure results in a larger amplitude. The *period* of a sine wave is the distance between its maximum peaks (alternatively, its minimum troughs). It is the length of one cycle of the function. The function sin(x) has a period of 2π. In relation to sound, periodicity is referred to as *wavelength*, which, similarly, is the length of one vibratory cycle (the distance between areas of high pressure).

The wavelength is inversely proportional to *frequency*, which is the rate of vibration of a wave. Specifically, frequency is measured in hertz (Hz) and is defined to be the number of times the wave oscillates in one second. So, for example, a sound with a frequency of 440Hz means that its wavelength cycles through 440 times in one second. This frequency can be modeled by the mathematical function $f(x) = \sin(880\pi x)$.

The sine wave is a "pure" tone; it contains no overtones/harmonics.[3] In other words, what you hear is, precisely, what you hear. The frequency of the sine tone correlates to its pitch. The higher the frequency, the higher the pitch, with shorter wavelengths resulting in more oscillations per second. The lower the frequency, the lower the pitch, with longer wavelengths oscillating fewer times per second.

2 Note that the volume of a sound is measured in decibels (dB), which is a logarithmic representation of amplitude. Specifically, if a is the amplitude of a wave, then the dB level is defined as: $dB = 20log\left(\frac{a}{a_0}\right)$, where a_0 is a reference amplitude equal to 10^{-5}. This reference amplitude scales the dB range to one that corresponds to human hearing.

3 A pure tone is any tone with a sinusoidal waveform. As such, it contains only a single frequency. Complex tones – tones that are not sinusoidal – are composed of multiple frequencies, consisting of a fundamental – the frequency with the greatest amplitude – and harmonics or overtones. These latter resonant frequencies vibrate at a rate that is a scale factor of the fundamental. If the scale factor is an integer, then the resonant frequency is a harmonic. This means that in any given complex tone there are potentially an infinite number of frequencies sounding simultaneously. This multiplicity is what gives a sound its character or timbre.

MATHEMATICAL FUNCTIONS – Domain, Range, and Composites

The sine function is a model of how sound behaves as a wave. In the most general sense, a mathematical function is a formula that maps inputs – x – to outputs – $f(x)$. In the case of the waveform, the input is time (as measured in seconds), and the output is amplitude (as measured in variations of air pressure)[4]. These inputs and outputs correspond to the domain and range of a function.

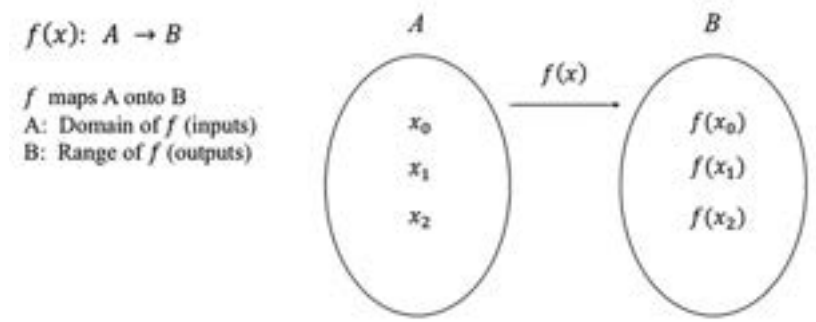

Figure 5. Mapping of Domain and Range.

It is important to have a shared, mathematical understanding of domain and range before moving on, in part because I want to offer a theoretically flexible and creative application in their relation to sound, or to a sound, or to something that is sounding.

Mathematically, the domain is the set of all possible values for which a function is defined, and the range is the set of all possible output values for that function. Note that since the outputs depend on the inputs, the range depends on the domain.

For example, the domain and range of the function $f(x) = 3x$ is the set of all real numbers.[5] I can put any real number I want into this function, and it will output three times the value of the input (i.e., $f(2) = 6$). The outputs are also real numbers. The graph of f confirms this. The line is continuous in both the positive and negative x directions and will thus hit every output in the set of real numbers. Contrastingly, let's look at the function $g(x) = x^2$. The domain is all real numbers, however the range is restricted to the set of non-negative real numbers. This can be proven algebraically, as the square of any real number will result in a non-negative number, and can be seen graphically, as the graph of g does not extend below the x-axis.

4 The amplitude of a soundwave measures variations in pressure as the wave moves through a medium (see Footnote 1 above). Much like the sine wave, the peak amplitude of a soundwave is measured as the positive distance between the highest (or lowest) pressure and the equilibrium axis.

5 $\mathbb{R}$ is the mathematical notation for all real numbers

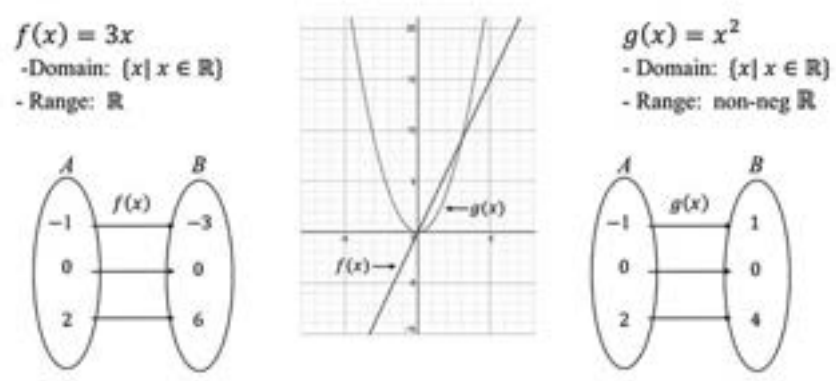

Figure 6. Domain and Range of Two Functions.

When considering $f(x) = \sin(x)$, the domain is all real numbers, while the range is restricted to the values between –1 and 1, inclusively. This can be seen on the graph itself. Note that the range of the 440Hz sine tone is similarly restricted depending upon the chosen amplitude.

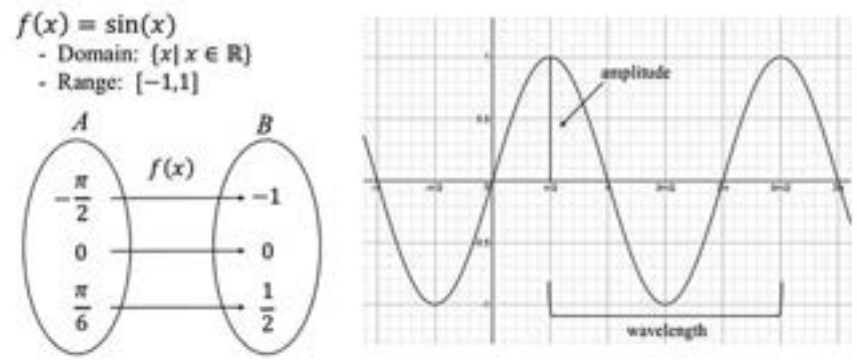

Figure 7. Domain and Range of the Sine Function.

Domain and range are the driving factors in the mathematical process of composition. When composing two functions, the outputs of one become the inputs of the other. One function is quite literally put into another.

Symbolically, the composite of two functions, $f(x)$ and $g(x)$, is written as: $f(g(x)) = (f \circ g)(x)$

We call this "the composition of f with g" or "f composed with g" or "f of g of x."

In this notation, we can see that $g(x)$ is being put into $f(x)$. This means that the domain of the composite function is dependent on the range of g. Further, since the range of g depends on its own domain, in a composite function the domain of the inside dictates the domain of the outside. This establishes interdependency between domains and ranges. It also suggests that the order of composition is important, i.e.,

putting g into f might result in something different than putting f into g. This is, in fact, the case. Composition is not commutative; order matters.

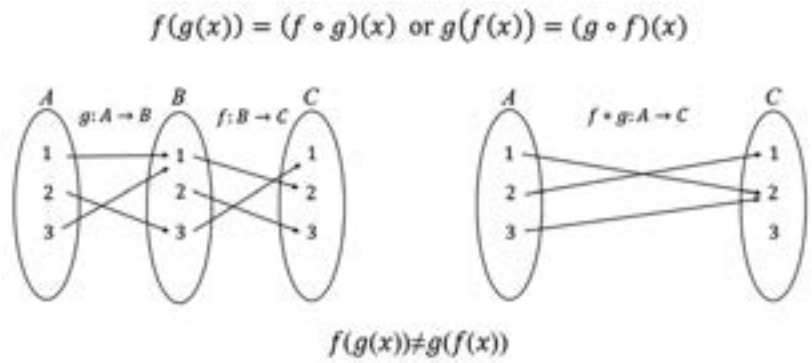

Figure 8. Domain and Range of Composite Functions.

Let's look at some concrete examples. Suppose $f(x) = 3x$ and $g(x) = x^2$. Recall that the domain and range of f, as well as the domain of g, is all real numbers. The range of g is the set of non-negative real numbers. Since the range of g is restricted, the domain of $f(g(x))$ will be similarly restricted, which ultimately restricts the range of the composite function. Note that reversing the order of composition, we get a different result.

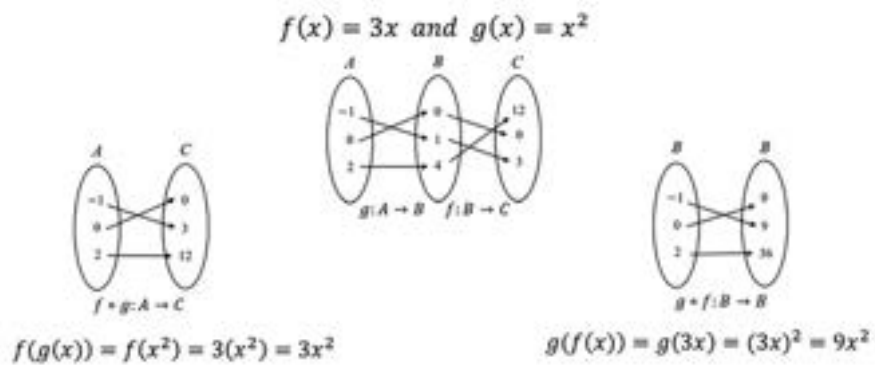

Figure 9. The Composition of Two Functions.

This method of composition can be used, iteratively and repeatedly, on a function itself, and when a function is composed with itself in this way, the result is often a predictable pattern of outputs.

Take, for example, the function $f(x) = \frac{1}{x}$. Successive iterations of self-composition result in one of two outputs: x or $\frac{1}{x}$. The function keeps mapping back and forth between these two.

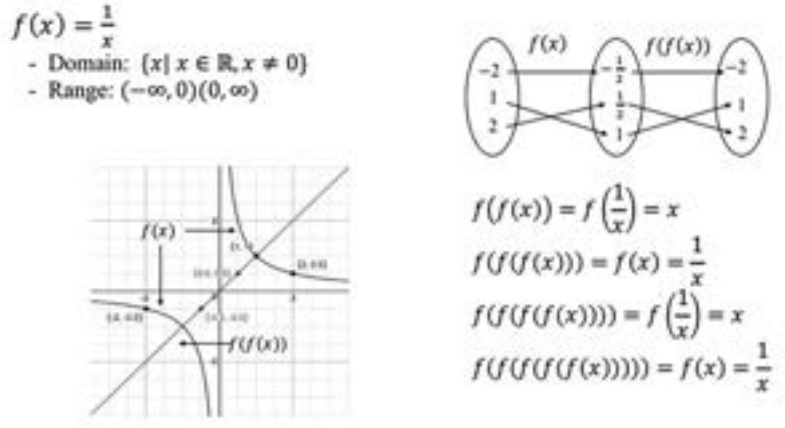

Figure 10. A Self Composite Function.

This predictability in math is not surprising, given the nature of our original function. In applying this iterative process to sound, will similar patterns emerge? On a fundamental level, mathematical composition uses the outputs of one function as the inputs for another. What would it mean to use the outputs of one sound as the inputs for another, to compose a sound with another sound, or even a sound with itself?

BACK TO SOUND

I am interested in mathematical composition because it relies on the interdependencies between inputs and outputs. Looking specifically at the iterative and recursive process of composing a sound with itself, this interdependency becomes intricate, intimate, and insular. A function or sound is not merely mapped onto itself, as a function would map the inputs of one set onto the outputs of another. Rather, in this process a function or sound could be mapped *into* itself.

How do domain and range relate to sound? What is the domain of sound? What is the domain of a sound, and are these necessarily the same?

A conventional definition of domain refers to a specific area of knowledge, or an area of ownership or control. When I asked someone close to me what she thought the domain of sound to be, she immediately replied "perception" – the domain of sound is a sense or sensorial experience. Another possibility is that the domain of sound is all things audible, or all things able to be made audible, or all things containing audibility. This leads me back to the ideas of what it means to sound, to be sounding, and to make a sound. The distinctions here, while at first glance subtle, are important, specifically as they relate to the credence and creative potential of sounds that are always already present in a given space or object,

regardless of what/who/how they might be activated. The distinction is a matter of agency. In the composite of a sound with itself, this agency is self-contained and self-propelled. It is wholly within the sound, and yet in the process of recursive composition there is the possibility for something new to be created, to break forth from the insularity of the original, perhaps precisely because of this insularity.[6] This iterative process is defined by self-repetition.

We often think of repetition in terms of comfort. We repeat to familiarize, to reassure. Repetition can also push a space, an experience, or a self, into crisis. In repeating, the potential vulnerability of the familiar becomes unveiled. The crisis of repetition is in this unveiling, this "fall from the familiar." How is this notion of crisis thought out in and through a process such as mathematical composition? Is it implicit, and/or does it require the act of composition for its actualization? I think that the sound possesses its own potential towards crisis, or for crisis, and it is the process of composition that propels its vulnerability into play. Where does the crisis erupt, in what form, and how does this change the sound? Is the sound capable of self-evaluation? Can the sound withstand the crisis?

One place to look for crisis through repetition in sound is in reverberation. Reverberation is a phenomenon of repeated reflections. When an original signal from a sound source in an enclosed space is reflected back by the boundaries of that space, the build-up and simultaneity of these reflections creates reverberation.

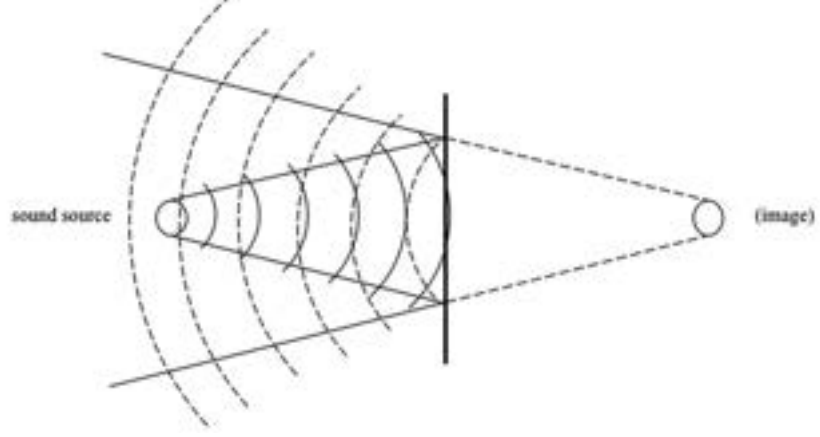

Figure 11. Reverberation – Repeated Reflections of Sound Waves.

In this build-up, sound is repeatedly intersecting with itself, and changing itself as a result. Taken together, these reflections can cause a sonic crisis, where the original sound can become distorted to the point of unrecognizability. This is close to the

6 This idea of breaking forth from, or breaking through, insularity resonates with Henri Bergson's notion of the potential as it relates to the simultaneity of time (Bergson, 1991). Bergson sees the past, present, and future as existing simultaneously. In so far as there exists a mirage of the present in the past, a future can only be conceived in real terms, based on the present. What Bergson calls the potential or virtual, though, is distinct. It is a place of becoming, erupting out of the simultaneity. It is the site of radical creativity. This eruption from the familiar is not unlike the breaking forth from insularity.

model that I am proposing, with the distinction that in reverberation, the distortion and crisis take place outside – within a given space – and in iterative composition, the crisis is located within.[7]

A COMPOSITIONAL EXPERIMENT

Recall that the domain of the waveform is time. For the purposes of this experiment, I will use $t \geq 0$, where t is in the set of positive real numbers and $t = 0$ is the "press record" moment. It becomes interesting to think about the characteristics of a waveform if we extend this domain. As a time-based phenomenon, the linearity of the domain corresponds to ideas of what has sounded ($t < 0$), what is sounding ($t = 0$), and what might be sounded/sounding ($t > 0$).

Sounds whose domain is the set of negative real numbers are sounds in past time, sounds that have already sounded. What are the outputs of negative time? Do they still sound?

While these philosophical introspections are important, I want to attempt to ground them in the realm of sounds themselves, in the analysis of inputs and outputs and compositions of waveforms. Examining the sine wave might be the most direct way to begin.

As mentioned earlier, the sine tone oscillating at 440Hz is represented by the equation:

$$f(x) = \sin(880\pi x)$$

Applying recursive composition to this function would produce the following series of functions:

$$f(x) = \sin(880\pi x)$$
$$f_1 = f(f(x)) = f(\sin(880\pi x)) = \sin[880\pi(\sin(880\pi x))]$$
$$f_2 = f(f_1) = \sin[880\pi(\sin(880\pi(f_1)))]$$
$$f_3 = f(f_2) = \sin[880\pi(\sin\ sin\ (880\pi(\sin\ sin\ (880\pi ...))))]$$
$$f_4 = f(f_3) = \ldots$$

We could continue this iterative composition indefinitely, and graphing this series of compositions produces a predictable, yet perhaps surprising, pattern.

Below is the graph of the first 10 compositions. Note that the functions themselves maintain their wavelength, while their amplitude decreases with each composite. Further, the peaks and troughs of this wave are "flattening" out.

7 Again, Bergson resonates here. The site of temporal crisis for Bergson – the potential, the place of radical creativity – parallels the site/sound of sonic crisis of iterative composition. In both cases, the insularity is breached from within.

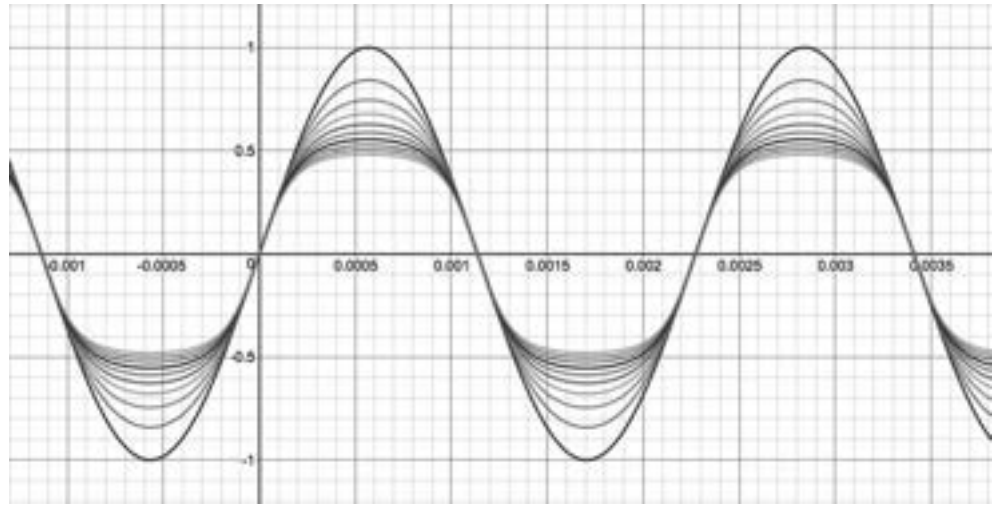

Figure 12. The Self Composite Sine Function (Note: graph produced by Desmos Graphing Calculator, 2019).

If we continued this process, the pattern would continue as well. In mathematics, limit analysis can be used to predict the shape and output of this wave as the process is pushed to infinity. This analysis shows that the amplitude will in fact approach 0.[8]

Pushing this iterative composition to its limit results in a sense of self-silencing, or self-muting, as if the increased scrutiny into the interiority of this wave – as this wave is put back into itself ad infinitum – results in its own silence. Silence might be the crisis, the point towards which self- repetition through composition approaches as this sound is continually mapped back into itself.

In applying this method of analysis to a sound that is not a pure tone (i.e. all sounds that are not sine tones), we need some more tools.[9] The periodicity of the sine tone guarantees that we can analyze its relative frequency given its waveform. However, for other sounds, the frequency is not as easily identifiable. It requires a tool that is able to take a complex waveform and break it down into smaller, more recognizable components. This function is the Fourier Transformation.

In essence, the Fourier Transformation decomposes a function into its component frequencies, into its separate sine and cosine parts (note that the cosine function is the sine function with a phase/horizontal shift of $\frac{\pi}{2}$ radians). With this tool, a complex wave or sound can be represented by a sum of sine and cosine functions, making individual frequencies more easily identifiable.

8 The convergence or divergence of infinite, iterated compositions are a subject of both functional analysis and metric space theory. The limits of such compositions can be found using limit analysis and contraction/fixed-point theorems such as the Banach Fixed-Point Theorem.

9 For more information on pure and complex tones, see Footnote 3 above.

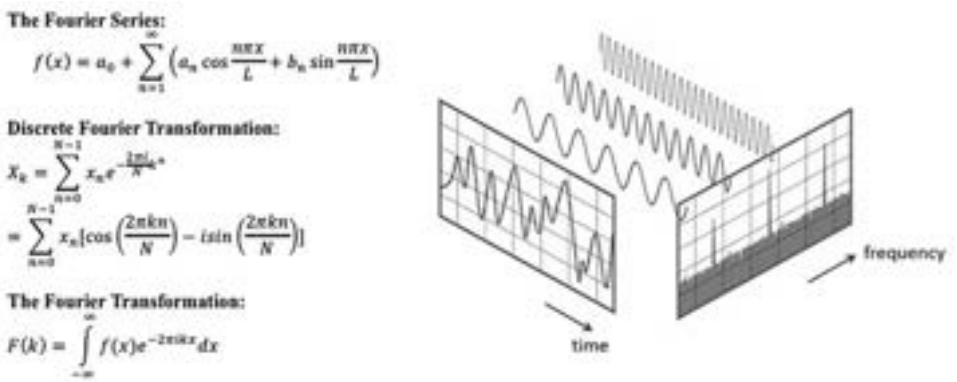

Figure 13. The Fourier Transformation (Note: the image on the right is from "FFT-Time- Frequency-View," by Phonical. https://commons.wikimedia.org/w/index.php?curid=64473578. Copyright 2017. CC BY-SA 4.0).

In particular, the Discrete Fourier Transformation is a way to switch from the time domain to the frequency domain. This transformation will be unique for each sound, and thus will produce a different composition dependent upon the original waveform.

Conventionally, this tool is used on the waveform itself, mapping the time domain onto a frequency domain. With this experiment, I am proposing to first extract the amplitude data from a given waveform (the outputs) and use them as inputs in the Discrete Fourier Transformation, thus mapping amplitude range onto a frequency domain.[10] At each stage in this process, I also plan on producing a spectrogram – a visual mapping of frequency over time – so that I can record the frequency changes with successive iterations. The graphs below represent some beginning endeavors into this experiment. They are all visual representations of the same original waveform.

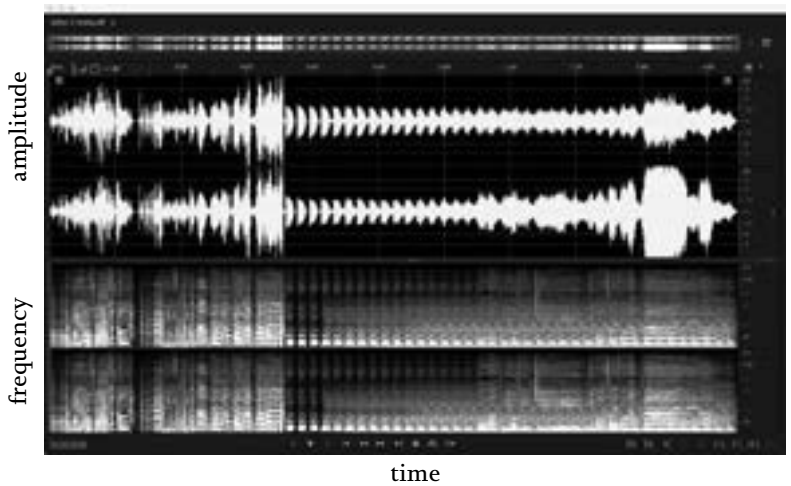

Figure 14. Waveform (above) and Spectrogram (below).

10 This amplitude data would coincide with the amplitude envelope of a waveform: the (non-negative) profile energy of sound over time. In the Fourier Transformation, this can be done by either using the absolute value or a Hilbert transformation, which essentially corresponds to a phase shift of $\frac{\pi}{2}$ radians.

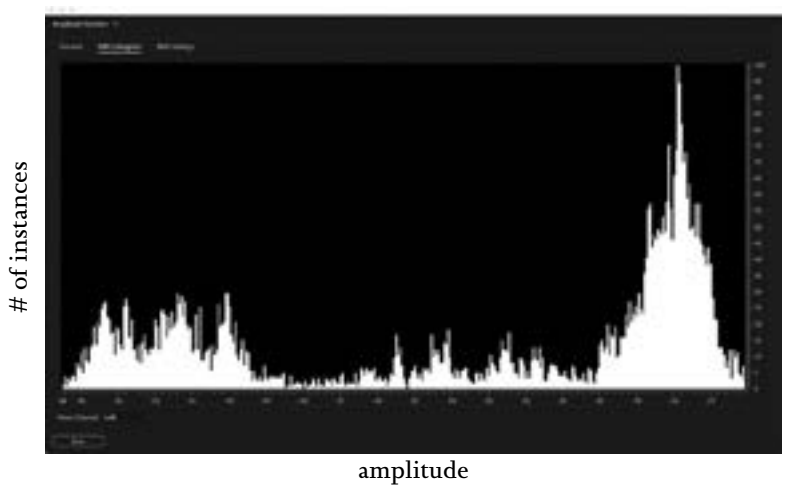

Figure 15. Amplitude Histogram.

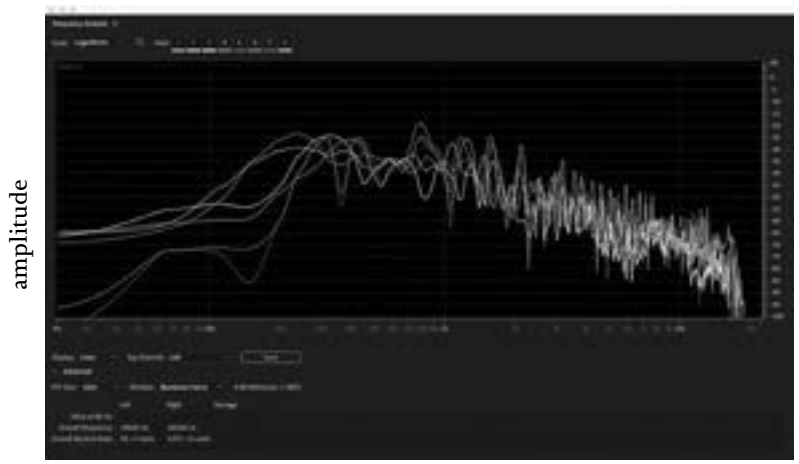

Figure 16. Mapping of Amplitude Over Frequency.

Conclusion

This is an experiment in self-mapping sound, in composing with composites. In full transparency I am at the beginning stages of this experiment. I know how to mathematically describe and analyze these compositions, but the question 'what might these sound like?' is perhaps beyond the purview of the domain of mathematical modeling.

I do know that this compositional process is generative (which has its own history and context rooted in the works and processes of minimalist composers like Reich and Riley)[11]. This compositional process is not aleatoric, as it relies on a fixed mapping of one domain/range onto, and into, another, which can be calculated

11 For more on minimalism, post-minimalism, and generative/additive methodologies, see Fink (2009) and Eastman (2005).

given the individual waveforms themselves. This compositional process is not additive, and while it is a mapping of potential repetitive patterns, it is more than a serial approach to composition.[12] It is a process that works from the inside out, that explores how the interiority of a sound is intimately related to, and can in fact shape and manipulate, its exterior. This compositional process is iterative; it can be pushed to scale and, in the case of composing a sound with itself, it can be self-generative and self-inflicted/self- reflective. This is an exploration into the interiority of sounds, into the residues of sounds, and in using the composite as a mathematical model and compositional framework, I am hoping for a new way to combine and relate sounds: a new way for sounds to sound themselves.

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12 Serialism in composition is based on a premise of serial, ordered patterns related to pitch, rhythm, dynamics, etc. Serial compositions, and specifically 12-tone music, can offer a counter to compositions based in tonality as no individual tone takes precedence, or dominance, over another.

3

HYBRID MEDIA: IMAGINATION AND PRACTICES

Hybrid Sound Spaces – Art and Science Collaborations

NIGEL LLWYD WILLIAM HELYER

ABSTRACT:
This paper discusses elements of my creative practice that are firmly based in art and science collaboration and will focus on three major developments. These examples have been selected as they differ from the typical short-term Artist in Residence model, each being undertaken over a period of several years. The second thread that these projects share is a core interest in sound.
The first project concerns the creation of sonic-cartographies, geo-spatially located, immersive audio interactives, undertaken by the artist as *SonicLandscapes* (with Dolby Australia) and subsequently as *AudioNomad* (with UNSW).
Under the IceCap is an ongoing collaboration with the Institute for Marine and Antarctic Studies (UTAS) which transforms complex bio-logging data (collected by Southern Elephant Seals diving under Antarctic ice caps) into animated 3D mapping environments accompanied by data sonification and/or live music performance from data derived graphical scores.
The final section, *GeneMusiK,* describes a system in which music notation is transcribed into synthetic DNA, which is inserted into bacteria, mutated in vivo and finally extracted and resequenced into music – in effect creating a biological music mixing system. *GeneMusiK* commenced experimentally in 2003 and has recently produced successful results at the Instituto Medicina Molecular (Lisboa).

KEYWORDS: art and science, art and environment, sound-mapping, data sonification, data visualisation, bio-logging, antarctic, genetics, micro-biology.

SECTION 1: Audio-Portraits; SonicLandscapes and AudioNomad

Walking in Augmented Reality

In 1998 I was fortunate enough to be awarded an Art and Science Artist in Residence at Lake Technology in Sydney (now known as Dolby Australia) to develop a speculative map-based Virtual Audio Reality system. The salient feature of the *SonicLandscapes* (and the subsequent *AudioNomad*) project was the juxtaposition of a fictive but very convincing 3D immersive soundscape, accurately positioned by cartographic software, upon a physical terrain. Participants would engage with a seemingly live sonic organism, responsive to their presence and orientation; the soundscape, animated by the traces of their wanderings, appeared uncannily embedded in the surrounding space. The conceptual cues for this research and development programme were taken from two literary sources.

Conceptual Origins

There is a marvellous passage in Lewis Carroll's *Sylvie and Bruno Concluded* (Carroll, 1895) that describes a unique map, made on a one-to-one scale, that is, a map made to fit exactly over the physical terrain that it represents, the obvious irony being that it totally obscures the features it is intended to represent.[1]

> "What a useful thing a pocket-map is!" I remarked.
> "That's another thing we've learned from your Nation," said Mein Herr, "map-making. But we've carried it much further than you. What do you consider the largest map that would be really useful?"
> "About six inches to the mile."
> "Only six inches!" exclaimed Mein Herr. "We very soon got to six yards to the mile. Then we tried a hundred yards to the mile. And then came the grandest idea of all! We actually made a map of the country, on the scale of a mile to the mile!"
> "Have you used it much?" I enquired.
> "It has never been spread out, yet," said Mein Herr: "the farmers objected: they said it would cover the whole country, and shut out the sunlight!
> So we now use the country itself, as its own map, and I assure you it does nearly as well."

SonicLandscapes took up Carroll's conceit, replacing his opaque map with the transparency of a virtual GPS mapped space. GPS partakes of Carroll's world covering metaphor in its one-to-one relationship with terrain but differs in its immateriality, which provided *SonicLandscapes* with a matrix into which content as audio memory objects could be situated.

A second literary source provided the impetus for developing SonicLandscapes and the concept of seeding a physical environment with virtual audio memories. The storage and retrieval of audio content within a complex soundscape set within a physical landscape, has its roots in a classical mnemonic system for storing rhetoric. In "The Art of Memory" Frances Yates (1966) paints a vivid picture of the ancient technique that enabled orators to place memory objects, such as lengthy quotations, within the labyrinthine spaces of classical architecture. By visualising an architectural interior, real or imaginary, the speaker might place a red cloak over a sculpture and then a sword on a table to act as mnemonic triggers. By memorising a stroll through this virtual architecture, an orator could retrieve a vast amount of correctly sequenced rhetoric. In English we still use the trope "in the first place, in the second place ……"

1 A concept re-worked by Jorge Luis Borges in the March 1946 edition of Los Anales de Buenos Aires, Vol. 1, No. 3....*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*. (Borges, 1946, p. 53)

The ancient *Ars Memoriae* techniques described by Yates are certainly based upon our deep seated capacity to associate thought and more specifically memory, with geo-spatial locations – an evolutionary feature that situates *thought as action* in the physical environment. In this manner thought and memory are not abstracted and deracinated but are complex products linking memory and cultural knowledge with specific places, as well as to the many sensory attributes of such loci, their odours, visual markers and acoustic properties, which subsequently serve as powerful associative triggers.

The expanded sensory inputs that walking provides (especially in natural environments) afford different modalities of thinking that are in stark contrast to those based upon extant knowledge, contained in books and which serve to support the assumptions of the status quo. Nietzsche was quite clear about his preferences when it came to thinking.

> "We do not belong to those who have ideas only among books, when stimulated by books. It is our habit to think outdoors – walking, leaping, climbing, dancing preferably on lonely mountains or near the sea where even the trails become thoughtful." (Nietzsche, 1882)

When the *SonicLandscapes* project started, some twenty years ago, the US Government still applied *selective availability* to GPS which rendered it only vaguely accurate, so we employed the technique of *differential* GPS in the prototype system making it capable of operating with a terrestrial accuracy of 2 cm and with a one degree accuracy of rotational head orientation. The tracking technology for the *SonicLandscapes* project was provided throughout by the SNAP (Satellite Navigation and Positioning) Lab of the University of New South Wales, which, when combined with Lake's patented surround sound headphones (now know as Dolby Headphone, common in airline business class), delivered a convincing, immersive audio experience that reproduced distance and directional and atmospheric effects. The choice of a prototype test site for the project was the gothic graveyard of St Stephen's in Newtown, one of Sydney's oldest burial grounds, which provided an ideal, if spooky, pedestrian environment, rich in historical material, with interesting visual surroundings.

At the outset the work on *SonicLandscapes* project was regarded as a novelty within the hard-nosed, high tech, research and engineering environment of Lake Technology, a research culture which aimed to produce a new patent every week (which is slightly more than Edison's benchmark of once every nine days). However, within six months *SonicLandscapes* was designated as one of the company's core research projects, producing three patents within the course of the first year – and suddenly I found myself a consultant to the lab's key concept development team. Unfortunately, in the world of technology development, rapid success often invites rapid change – the American company Dolby acquired Lake Technology for its IP portfolio and temporarily froze research in favour of product development – so after two and a half years of intensive work it was time to move. However, not to be thwarted, I joined forces with my research associates[2] from the University of New South Wales and successfully applied for Federal research funding, and together we formed the *AudioNomad Research Group* (2003 ~ 2009).

2 Dr Christoper Rizos and Dr Daniel Woo.

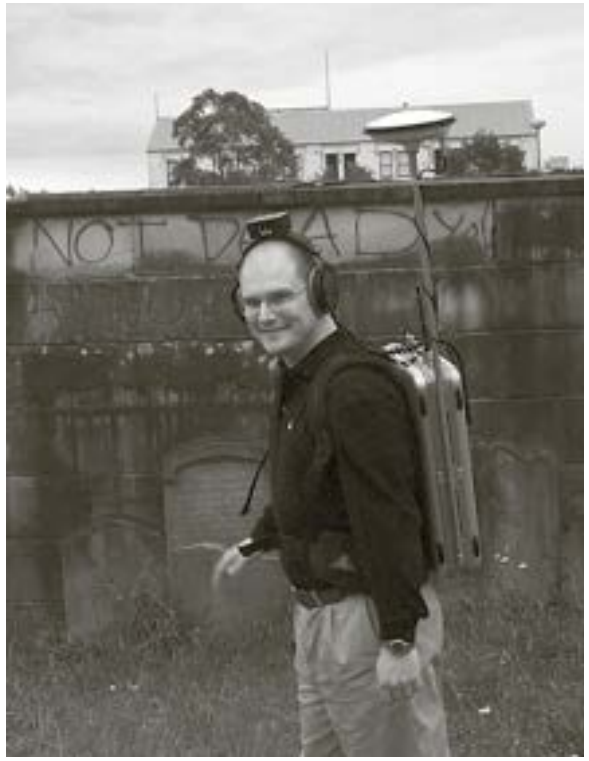

Figure 1. *SonicLandscapes* prototype being tested in St. Stephen's graveyard, Sydney, 1999. Image: Nigel Helyer.

Whereas *SonicLandscapes* was basic applied science with a cultural spin *AudioNomad* was conceived from the outset as an arts driven research and development programme focussed upon a series of cross-disciplinary projects that utilised GPS-enabled, location-based audio applications. This meant that each new work was tailored to a specific geographical and cultural context and was associated with a significant international exhibition or festival.

The resulting series of interactive artworks enabled the audience to experience an immersive virtual/augmented audio world – designed to be perceived as though it emanated from the real world, with each individual sound appearing to originate from a single real object or environmental feature and mixed to form a seamless soundscape. Whereas our classical rhetorician would recall a walk through imaginary architecture in order to retrieve the sequential elements of a speech, the participants in a *SonicLandscapes* or *AudioNomad* project would literally walk in a real environment – their physical position and orientation performing a multi-channel soundscape delivered via surround-enabled headphones. The team were always careful to ensure that the virtual audio image appeared as a layer that combined with the soundscape of the location in a manner that the two became indistinguishable.

As the project developed, we created alternatives to the basic walking modality – the system output was deployed to massive surround-speaker arrays mounted within large mobile platforms such as cars and ships. In the case of the ship-mounted works, *Syren* for ISEA2004 in the Baltic Sea and *Syren for Port Jackson* 2006 on Sydney

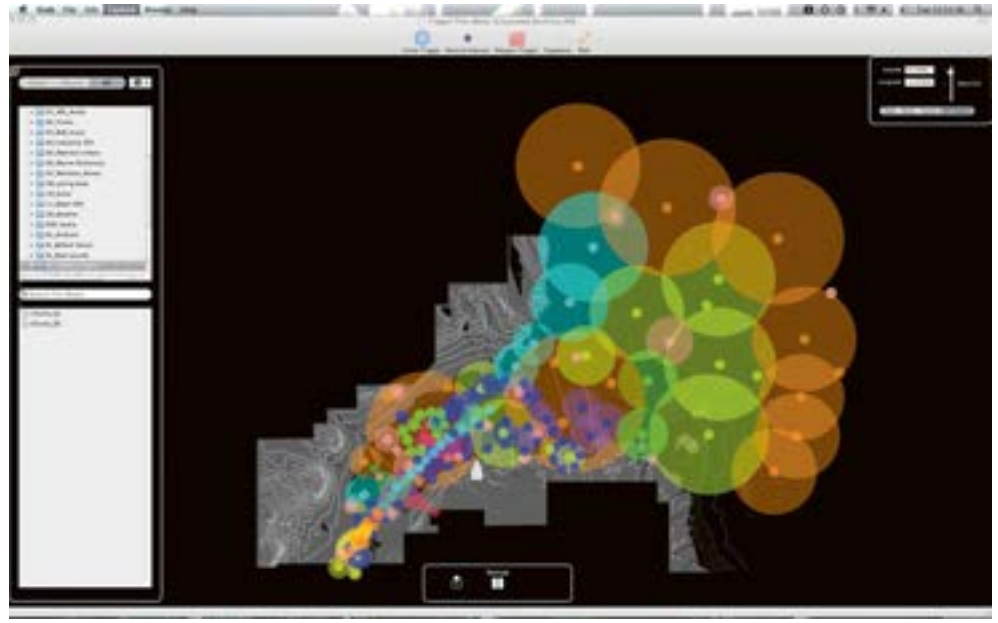

Figure 2. Screen interface for an AudioNomad project. Image: Nigel Helyer.

Harbour, the listener still moved through the landscape/seascape but as one transported both literally and metaphorically, on a ship. In subsequent developments for museum exhibitions, the system was configured to be driven from a console mounted interactive map, allowing the user to navigate a virtual mapped space and simultaneously drive a powerful, immersive, surround speaker array.

Syren; some Detail

Syren (Helyer, 2003) was a shipboard version of augmented audio reality that allowed passengers to link the multichannel surround-sound experience onboard the vessel with the visual experience of the surroundings. Via a high-resolution GPS system coupled to a digital compass, the system was able to automatically access geospatial information as the ship navigated the electronic charts associated with the ship's track. This positional information was used to render a surround-sound, 3D soundscape, corresponding to proximate physical features via a twelve point two (12.2) speaker array. *Syren* made its debut on the cruise ship "Opera" on the Baltic Sea as part of the International Symposium on Electronic Arts, in Helsinki in August 2004. A subsequent version, entitled *Syren for Port Jackson*[3] was run over three days in March 2006 in conjunction with the conference New Constellations: Art, Science, and Society at the Museum of Contemporary Art in Sydney.

These projects test concepts in virtual soundscape design at a much larger scale than is possible with handheld *AudioNomad* systems. Each maritime project was a specifically designed sonic seascape with special attention paid to local maritime narratives, histories, and specific elements of the local ecology and seascape.

3 New Constellations exhibition in conjunction with the Museum of Contemporary Art, Sydney, 2006

Figure 3. Proofing audio locations with a test rig in Port Jackson (Sydney Harbour). Image: AudioNomad.

Figure 4. Onboard the project vessel equipped with a 12.2 surround sound array. Image: AudioNomad.

The sonic components were interwoven to form a unified narrative much like those found in ancient epic voyages – combining contemporary political and cultural life with ambient and environmental sounds, music and song, as well as multilingual vocal narratives drawn from archival and live recordings.

As the ship navigated through and around the harbours, the software responded to GPS triggers to call up elements of the soundscape, rendering them to the appropriate bearing and distance relative to the ships track and so simulating a soundscape associated with the landscape and seascape features that formed the horizon – sounds to the aft slowly fading as sounds ahead emerged. One of the principal effects of *Syren* was to suggest a series of parallel audio realities that appeared to overlay the visual landscape and seascape and opened up the possibility of observing a cultural and historical axis pivoting on a series of geospatial points.

Logistic and Conceptual Challenges

The compositional challenges of virtual audio reality differ radically from conventional audio production. In general audio, works are linear and structured in the temporal domain (even if they are tagged to physical points of interest, as in an audio tour), however, in these virtual audio reality compositions the audio material is structured spatially – there is no overall temporal structure other than at the local level of the individual sound file – here, the temporal and sequential structure is activated by the participant who 'performs' the soundscape through movement.

Composing in this mode is initially disconcerting, firstly as the composition resides in a spatial matrix and not in a linear temporal format, and secondly because the composer's raw materials consist of dry, mono sound files that are only rendered into a complex sonic mix when the system is activated by a participant. The placement of files and the allocation of their behaviours and interactions is, in effect, a score, but a score that has no single or preferred outcome, but one which acts as a portal to parallel audio worlds.

Again, unlike conventional sound design or musical composition, geo-spatially located audio needs, above all, to be sensitive to its environmental and architectural context, as well as to the fundamentally nonlinear manner in which the mobile user might navigate the terrain and thus determine the interaction with the content. Projects designed for walking require consideration of the user's potential behaviour as they navigate architectural and environmental structures, which provide both accessible routes and present physical obstacles which determine position, walking speed, heading and dwell time. These factors in turn have implications for the perception of geospatial displacement, wherein distance and speed are transposed to volume, reverberation and loudness so as to convincingly simulate the potentially large scale of architectural, landscape or seascape features.

As *AudioNomad* grew through iterations the compositional toolset developed in complexity and sophistication. The core attributes, such as positional accuracy, convincing audio localisation via surround sound headphones (or surround speaker arrays) and the ability of the system to deliver multiple channels of audio simultaneously all contributed to the overall immersive experience. This foundation supported a palette of compositional (and editing) tools that consisted of geolocated trigger zones that contained audio file stacks together with their attributes, which, for example might include volume ramps, file sequencing, looping and atmospheric audio effects, as well as various trajectory behaviours either related to geography or to the auditor's position and trajectory. Thus, a participant might approach a physical object, trigger a cascade of audio files then move away, terminating the geographically fixed files but taking away, for example, a vocal narrative that slowly circled the auditor's head.

Teleportation and other worlds – a third modality made a break from the 'purist' approach that seamlessly co-locates the soundscape with the landscape. The *Run Silent Run Deep* project was undertaken as a three-month Artist in Residence at the Tropical Marine Science Institute of the National University of Singapore and exhibited at the National Museum of Singapore as part of the 2008 International Symposium of Electronic Arts. Making an ironic twist on the wartime submariner's motto, *Run Silent Run Deep*, the project maps an audio-portrait of Singapore Island with a strong emphasis on discovering and amplifying the maritime life and marine biology of the island.

Visitors to the work were able explore a massive archive of audio files through interaction with a cartographic interface displayed on a custom-built tabletop projection surface. A circular twelve point two speaker array rendered a powerfully immersive soundscape in real time, according to the position, orientation and relative velocity of the user's track through the virtual map space. Again, the user is at the centre of a sonic universe and is palpably in control and aware of both their spatial movement and the sonic events that their movements provoke. However, in this modality, there is an inevitable displacement between the physical location of the participant and the mapped location, as well as the provenance of the recorded material, recalling the 'schitzophonic' nature of all recorded sound, a term coined by R. Murray Schafer to denote the dislocation of recorded audio from its original source (Schafer, 1977).

Thus, the engagement with a museum-based static interface, which is spatially dislocated from the physical landscape features that its cartographic interface represents, produces a more abstract and subjective experience. The creative synergy arises between the interrogation of a cartographic, representational space and the dynamics of the real-time composition that such navigation renders.

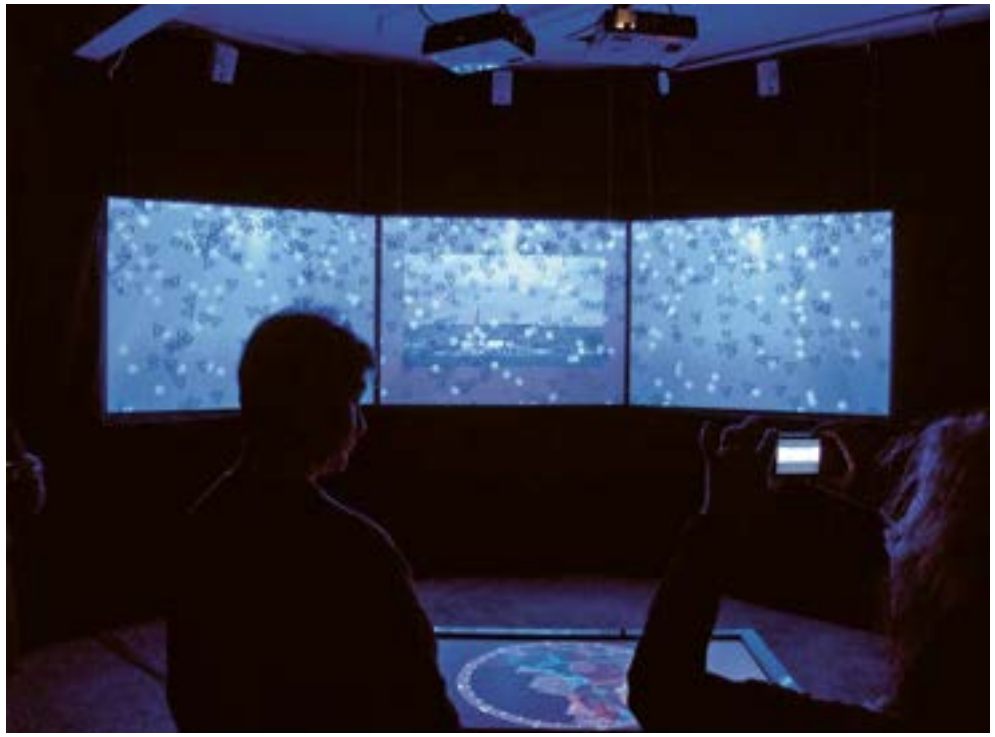

Figure 5. Ecolocated exhibited in Belfast for ISEA2009, a console driven experience with location sensitive animated visuals linked to sound files (image Nigel Helyer).

Conclusion

Ironically the creative foundation for these sophisticated augmented audio reality works is firmly rooted on the ground, as each project is completely site-specific. The collection of the audio content is a painstaking process undertaken over hundreds of hours of field recording, amassing environmental and urban soundscapes as well as vocal and musical material. This is where the *location* of 'location-sensitive' really comes from – a gradually developed intimate knowledge formed by a process of deep listening to an environment, not to mention equally lengthy duration spent in the studio editing and designing the soundscapes. Each work might involve thousands of sound files, and their associated proximity triggers, volume ramps, trajectories and playback instructions, etc.

Both the composition and the experience of an *AudioNomad* soundscape occurs simultaneously in the temporal and spatial domains. Whilst the experience of audio is by nature temporal and is generally perceived as both continuous and

linear, the experience of a spatially constructed soundscape is far less predictable. This situation is complicated by the nature of the content, which references a range of historical and contemporary material and thus disturbs the perception of a simple temporal register. Although the works are inevitably spatially bound (albeit often on a geographically large scale) and might contain principal vectors of movement (obvious routes or physical barriers) the compositional structure and strategy does not impose a spatial hierarchy or even propose an explicit spatial structure. Spatio-temporal complexity is, for example, amplified by the pace of walking through the physical landscape and the manner in which the landscape meshes with the sound events, which can be fixed in absolute space, coupled to a trajectory, or positioned relative to the participant's position. While the *AudioNomad* compositional toolset is relatively simple, in practice it is able to produce an extraordinary level of sonic complexity and above all, generate multiple layers of sonic associations with a physical site, unlocking memories and fuelling the imagination.

Whilst the initial *SonicLandscapes* project was collateral damage in a corporate merger, *AudioNomad* was eventually a casualty of its own success. As our federally funded research came to a close the group was approached by our host University (UNSW) and offered a deal as a startup company complete with venture capital. Perhaps I should have read the writing on the wall (or at least the fine print). The freedom that the preceding research period afforded was gradually replaced by the financial and governance constraints of a start-up. The project eventually wound up when the University declined to underwrite our appointed CEO's business plan – he was fired and our cash supply suspended – pending our ability to land a commercial deal. In effect we had been hung out to dry by risk averse bureaucrats. We delivered our outstanding exhibition commitments and saw our crew of PhD students through to completion (who were of course immediately offered jobs in high profile labs at salary levels four times those of their academic supervisors). And so, our virtual audio world ended not with a bang but a whimper.

SECTION 2: Under the IceCap

The seeds of the *Under the IceCap* long-term collaboration were planted during the Fourth International Conference on Bio-Logging (Hobart March 2010) when I was invited to create an interactive sonic sound-map from satellite bio-logging data collected by IMAS (the Institute for Marine and Antarctic Studies), the Australian Antarctic Division and French Antarctic scientists, from marine species tagged with data collecting devices in the region of three sub-Antarctic islands: Heard, Davis and Kerguelen. This initial artwork formed the basis for an ongoing in-depth interdisciplinary research and development project that combines visual arts, new media arts and music with environmental science and advanced computer data-visualisation and sonification.

The byeline for the Institute of Marine and Antarctic Studies is "Turning Nature into Knowledge". The *Under the IceCap* project supplies a second line "Turning Knowledge into Culture", encapsulating a powerful Art and Science synthesis

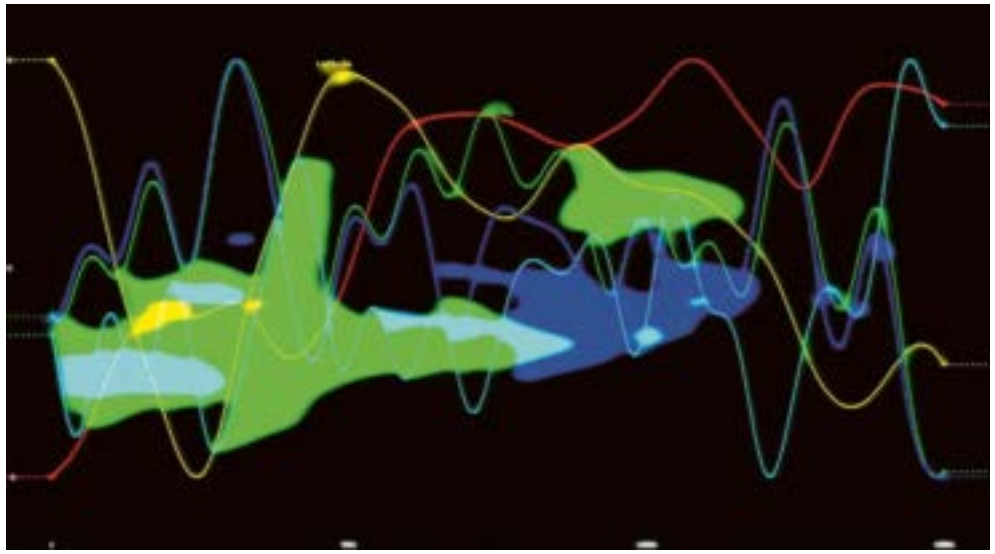

Figure 6. Animated graphical score generated from BioLogging data. Image: Nigel Helyer, 2012.

and simultaneously raising the expectation but also the risk of the endeavour. The primary aim is to produce a *third term*, creative works that fuse scientific and artistic disciplines and which are compelling and *affective* but simultaneously works of scientific *utility* – tapping into both sides of the brain! Our key focus has been the relationship of environmental knowledge generated from Antarctic bio-logging data with the Anthropogenic changes in the biosphere and how we might effectively render this knowledge in the public sphere.

We might conjecture that Science is constrained by objectivity and impartiality whilst Art is constrained by subjectivity and partiality. But both disciplines experience similar difficulties in establishing effective communication with either the public at large, or the structures of governance and policy. The *raison d'être* of *Under the IceCap* is to explore the environmental, social and political issues that are currently transforming our biosphere and to experiment with radical means of expressing 'hard' scientific research as cultural production that can render this knowledge as a broad form of broad social discourse.

Working closely with Marine Biologist Dr Mary-Anne Lee we realised that the extensive and extremely complex datasets collected by southern elephant seals (*Mirounga leonina*) during their deep dives under the Antarctic ice, and on their long transits across the Southern Ocean, represented a considerable interpretive challenge. A challenge which provided the potential for a hybrid art and science exploration of new ways in which to manifest the data and create opportunities to increase public awareness and debate around environmental and climate issues.

Our task has been to develop novel techniques for visualising and sonifying the complex bio-logging data collected by southern elephant seals and to make these data palpable, by transforming them into a series of experimental music concerts and visual and sonified installations.

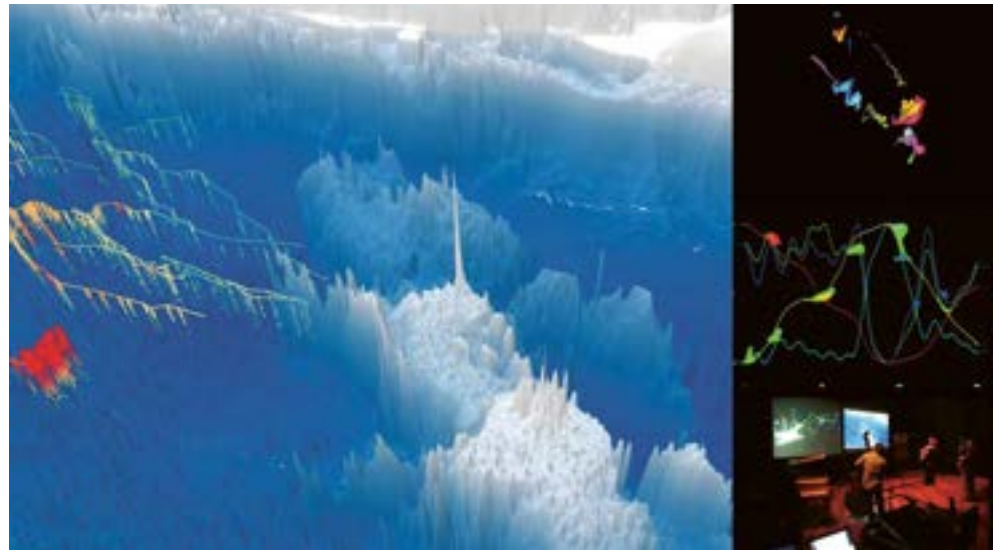

Figure 7. Under the IceCap 3D animated data map and data-generated graphical scores, 2012. Image: Nigel Helyer.

Our method insists that the artistic and scientific paradigms which intersect in *Under the IceCap* form the basis of a robust and productive trans-disciplinary collaboration. The word collaboration is widely and often incorrectly used in art and science projects, where typically one discipline is conceptually or methodologically subservient to the other. However, the emphasis within *Under the IceCap* is to design and maintain an open, consensual and collective creative research process, one that balances the knowledge bases, motivations and target audiences of the art and science disciplines equally.

Environmental Background – Geography and Species

Firstly, some contextual information about the species and the environments that generate our source data. The Southern Elephant Seal is the largest of the pinnipeds and exhibits strong sexual dimorphism, the males being significantly larger than the females. Males have been recorded to weigh up to 4000 kg with a length of up to 6.85m. The smaller females forage mainly in the pelagic zone whilst the males will forage in both pelagic and benthic zones, diving to depths of up to 2000 m with the ability to remain submerged for two hours. There are three main sub-populations, in the South Atlantic, the Indian Ocean and the sub-Antarctic islands of the Pacific Ocean.

The bio-logging devices illustrated below (see Figure 8) are attached once the animal has moulted and with luck can remain in-situ for up to a year. The device transmits a range of data to a satellite each time the seal surfaces providing information about location, temperature, salinity, pH and a range of other water qualities. Because of their capacity to dive deep in the water column and their habit of foraging under the Antarctic ice shelves, southern elephant seals provide a unique source of information regarding deep water conditions associated with the production of

Figure 8. Antarctic Chic; Biologging trackers carried by southern elephant seals. Image: Ben Arthur and Clive McMahon, 2010.

ocean currents (thermohaline circulation) and sea ice formation, both vital indicators of global climate change, which would otherwise be unobtainable.

Live Performance Series "Vox on the Rox"

The premise of the first stage of the collaboration was the creation of an interactive sonic-cartography that combined bio-logging data with ambient recordings of Antarctic species. This system invited participants to explore a media rich map space of accurately geo-located soundscapes. Using this as a starting point, we began to investigate the potential for other and more dynamic means to interpret the data.

Our eventual solution was to work with a group of gifted improvisation musicians from the Tasmanian Conservatorium of Music[4] and was based upon the premise that musical training provides a unique set of skills: dynamic and intuitive responses, collaborative behaviour and strong interpretive abilities; in short, the musically trained mind should, we reasoned, be perfect for pattern recognition and interpretation.

This approach opened up a new set of possibilities and challenges, in terms of how to visualise and transact data in such a way that it could be translated into music, not digitally but by live performers responding in real time. Whilst the musical interpretations of graphical scores is synonymous with Modernism; and whilst sonification goes hand in hand with the history of computer music, our experiment

4 Andrew Legge, Alistair Dobson, Nick Hayward and Glen Hodges – aka iCon.

was with the effectiveness of translating massive data sets into animated cartographic visualisations, and graphical scores and hence to a real-time musical response. These factors presented us with a *carte blanche* which we were eager to explore.

> "Anything in the Universe that has been or can be given a graphic representation is a possible notation for music." (Cardew, 1976, p. 251)

In terms of methodology the initial concert *Vox on the Rox* grouped the datasets into three movements. The first movement contained animated graphical scores that displayed the track of a single animal shown as four sets of variables; surface wind speed; depth with salinity; depth with temperature and ocean bottom with density. The second movement represented two animals with two sets of paired variables whilst the third movement, four animals with one set of paired variables.

The animated graphical scores were synchronised with an animated three-dimensional underwater map-scape which represented the seal dives and transit tracks and employed the Eon Fusion software (see Figure 9 below). The four performers were free to follow both visual data flows simultaneously.

In the first movement each instrument was assigned a set of variables collected by a single seal – for instance piano to surface wind speed, saxophone to depth and salinity, double bass to depth and temperature and guitar to ocean bottom and bottom density. In the second movement each of the two animals had two instruments assigned to its data and thus in the third movement each seal was followed by a single instrument. The attention being focussed on the points in the data flow where seals intersected geo-spatially suggesting the potential for the musical interpretation to likewise correspond.[5]

Figure 9. Vox on the Rox concert showing 3D animated map and graphical score. Image: Nigel Helyer, 2011.

5 See example at Helyer (2013).

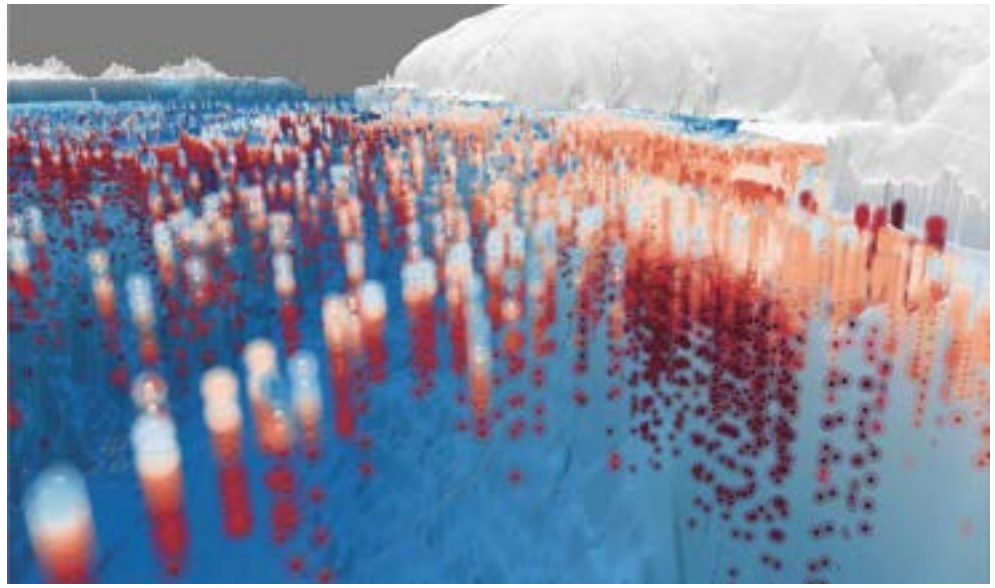

Figure 10. Showing an animated 3D underwater mapping of Seal data trails. Image: Nigel Helyer, 2011.

From a metaphorical perspective the relationship that evolved between the four improvisation musicians during their first encounter with this data-environment (we agreed not to review or rehearse the material) resonates strongly with the situation of animals foraging in the harsh, dark, underwater world of the ice shelf. In both cases information has to be processed instantly and a response generated on the fly. However, this is not simply a response to the perceived external environment but also builds a network of communications within the group, developing a form of entrainment, establishing collective responses to the unknown, evolving a methodology that maps around the environment.

Naturally from a strictly scientific perspective a valid criticism can be raised concerning the level of ambiguity and ambivalence of any intuitive response to such graphical scores and 3D mappings, especially when they are initial responses, generated instantaneously, to be simultaneously negotiated within the ensemble. However, it is worth considering that the scientific data itself is an abstract, generic and scant description of the vast and complex reality of the living environment, not to mention the mediation of statistical tools and representational techniques that are employed to give meaning during data analysis.

"There are three kinds of lies: lies, damned lies, and statistics."[6]

The *Vox on the Rox* concert series supported our hunch that the skills and perceptions of musicians placed them in a good position to interact with complex streams of real-time information, creating a *sweetspot* connecting a traditional scientific

6 Attributed by Mark Twain to the 19th-century British Prime Minister Benjamin Disraeli.

approach with a creative sensibility, effectively opening up an enormous range of enquiry into the deep structures of the Southern Ocean, the engine of our climate.

Since then, our collaboration has continued and whilst the philosophical aims remain consistent, the aesthetic palette has been expanded. Subsequent creative works have used the biologging data sets to produce a range of hybrid-musics, that range from direct transposition into conventional musical scores[7], arrangements for ensembles of mechanical musical devices8 and, most recently, choral works and sound-installations.

Ever mindful of Disraeli's sceptical words, these new works aim to form a confluence of biological data, economic and climate data and attempt to draw parallels, if not conclusions, about the very strong relationships between human economic activities and our changing bio-sphere, illuminating the resonances and dissonances in these data flows so that the audience can begin to discover recurring patterns of a global scale.

SECTION 3: GeneMusiK

Starting in 2003, artist Joe Davis and I exchanged a series of ideas for encrypting information in DNA. Davis pursuing textual, and I musical codes. At that time, I was collaborating with the School of Agricultural Science (University of Western Australia) as part of an Artist in Residence at the Symbiotica Lab to develop a proof-of-concept system designed to translate music into DNA which when inserted into the plasmid DNA of Bacteria was able to be re-mixed then subsequently extracted and de-coded into novel musical forms. Time, tide and microbiology, however, wait for no one and, although my first attempts proved theoretically possible, the realities of the biological process out-matched both my time and my budget.

Figure 11. The author at work in the Earth Sciences Laboratories (UWA) 2003.

7 See two sonic treatments of the same data sets: DrSonique (2013) and DrSonique (2014).
8 See BioLogging – Retrofit: Helyer (2015).

Fast-forward eleven years to 2014 and Davis is working to realise his *Malus Ecclesia* project at Harvard Medical School. Davis plans to transpose the fount of all human knowledge, Wikipedia (sic) within the junk DNA of an ancient strain of Apple. Malus in Latin represents both Apple and Evil (whereas Ecclesia refers to Church – and pays homage to George Church, the Harvard Professor with whom Davis is working).

In his reprise of the Garden of Eden scenario, Davis will ultimately fill a grove with grafted apple trees which will presumably contain all branches of Knowledge. However, the apples may be covered by an indictment against consumption, this time issued not by Jehovah but by the US Food and Drug Administration!

In a similar vein I have continued to nurture my interest in the parallelism between Genes, Memes and Musical Notation, considering all three as mnemonic structures capable of evolution and functioning to embody and transmit memory. It is this powerful mnemonic metaphor that drives the *GeneMusiK* project to create a re-mix of cultural, social and biological pathways, by hybridising one set of cultural values with another via the transformations of musical and genetic codes embodied in bacterial cultures.

To describe the method in simple terms – standard musical notation is converted to DNA codons by devising a set of conversion tables; the resulting DNA is synthesised in the lab and can be manipulated, in-silica; in-vitro or in-vivo. In the latter scenario I have been using standard lab grade E.Coli bacteria which can be mutated in various ways. The 'rearranged' DNA can then be extracted and de-coded by the same conversion tables and rendered once again into musical notation.

In 2014 the VryFees Festival in Bloemfontien, South Africa invited me as an artist-in-residence to re-develop the hibernating *GeneMusiK* project. Based between a microbiology lab and a music Conservatorium I also worked with indigenous South-African San musicians who live in Platfontein a bleak re-settlement camp some two hour drive to the West, near Kimberly in the Northern Cape. The aim was to hybridise local ethnic music with the epitome of the western musical tradition, a string Quartet from the University of the Free State, Odeion Music School.

Figure 12. The project re-commences at the University of the Free State, Bloemfontien (SA) 2013.

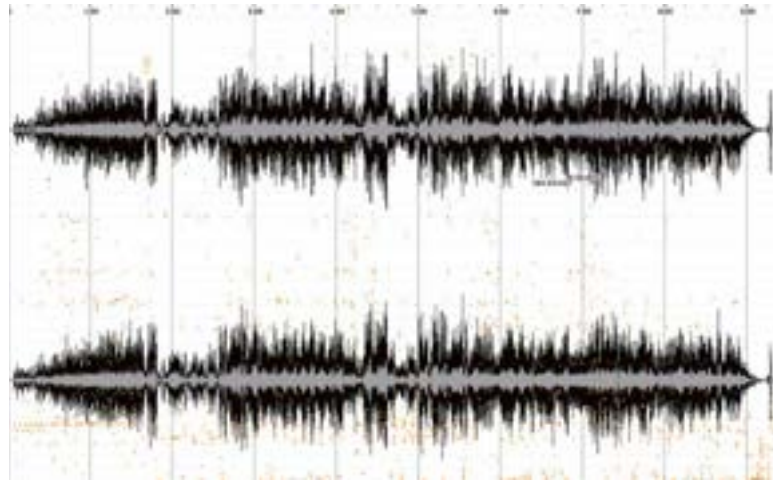

Figure 13. Sonogram of field recording of a traditional San song. Image: Nigel Helyer.

Figure 14. Working in Platfontein (SA) with my associate, Master Jasheel. Image: Nigel Helyer.

During my sojourn in Bloemfontein, the project established a successful prototype of all the functional components that comprise the complex chain of transformations – taking audio field recordings (of San musicians) via audio analysis and into musical notation, thence into DNA and then into Bacterial culture, to subsequently be extracted and ultimately rendered as scores for a musical performance.

On my research travels I was fortunate enough to uncover a unique early transcription of San music discovered in an explorer's publication from 1810. W. J. Burchell was a British polymath, scientist, botanist, musician and intrepid traveller and it was in his "Travels into Southern Africa" (Burchell, 1810) that I came upon an illustration of a seated San bushman playing a mouth bow or Gorah, accompanied by a musical transcription.

Figure 15. Drawing of a San Bushman playing the Gorah with musical annotation, from Travels in the Interior of Southern Africa, Burchell.

Figure 16. The string quartet of the Odeion School of Music (UFS) tackle a 'difficult listening' score. Image: Nigel Helyer.

Using this simple score as an extra source of musical information, an additional DNA sequence was generated and, as before, the action of restriction enzymes were used to fragment the DNA code. The re-assembled fragments generating a novel sequence which was incorporated with the contemporary San content and merged into a final composition which was given to the Odeion String Quartet to play. The result from the initial rehearsals was a complex and challenging work and certainly not easy listening!

This second version saw the *GeneMusiK* project progress but once again time and financial constraints restricted it to an in-silica modelling of the potential outcome – albeit one with a complex musical outcome.

Finally, in 2016, thirteen years after the first attempt in 2016, I was invited as Artist in Residence to the Instituto Medical Molecular, Lisboa by the immunologist Dr Luis Graca. In the labs of the IMM we finally managed to undertake the entire biological process. Taking a simple arrangement of "Somewhere over the Rainbow" I devised a minimalistic conversion table to constrain the length of the DNA sequences and to restrict the amount of repetition (which causes problems in DNA synthesis). From my single batch of synthetic DNA I now have the task of re-converting fifty blocks of DNA mutations into fifty new musical scores, and then finding someone crazy enough to try and play them – watch and listen to this space.

Figure17. DNA sequences after mutation and ready to be translated into musical scores. Image: Nigel Helyer.

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Interdisciplinary Collaboration Using Art-A- Hack™ Practice Methodology – The World's First Co-Lab on Developing Cyborg Arts

ELLEN PEARLMAN

ABSTRACT:
A co-lab in Cyborg Arts was conducted at Parsons/New School University in New York City, over the course of a semester. Bruno Latour's Actor Network Theory (ANT) (Latour 2007) was key in facilitating creative collaboration solutions. With the assistance of the Cyborg Foundation three teams[1] were culled from an open call were in the New York City vicinity to build prototypes of a new cyborg sense: Team Glass, Team Radiation, and Team Haptics. Team Glass wanted to make a cyborg sense to detect the rhythm of changes in the sun's solar flares. Team Radiation chose to develop a sense that differentiated, and signaled an individual about different types of organic and inorganic radiation in their immediate environment. Team Haptics used the team leader's self-selected body as the location to correct a medical problem through a new cyborg sense. Students from Parsons could choose which of the three teams to work with. Experts and guests either visited the co-lab in person, or used Skype live time to converse with the teams over the course of the semester.
This paper discusses how an ANT analysis of practice based learning led to incremental breakthroughs such as starting, stopping, abandoning, and resuming developing these sensing techniques. This resulted in proof of concept artworks, and showcased new aspects of cyborg art.

KEYWORDS: cyborg, cyborg arts, cybernetics, actor network theory, co-lab.

Introduction

The Cyborg Foundation, consisting of living cyborgs Neil Harbisson and Moon Ribas, approved an open call that was placed in a variety of media, art and technology sites. The call stated an opportunity was being offered for "a collaboration between artists, technologists, designers, engineers, makers, and/or scientists to create and develop technologies that expand human capabilities and perception" (Harbisson et al., 2017). Teams were formed around the most compelling concept, and the team leader was the person with the clearest idea. The ideas were selected in close collaboration with the Cyborg Foundation.

Posthuman scholar Katherine Hayles defines the cyborg as having "informational pathways connecting the organic body to its prosthetic extensions" (Hayles, 1999, p. 2). The idea behind the open call was to create a co-lab to enhance human

1 All participant names have been anonymized

senses using various digitized parts. These parts were designed to eventually be implanted inside a person, but not as part of the co-lab, where they would only exist as a constructed proof of concept.

Harbisson was born colorblind and can only perceive black, white and various shades of grey. Over the course of a number of years he implanted a sensor, called an eyeborg directly into his skull that turned the approximately 360 colors he could not perceive into sounds. These sounds, and the process of how he perceives them is the focus of his creative practice. Ribas has a chip implanted in her arm and both feet that senses earthquake data twenty-four hours a day. She uses that data to create live time choreography (Harbisson & Ribas, 2016). She has since had the earthquake sensors in her feet removed, in order to understand the act of missing a cyborg sense (Ribas, 2019).

More than seventy people responded to the open call, with three project ideas selected in collaboration with the Cyborg Foundation. Approximately twenty-five individuals with varying skill sets ranging from programing, design, theory and scientific acumen were chosen to work on the three teams. They were Team Glass, Team Radiation, and Team Haptics. Team Glass, headed by glass artist Laurie focused on a sense to detect changes in the sun's solar flares using data obtained from NASA readings. Team Radiation, led by artist Arnold strove to develop a sense to detect organic and inorganic radiation. Inorganic radiation for the team's purposes mean electromagnetic signals, and organic radiation meant something as simple as a sound wave, a natural radiation. Team Haptics, headed by Marcella, wanted to make a cyborg sense to coordinate her gait, which had been impeded by a medical condition. Students chose which team they would work with.

Theory

I used Bruno Latour's Actor Network Theory that includes examining both people and things. ANT is an invaluable methodology to better understand the failure and crisis of multiple actors (human and non-human) in a network. It portrays both human and non-human elements as equal actors employing a 'sociology of translation' with each 'actor' representing a vital link in the network, including the types of interchanges that occur between objects and individual subjects. An actor could be an electronic signal that was not processing information correctly, or computer code that was compiling producing multiple errors. These can be events or actors they are just as important as the communication between the two people that may have been trying to fix the coding error, because all are component actors in the network depending on the interpretation the author of the network wishes to assign to each event, person or thing.

Using the word 'actor' itself is very fluid. Latour states that "An 'actor' in the hyphenated expression actor-network is not the source of action but the moving target of a vast array of entities swarming toward it…Action is borrowed, distributed, suggested, influenced, dominated, betrayed, translated" (Latour, 2007, p. 46). For the purposes of this paper I use the word 'actor' to describe any person or thing

involved in an exchange, or chain of events that relates to a situation in the past, present or future that affects the outcome of that situation.

A 'sociology of translation' does not mean that an actor, or 'actant' (that which is acted upon) is human, but just that it is a semiotic definition that grants activity of itself in relation to others, sentient or non-sentient things. The translation is actually the movement between the two entities as a method rather than a theory, "an entity that does the tracing and the inscribing…an ontological definition" (Latour, 1998, para. 14).

Latour realized it is better to trace connections or "associations" between controversies than try to unpack or explain the actual controversies themselves. ANT examines the problems being tackled, the actors involved, how to make other actors interested in the situation, have actors agree with their assigned roles, and make sure the delegated actors represent the situation correctly. If the actors are not in agreement, then the network under consideration ceases to function, or communicate. This type of breakdown happened a number of times during the sixteen-week co-lab.

ANT's methods that revolve around a 'sociology of translation' consist of four categories for living and non-living actors and the situations they become involved in, and has ample allowance for things that break and fail. Everything can be an actor (human and non-human) in a network, with the designation open to interpretation. The participation of a key 'actor' (person) or their non-participation can change so many things. It can lead to a host of new decisions each contributing to new directions. The functioning, or non-functioning of a key non-human actor (like a piece of equipment) can also lead to other new decisions and directions. Each change or disruption influences every other decision and must be dealt with either on the spot, or at a later date depending on its need.

English professor Bruce Clarke says Latour follows the circulation of 'quasi-objects' that "name the objecthood of subjects (such as human persons) and the subjecthood of objects 'such as machines and on-human organisms'" (Clarke, 2008, p. 44). He further states, "Latour comes to see that this more refined ontological and procedural mode of translation as one of the two poles of modern practice" (Clarke, 2008, p. 49). Latour admits many of his concepts and methodologies are ethnographic in nature, deriving from the "sociology of science and technology" (Cressman, 2009), and that the central tenants of ANT do come from a "sociology of translation" referenced above.

ANT has four parts. The first involves defining the problem being worked on which includes placing the actors and defining the lead actor, as they are usually are indispensable. The second part consists of making sure other actors are interested in the situation in which they find themselves, as this is not always the case. The third part is getting the actors to agree with their assigned roles, again something that may be very easy, or quite difficult depending on who, or what the actor is. The fourth part is to ascertain if the actors are representing the situation correctly, or can fulfill their role.

ANT clearly recognizes that works employing complex technologies are bound to stall, fail, and fall apart. It covers relationships between things (equipment, cameras, computers, cable connections), and transient, dissolving and re-forming relationships between "actors" (humans) and things. One of its most useful aspects is it allows for adversarial relations, as conflicts are bound to arise between human agents, or software and hardware components, or combinations therein.

Within this context any actor, whether human or non-human, serves as one part in a specific situation. This one part is referred to as punctualization. Punctualization can also be thought of as 'encapsulation' a process of enclosing bits of software programming code in 'capsules' that forms the basis of object-oriented programming. Cressman refers to punctualization as "the process by which complex actor-networks are black boxed and linked with other networks to create larger actor-networks (Cressman, 2009, p. 5)." If the network breaks down, then the punctualization or communication breaks down, and the capsulation is broken open and ceases to function. This is referred to as depunctualization where networks de-link from larger actor-networks.

Interactions between specific actors are called "tokens" or "quasi-objects" in a network and are created when networks connect, or experience punctualization. They can be thought of as tiny little objects existing for a brief moment in time. Creating tokens that are continually used strengthens the network. Tokens that do not perform transmission, either between objects, people, or objects and people, through breakdown, conflict, or even boredom can cause full network breakdown. When an actor does not transmit the token, punctualization decreases.

In ANT everything can be viewed as either an actor, or as part of the network, depending framing of the environment as to which label is applied. In a physical network one computer can be one node alone by itself, or part of a multi-node system – depending on how it is framed or contextualized. This perspective deals with both human and non-human 'actors'.

Co-Lab Idea

The co-lab held at Parsons was approximately sixteen weeks long. A co-lab includes external professionals and invited guests within an academic setting so students participate as equals in the development of a theme or concept. A co-lab differs from a workshop, in that a workshop focuses on a skills-based short-term exploration of tasks. This co-lab was tasked with making a proof of concept artwork that had the potential to be turned into a cyborg sense. The selected team members were programmers, research scientists, designers, artists, indy makers, creative business studios, and non-profit executives. The students tracked their progress on a private Tumblr account, and everyone posted on a group Slack. This helped me, as a facilitator, to monitor group dynamics, progress and setbacks in terms of ANT analysis.

The students were assigned readings on the posthuman and cyborgs, and readings about creative collaborations. Some students jumped right in and began contributing either their coding or design skills towards the creation of cyborg

senses. Other students chose to study theoretical aspects of the topics they were learning about by researching and composing papers on the topic of the posthuman.

During the semester different guests participated via Skype, or visited the class in person. The Cyborg Foundation's Haribisson and Ribas Skyp'ed in from Barcelona, Spain to initiate the first class, and to view and comment on the team's projects for the final class. Guests included scientific researchers who were developing cyborg senses for the blind, other cyborg artists who were developing new senses in their own practices, cyborg start-up companies who were selling cyborg senses online, body hacking conference organisers, and directors of indy maker spaces.

The teams would present their project ideas to the guests with both sides exchanging viewpoints. The need for external guests, expecially in the beginning of the semester was important because the topic of living cyborgs was new to almost all of the students, and not deeply familiar to the professional participants, though they all wanted to learn about it. Co-lab participants needed real-world examples supplied by conversing with guests. The theories of Bruno Latour's ANT was never discussed, as ANT was used solely in my role as supervisor/facilitator to mediate the learning goals and monitor the team's development.

Implementation

Over the course of sixteen weeks, the first four or five weeks began with guest lectures of individuals working in the field of cybernetic augmentation. Some were out and out 'body hackers', meaning they, or their friends would perform some type of insertion surgery. Some augmented their bodies for entertainment reasons and became professional performers, and others were involved in engineering design or medical research to help those with disabilities. These guests were in addition to the co-lab's partners, the Cyborg Foundation, who participated in the first, and the last class.

The lab would then progress with the teams in a group huddle, and as a facilitator, I would move around to sit in with each team throughout the co-lab assessing their needs. Sometimes I would actively insert myself into the discussion, thus becoming one of the 'actors'. At other times I would just observe and stay silent (no initiation of punctualization). There was no clear plan as to how this time would be used. Some weeks the teams would focus on programming, or design, or concept. Other weeks they would have heated and animated discussions. Each meeting was different, and different individuals would become more or less active on a random scale.

At the conclusion of every session each of the team leaders and summarized to everyone what their team's progress and setbacks had been for that particular week. This showed each team that the other teams were experiencing similar journeys, meaning they were also having breakthroughs and obstacles. For example, Team Glass may have understood that day what circuits to use, but their software coding did not work. Team Radiation may have connected two different pieces of hardware together, but the output was not clear, and there was no way to interpret their data. Team Haptics may have been unable to coordinate their four accelerometers,

but they were all in agreement about the difficulty. When each team listened to the other teams experiences, this became part of their ability to see ANT in action, though the term was never discussed, as this would have shifted the focus from a hands-on, practice based lab to a theory-based discussion of methodology. There were no fixed benchmarks, as developing a cyborg sense was an iterative process that had dead ends and delays, as well as breakthroughs, all of them impossible to predict. The teams mostly worked only within their own group, though there were a few occasions where the teams offered each other suggestions, though that usually occurred at the end of the summation period for that particular session.

Team Glass had trouble figuring out how to put together their cyborg sense of showing solar flares. The team leader considered all suggestions from all team members, giving equal weight to everyone's ideas, which led to the team being unable to make a decision. Team Radiation had a dominating team leader, who did

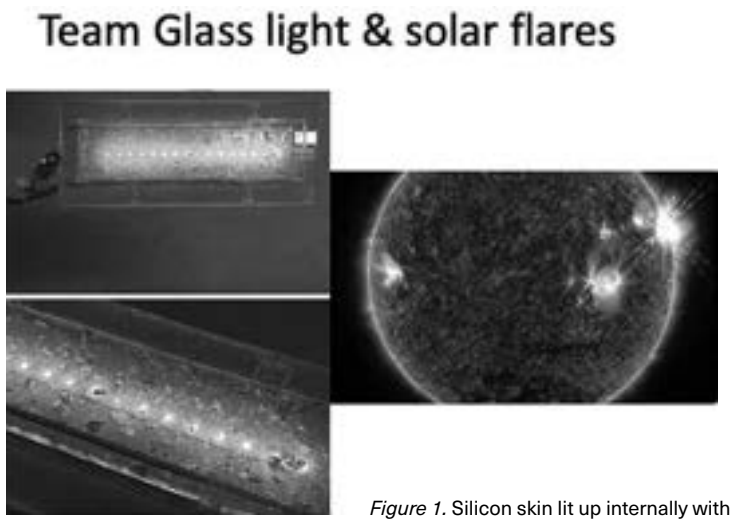

Figure 1. Silicon skin lit up internally with light.

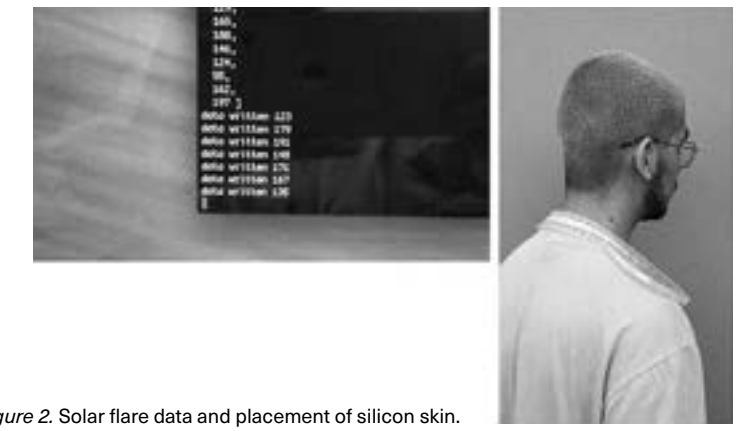

Figure 2. Solar flare data and placement of silicon skin.

not allow other points of view. Other team members resented his dominance, and refused to contribute anything further, which led to a stalemate. Though both styles were completely different (indecision vs. dominance), their outcome was the same, as no decisions were reached. Team Haptics had the most effective style brought about by the team leader. Though she considered other's suggestions she made the final decision, but with everyone's consent.

Team Glass needed intervention and discussed their ideas as a group, while I analyzed the situation using ANT methodology. They had nothing (no 'actor) supplying raw information for their project's goal. I suggested they consult NASA's on-line database of solar flare data to anchor their concepts. With that idea in place a team member figured out a software solution to connect the raw data from the NASA space station to a piece of actual hardware triggering a small light to turn on each time it reached a certain number. Though it seemed like a small breakthrough, it actually completed the ANT network of people and non-human 'actors', as the main, 'actor' was raw data linked to programming code. They began 'punctualizing' and passing 'tokens' between one another, and the network. Once the team saw progress they gained confidence and came to a consensus for the next step, to find the correct grade of silicon to make a synthetic skin to encase LED lights. This skin would eventually be placed on the body.

Team Radiation required delicate intervention on a one-to-one basis, before, or during class, or through private, not group emails. The team leader consistently spoke in more technical terms than the rest of his team to both confuse and dominate them. Only one other team member was technically knowledgeable enough to even challenge him, which led to a very public stalemate between the two. When this stalemate happened 'tokens' or messages between actors ceased. What was necessary was to have all actors exchanging tokens, or units of information. I intervened by sending individualized, personal emails to each of them, and spoke to them privately before class, suggesting they reconsider their perspectives. This initiated the reintroduction of tokens, or the exchange of information.

Team Haptics the team leader used her own body for experimentation. Due to a medical condition her walking gait had a delay between her intention to walk, and her leg movements. A built from scratch portable motion capture detection system was placed on her body to alert her though either a slight haptic pressure, or audible sound that she needed to change or modify her gait.

An ANT analysis revealed the team leader's body was the main 'actor'. That body was not communicating correctly with all its sub actants. It was not 'punctualizing' with its various parts. Specific points on her body were assigned to different colored light that were filmed capturing her actual gait, and re-introducing punctualization between her body parts. Portable accelerometers were used to interpret the numeric of "X "(length), "Y" (height), and "Z" (depth) coordinates. The team mathematically created a responsive software formula to read the X, Y, or Z body coordinates over time. This data served as the basis for re-punctualizing the coordinates of the depunctualized 'actor's body.

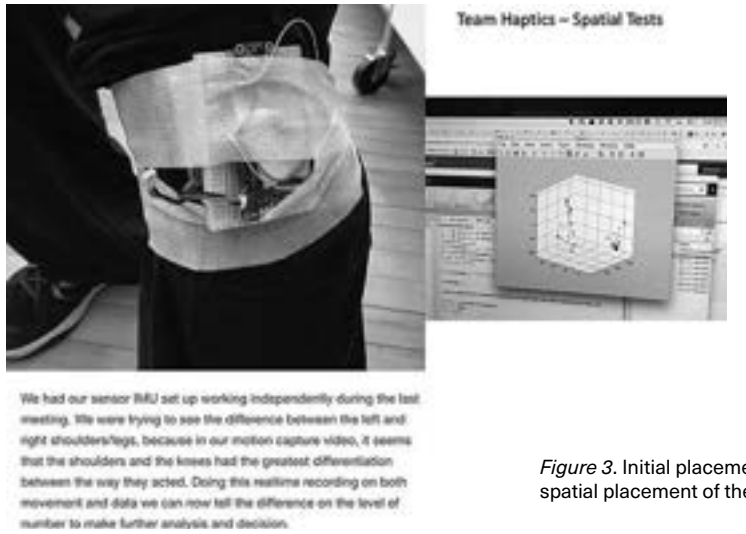

Figure 3. Initial placement of the haptic device, spatial placement of the device.

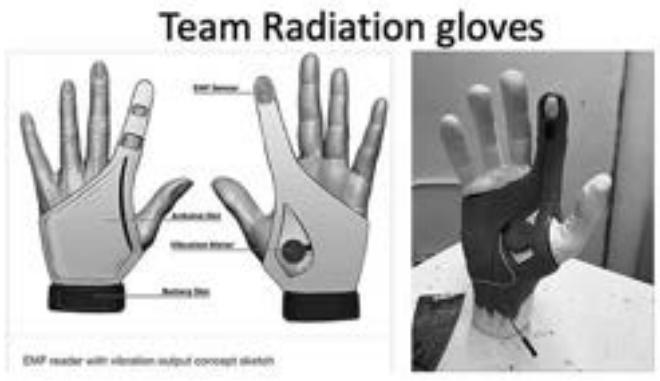

Figure 4. Radiation sensor gloves with sensor and motor.

How ANT Methodology Was Used

It is challenging to defend arts practice as research and learning in the context of scientific and sociological methodology without a results-oriented quantitative or qualitative investigative methodology and thorough analysis. The process of the investigation is the core of arts practice, and process does not always yield clear, coherent results or a definitive conclusion. Linda Candy, a professor of creativity and cognition research says this tension arises because of the need for professional practices to be defined in a way that is commonly agreed (Candy & Edmonds, 2011). It needs to conform to be certified as having worth, and contribute towards the production of knowledge. It usually takes place within the confines of the research university, as opposed to other less codified environments.

Arts professor Stephen Scrivener (Scrivener & Chapman, 2004) defines research as "an original investigation undertaken in order to gain knowledge and understanding." But art making does not just contribute 'original knowledge (Scrivener & Chapman,

2004, p. 1)' in the form of the end product art object. It is the entire process, and the knowledge gained during the process that contributes towards the making of original art that spurs innovation. Scrivener argues linguistic statements or propositions are more valued inside academia as contributing something of substance rather than art objects or creative works. The works produced by artists, like a speculative cyborg sense do not contain 'arguments', the pillar of academic discourse. Curatorial and interaction design professor Lizzie Muller (2012) argues that the artist/practitioner, as is the common term to refer to this hybrid, creates new knowledge while engaging in 'real situations' instead of solely setting up situations to create new knowledge. There is no hypothesis to disprove these events, just an experimental path to engage with, which occurred with Teams Glass, Radiation and Haptics. The practitioner's role becomes that of someone adopting a 'stance towards enquiry'. New tools of enquiry must be chosen from a range of practices that involve art, design, science, engineering, psychology, and critical theory to make these types of inventive explorations within practice-based scenarios. This is especially necessary, as and the field of arts practice as research is constantly evolving. It is under these circumstances the artist is working with a hybrid or a "transdisciplinary" mode of inquiry, one that is more speculative and thus more frustrating to traditional academic disciplines. The work of Robin Nelson, Director of Research at the University of London Central School of Speech and Drama has models of 'knowing' that more realistically resemble the environment of today's interdisciplinary and transdisciplinary practices (Nelson, 2013). Nelson's models also align more closely with Latour's ANT methodology, in that the 'know what works' can incorporate both the working, and non-working actors in a network.

Creative practice does not usually begin with a problem, but begins with, according to MIT professor of community development Cesar McDowell, an odd or 'messy' situation (McDowell, 2007). In the context of the co-lab this meant an idea (how to make a cyborg sense that does A, B, or C). It is 'messy' in that not only has it not been done before, but the teams that have been assembled and implemented to find a way to make that cyborg sense have no experience in how to make any cyborg sense. How to figure out what the problem is within any disorganized situation such as this uses a process of framing. The origins of the idea of framing arose with John Dewey's notion of the 'Problematic Situation', though it is beyond the scope of this paper to delve into the ontological and epistemological methods of how Dewey created that concept. McDowell, however, interprets Dewey's notion by positing that it begins with a 'vague image of a reality' identified from a surfeit of the complexity of the task at hand. In this case the task at hand is building one of the three imagined cyborg senses. These identified parts or features are coherently organized in such a way that the problem can be defined. For the co-lab an identified problem, such as the one for team Haptics is how to code and enable an accelerometer to measure gait, and send a haptic message to the wearer of the device that they should correct their gait, through pressure or even sound. The goal is to drive the thrust of the transformation of the situation by using the elements derived from the information in the frame. For team Haptics, for instance the frame included knowledge of

accelerometer technology, and its underlying code. That frame could be overlaid on another frame of interpretation, that of the gait of a body in motion. That would lead to two frames overlapping, knowledge of accelerometer technology and knowledge of the gait of a body in motion.

Understanding the framing and applying ANT analysis to its outcome was the background methodology for the co-lab. This means that my facilitation helped define the framing, though it was done subtly through asking questions and making small suggestions that let the team feel they had agency in solving the problems. The actual interaction between team members, their coding skills, their hardware capabilities, and each other created the ANT analysis and methodology by pinpointing the ANT actors, the network, the passed tokens, and the punctualization or depunctulazitaion. However, the teams were not aware of working within these structures, as I never mentioned them. They just assumed the energy flowed 'magically"

Framing looks at how the issue or problem is named, organized, and described. Rhetorical frames are like espoused theories, which means they highlight what an individual or group thinks they know or understand through speech and writing. Action frames are theories-in-use, a live-time response to difficult or perplexing situations. Rhetorical frames can debate with other rhetorical frames of meaning, which means convincing others that a specific conceptual frame is correct. The conceptual or rhetorical frame that wins exposes the weakness of the other frames, making sure to cloak its own inherent logical weakness. Radiation team leader Arnold was particularly skilled at this approach. He was very quick to expose others' flaws, and to use his technical knowledge to silence others by berating their suggestions. This would be an example of a conceptual frame that exposed others' weaknesses. No one else knew enough technically to ascertain if Arnold's own logic was correct or incorrect. It was only when I intervened and spoke with Arnold personally that he stopped attacking others so frequently.

Action frames occur during process time-based moments. They are often non-verbal and require action tasks, or motion-based changes in behavior that affect instant changes, and may or may not incorporate the knowledge of a rhetorical based frame to create new knowledge. This occurred with Marcella's Team Haptics, which had the least amount of personal friction. The programmers and physical computing members would work side-by-side inputting code to make instantaneous changes to the behavior of the accelerometer. There was not much rhetorical interaction occurring, just basic line code and on/off switches. The two types of frames, action and conceptual can work together, or separately. They are not dependent upon one another, though they can rely upon one another according to circumstances. Connecting the frames through ANT analysis became a methodological solution to moments of inaction, miscommunication and system failure.

Identifying hidden assumptions, part of action framing, is difficult because tacit thinking is an assumption, or an underlying action frame. In terms of coding a hidden assumption could be part of the coding language that the coder thinks is correct, but it is not. Once it is made obvious it turns into a concept or rhetorical frame, in that, for example, a coder could see that they made an incorrect

assumption. Values are the way we decide something, and lead us to make a judgment if it is appropriate or inappropriate. McDowell says when we frame a situation live time we do so as an action frame, and apply tacit values. The reason it is so hard to find out what an assumption is because it "is a kind of reverse engineering that disturbs our belief" (McDowell, 2007). It also takes a lot more time to reverse engineer a tacit assumption, instead of a more obvious and stated rhetorical frame. This working with assumptions that turned into concepts was most obvious with Team Radiation, as Arnold assumed that he was more intelligent than any of the other team members. I had to speak with him privately and explain that he was dominating and alienating his fellow team members, and if he did not change his attitude (assumptions) the entire team, and thus the entire project would fall apart. Fortunately, he did listen, and became more open to other's opinions. Thus, working in dynamic, evolving group situations can bring conflicts between disparate framing modalities, or can enhance these modalities. It depends upon the 'actors' within the framework.

Conclusion

There were approximately 40 team members and students, as well as various guests for a sixteen-week co-lab developing cyborg art at Parsons School of Design in New York City. Three cyborg senses were created as a functional proof of concepts working with ideas of solar flares, organic or inorganic radiation, and a new haptic sense to correct a medical condition with a participant's gait. Each sense was brought to a conclusion as a functional proof of concept, and its functionality was demonstrated to The Cyborg Foundation via Skype as part of the final class. The Parsons students had kept a blog with notes and short videos, and all teams participated in a group Slack, thus leaving a record of their progress, setbacks, conflicts and successes. Though each team's style was different, all three teams successfully demonstrated a model prototype of the team leader's initial concept. This showed that ANT Methodology, when used in subtle and unobtrusive ways, deployed with the fineness of a skilled facilitator can be a useful team in creative art hack team collaborations.

Bruno Latour's ANT identifies an 'actor' within the network as either a person or a thing. This dynamic designation evolved as the main 'actor' as each team shifted during the weekly meetings. The 'actor' could be the team leader, or the 'actor' could be the programming code. The next week the 'actor' could be the hardware. The following week it could be any of those three designations, or even more than one of them. Allowing the process to unfold, directed by the changing dynamics of the group collaboration, while maintaining coherent group interactions through either one-on-one interventions, facilitated group discussions, technical expertise and advice, or suggested readings and research in order to keep ongoing communication channels vibrant was the key to a successful outcome in building feasible first stage proof of concept cyborg senses.

The 'actor' either communicated (punctualized), or did not communicate (depunctualized) within the confines of the network, depending on what kind of

'tokens' were, or were not passed. Structuring framing modes based on ANT analysis allowed innovative solutions to emerge. It required a skilled assessment of group dynamics with non-didactic interventions to keep all the 'actors' in the network fully engaged. As a methodology, ANT implemented practical solutions within a dynamic matrix of professionals, students, and evolving technologies for art and design co-lab.

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How We Designed a Traveling Exhibition

AKIRA SANO, TOMOYASU YOSHITOMI, KENICHI MASAKI, YUMI WATANABE, HISANOBU SATOH

ABSTRACT:

In Japan, there are more than 130 facilities and centers related to river and water resource development. When flood disasters occur, these facilities work as disaster prevention bases. They also work as information centers during normal periods. Though they are important for disaster prevention and public-relations, many suffer from budgetary woes and inadequate information resources. JAWANET is an NPO which creates traveling exhibition units which provide information concerning water resources management. JAWANET has made three exhibitions so far. We report on the five features of these units: compactness, easy setup, plug-and-play, modularized, and understandable at a glance.

KEYWORDS: traveling exhibition, human centered design, disaster risk reduction.

Background

According to the Statistics Bureau of Japan, about 66% of the country's land is mountainous (Statistics Bureau of Japan, 2019). Japanese rivers tend to be short and rapid-flowing streams. Japan has been blessed with a large quantity of water from ancient times. On the other hand, lots of floods and disasters have occurred from heavy rains and typhoons.

Local governments and national facilities have tried to inform their residents with correct information about water and rain, and at the same time, explain how to minimize the impact of floods. There are about 130 facilities and centers related to water management in Japan (Foundation for Riverfront Improvement or Restoration, 2007, p. 3). These institutions have important roles in these local areas. When flood disaster comes, they are used as bases for disaster prevention, and also used as information centers on rivers and water during normal periods. Even though they are important to people's lives in disaster prevention and public-relations, many of them suffer from a lack of knowledge about how to show and distribute information, along with a lack of funding and staffing. In this situation, the tools which can inform people with the correct information related to water and river are needed.

In terms of disaster prevention content, there are many printed resources and information already for adults, but few of these have easily understandable content for children. Easily understandable resources for prevention have been long needed.

About JAWANET

JAWANET (Japan Water Exhibition Network) is a Japanese NPO founded in 2010. Its aim is to provide interesting exhibition units about water resources and management for people in general. The NPO is comprised of various interested persons, for example, university faculty members, students who study graphic design or interactive art, institute researchers, craft designers, exhibition planners, weather forecasters, and administrative officials. There are about thiry members, all of whom are volunteers. JAWANET has no sponsor at present, but has annual funds provided by various foundations from its inception.

In 2009, when the Japanese Government Revitalization Unit cut off the budgets for the river information centers, Tomoyasu Yoshitomi (a professor of Tokyo Gakugei University) and Hisanobu Satoh (an officer of the Japan Ministry of Land, Infrastructure, Transport and Tourism) felt the imperative to create traveling exhibitions for many money-strapped institutions in Japan to keep informing people about rivers and water. JAWANET was launched in 2010. Its members were invited to join by these institutions and their supporters and it holds meetings about six times every year to discuss exhibition units and how to improve them.

Figure 1. The logo of JAWANET. Its motif is based on the Japanese Kanji character 水 (water) and river flows.

Figure 2. A JAWANET meeting at the Ministry of Land, Infrastructure, Transport and Tourism. Every member gives ideas for improving the exhibitions.

Three JAWANET Exhibitions

JAWANET has designed three traveling exhibitions since 2010 to the present. All exhibition units are loaned for free. Through this experience of lending, we have found how holding these exhibitions in many places helps share the know-how and improves these local places' disaster prevention plans and fosters communication with each other. Through these three exhibition activities, JAWANET received the Award for Environment and Living at the 4th Good Life Award in 2016 (Ministry of the Environment, 2016) and an Award for Future Cultivation (Japan River Association, 2017) in the 19th Japan Water Prize in 2017.

Figure 3. A leaflet for the "A Sudden Heavy Cloudburst" exhibition held in Hokkaido Prefecture in 2017. This leaflet says "What is A Sudden Heavy Cloudburst? Shall we learn ways of protecting yourself from rain disasters?"

Figure 4. A map showing the 46 sites where the exhibition was held (Geospatial Information Authority of Japan, n.d.).

A Sudden Heavy Cloudburst (2012–2017)

"A Sudden Heavy Cloudburst" was the first exhibition, held from April 2012 to November 2017. Nine exhibition units were made and these traveled to a total of 46 places in Japan.

One variant of the exhibition was presented as "One Summer Day: A Sudden Heavy Rain Corridor". This informed visitors how to prepare against sudden heavy cloudbursts, using sound and light. The exhibition featured story tapestries of children on one summer day arranged in a corridor. People walked through this corridor to experience the sudden weather change. Flashlights and thunder sounds evoked the effects of the disaster. The story informed participants how to protect themselves from sudden rain and flood.

A "3D Rain Sound" unit provided a simulated atmosphere of a terrible cloudburst. The sound was recorded using dummy head microphones.

A unit named "Rain Weight" simulated the experience of carrying the weight of water. Fifty bottles of water were used to provide as much as 30mm rain per hour on a 6 foot by 3 foot tatami mat (a tatami is a straw-based matting common in traditional Japan dwellings). This unit helped participants to recognize the weight of flood water through this simulated experience.

Figure 5. "A Summer Day; A Story Corridor of a Cloudburst", a variation of this exhibition unit.

Figure 6. 3D Rain Sound Listening unit.

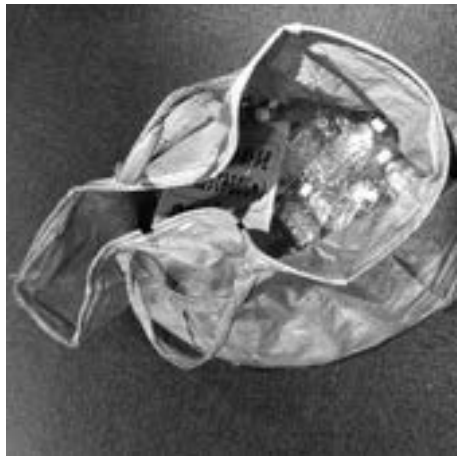

Figure 7. A unit for experience carrying amount of 30mm rain weight.

Figure 8. "Pump out flood" was an interactive unit for developing awareness about the amount of water by using a water pump connected to a computer. The visual image of flooded water depth and pump synchronized in real-time. A detection sensor and Arduino were used to measure the water amount, and Unity was used for the visualization.

An interactive unit labeled as "Pump out the Flood" provided the experience of pumping out floodwater using a water pump. It enabled participants to recognize the importance of prevention measures against floods.

Figure 9. A leaflet of "Rain and Living Things Exhibition" held in Iwate Prefecture in 2016. This leaflet says, "When it starts raining, living things start, Japan Tour". A three-frog orchestra is the main character of this exhibition.

Figure 10. Map showing the 33 sites where the exhibition was held (Geospatial Information Authority of Japan, n.d.).

Figure 11. Children enjoying the exhibition held in the Asamushi Aquarium in Aomori Prefecture in 2014.

The Life in the Rain (2013–2017)

The second exhibition created was "The Life in the Rain" which ran from June 2013 to November 2017. Ten exhibition units were made and they traveled to thirty-three places in Japan.

One unit, labeled "Text Rain", was an interactive exhibition which allowed participants to catch characters falling like raindrops. It was so popular for visitors.

A "plastination unit" featured a Japanese tree frog, a bull frog and snails. Visitors could touch all the plastinated objects. This gave visitors the opportunity to touch creatures living in nature.

Figure 12. Information panels mounted on round-shaped heavy-duty cardboard, designed to create a friendly atmosphere.

Figure 13. The "Text Rain" interactive unit. In this unit, rain characters fell from above and people could catch them by using their bodies. Microsoft Kinect was used to detect a person's posture in real-time. This program was written in Processing.

Figure 14. Plastination unit.

The "Rain Sound Instruments Collection" featured a number of rain instruments, for example, a spring drum, gilos in a shape of a frog and a rain stick, which visitors could touch or play with.

The "Photo Space" unit was set up for just fun to take pictures. This space was designed to provide a leisurely environment for taking photos using visitors' smartphones. All units were really appreciated by visitors and on-site staff.

Figure 15. The "Rain Sound Instruments Collection" unit.

Figure 16. The "Photo Space" unit.

The Rain Exhibition – Rough Rain and Blessing Rain (2018–present)

From 2018, the third exhibition labeled "The Rain Exhibition – Rough Rain and Blessing Rain" has been in operation. It has been exhibited in five locations in Japan thus far. The main theme of this exhibition is to show both faces of a river.

We have made nine units associated with this exhibition. The "Let's Guess This Sound" unit is an interactive unit designed to spark interest in living things around water places. In this unit, each time a sound associated with a living creature's cry is emitted, visitors can reveal the answer by scratching the unit's display with their fingers.

Figure 17. The leaflet of "The Rain Exhibition – Rough Rain and Blessing Rain".

Figure 18. "Let's Guess This Sound" is an interactive unit. Visitors guess a living creature's cry. Visitors can understand the answer by rubbing the display with their fingers. This display reads, "What is this sound? Let's rub to find the answer!".

Figure 19. The first "Rain Exhibition" held in Nagoya Municipal Minato Disaster Center in Aichi Prefecture 2018.

The "Rain Gauge" unit is a real instrument which is actually used in many meteorological stations. The aim of this unit is to give participants a chance to understand how it actually works and become interested in its use in the measurement of rain.

"Tamaru-Tamaru" is an interactive unit that shows how a water flood occurs in real-time at a site. The flood image is superimposed on the image taken by the unit camera in real-time and on a real scale. It helps to connect the senses with the number of inundations. This unit stimulates a scared feeling in the viewer to the flooding water and highlights the importance of early evacuation.

The Disaster Prevention Goods Unit is a collection of first aid goods, books and survival goods, along with a DIG (Disaster Imagination Game).

Figure 20. The "Rain gauge" unit. It is adapted from a real rain gauge used in meteorological stations. Water falls at the press of a button.

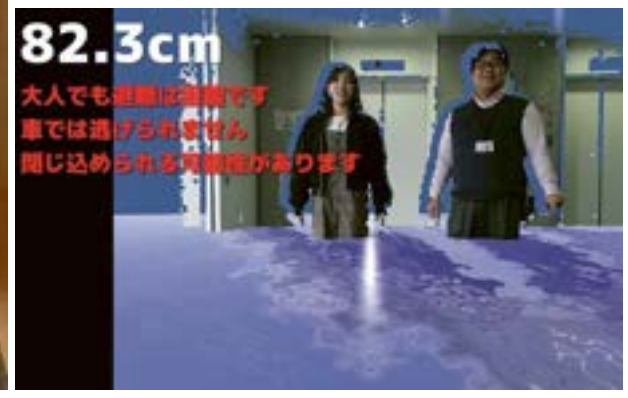

Figure 21. "Tamaru-Tamaru" unit is a real-time on-site flood simulator. Microsoft Kinect v2 is used to measure human posture and Unity for visuals. It shows a real-time flood visual with correct occlusion occurring at any place.

Figure 22. The Disaster Prevention Goods Unit. First aid goods, books, survival goods and a DIG (disaster imagination game) are displayed.

Five Tips Through 7 Years of Activities

JAWANET has spent time and thought on bettering its exhibitions since its beginning. Every time we start and lend our exhibition, JAWANET members have tried to go to the site as often possible as they can, not only to help the on-site staff but also to collect their honest comments face to face. We have received many comments and ideas for improvement from on-site staff, and have been able to have much discussion to prepare better exhibitions. And also, we have sent out questionnaires to every place and analyzed their responses.

Through these activities, we have found 5 tips for developing better exhibitions for transport and operation.

Compactness

Though every one of our exhibitions is ready to be lent to any place in Japan for free, the transport fee has been paid by the borrowers. Reducing this cost is paramount. So, all units are designed as foldables and made on strengthened cardboard to make the transport of these materials lighter.

Making units compact helps not only in reducing the transport fees, but also makes the exhibitions safer. For example, the initial version of the Text-Rain unit required a width of at least 3230 mm, so it was too large to be set up in narrow places. The second version unit could fit in smaller places by placing the projector at a height of about 2000 mm. But the feasibility of putting projectors at such an elevation was not adopted because of the possibility of an accident caused by a falling projector falling on children running around. Also, this idea was not suitable for many places because it required firm pillars or walls. The third version used a super short focus projector, which enabled it to be secured in a safe place and fit in narrow spaces.

Figure 23. All units are made with strengthened cardboard. Assembly needs only be done by combining or fixed with nuts.

Figure 24. The folded units in compact cargos. These cargos are general-sized ones used by Japanese transportation companies.

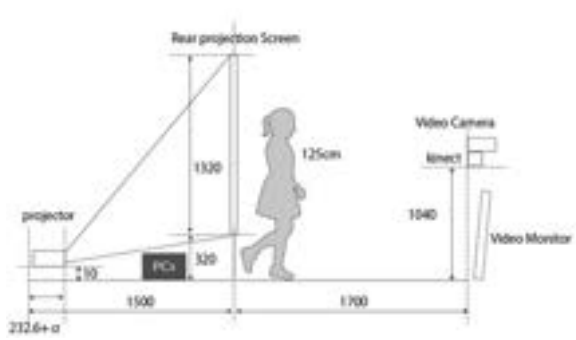

Figure 25. The first version of the text-rain unit. The rear projection required a wide space and also needed a number of mirrors or video monitors for users to watch by themselves.

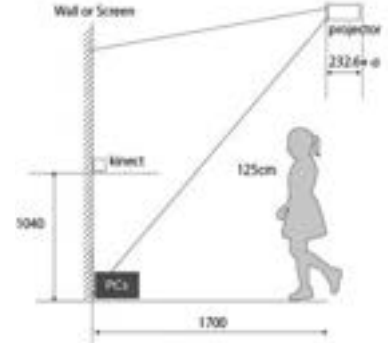

Figure 26. The second version. To put a projector at a high elevation, necessitated firm stands or walls, which could precipitate accidents.

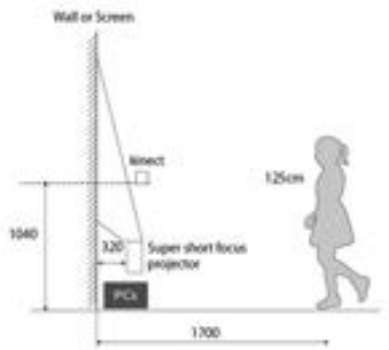

Figure 27. The third version. The use of super short focus projectors.

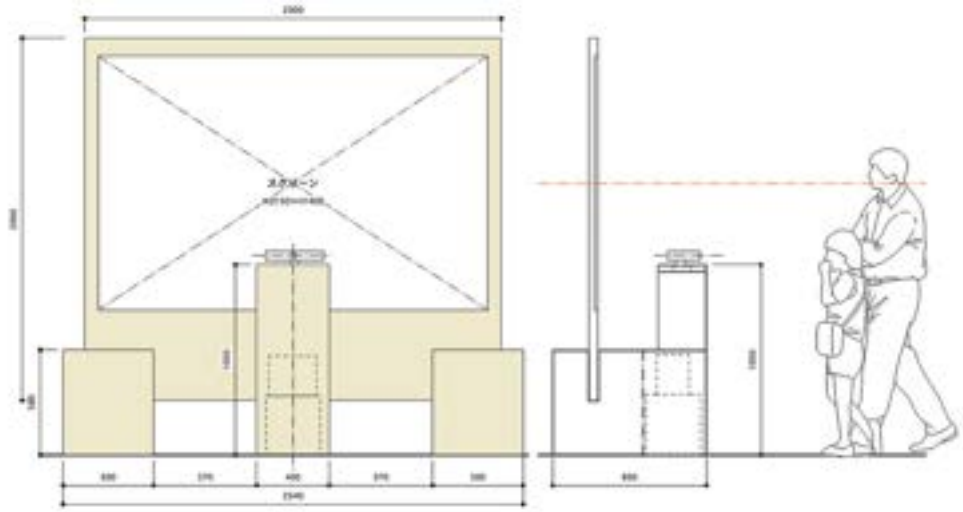

Figure 28. The final idea with a stand screen made with strengthened cardboard. This unit can be assembled at any place.

Easy Setup

Easy setup without special skills is quite helpful for on-site staff. We designed our units using a simple structure, and supplied them with easy to understand assembly manuals. For example, we use simple combinations and color markings for easy understanding.

Figure 29. The pair parts have same color marks. On-site staff just look and put together.

Figure 30. Color marking helps to staff to assemble the parts easily.

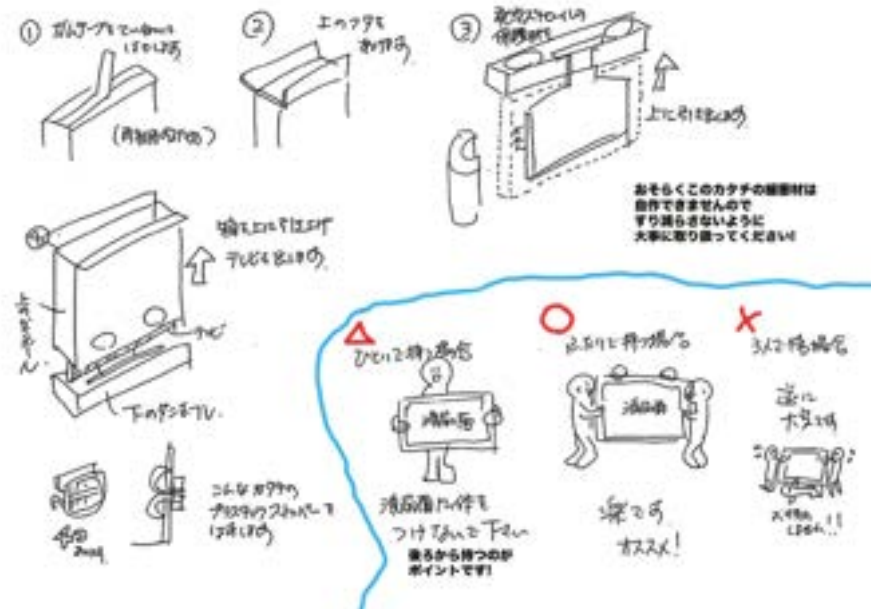

Figure 31. The Illustration manual on the outside of the box shows how to remove the huge TV monitors from the box.

We have no hesitation in revising our exhibition units. For example, "The Sudden Heavy Rain Corridor" consisted of large pillars and ceiling parts in its initial version. This took about one hour to set up and could not be done by one person. After working together with on-site staff, we felt the need to reduce the number of components. After discussions, we made a lighter version.

Figure 32. The original model of "The Sudden Heavy Rain Corridor" There was a ceiling on the top to put in flashlights. Setting the ceiling on the pillars needed the efforts of at least two persons and the use of ladders.

Figure 33. This version of the unit required large pillars and beams. This took much time to assemble and was difficult to set up.

Figure 34. The new design of the "One Summer Day" unit. There are no big pillars or ceiling. The folding panels are very easy to be assembled, yet still retain the semblance of a corridor.

Plug and Play

To make every day startup and maintenance easy, all electric units are designed for plug and play, requiring no special skills or expertise. In general, PC software needs mouse operations, but all the interactive units use an auto start, which makes them ideal for easy start-up. Also, the program is designed for less memory usage during long-time operations so as to prevent program crashes.

Figure 35. A manual affixed near the main electric switch. This manual shows how to switch on the device and provides a telephone number in case of trouble.

Modularized

In transporting these units to many places, we have found that the floor spaces for exhibitions are not the same. To ensure a flexible layout, our exhibitions are composed of small units. All the unit sizes are designed to fit on meeting tables which adhere to a quite basic and regular size in Japan. Using these basic tables help to make the exhibition cargo size small. And we also make miniatures of the units, which helps with planning and creating flexible layouts. At the same time, when we had interviewed children who came to this exhibition, these small miniatures stick in their memory and lead to active comments.

Figure 36. A basic table with white cloth. This table is commonly available in Japan.

Figure 37. Almost all units are designed to fit on tables.

Figure 38. Unit miniatures for layout planning.

Figure 39. Miniatures help save time and sharing layout image between staffs.

Understandable at a glance

We have tried to reduce instruction panels and designed units based on affordance theory. For example, the "One Summer Day" unit was designed like a corridor. This corridor form allowed people to pass through without requiring text alerts. For a unit titled "Rain Quiz", we chose to display it with a flip design. It was presented in a very easy to understand fashion to discover the hidden answer. This style was such a popular one that every visitor could use it. In the "Text Rain" unit, in instructions of how to play, an illustrated frog character showed the best posture to play in. The frog character helped children to enjoy this unit without text instructions. Because this unit also needs to keep participants at a distance at least 1.5m from the Kinect camera for correct sensor recognition, on-site staff gave us an idea to put umbrellas in front of units. This idea keeps children away without text information panels.

Figure 40. For the "One Summer Day" unit, the shape of corridor encourages visitors to pass through.

Figure 41. The "Rain Quiz" unit uses a very traditional style. This style is so popular, every visitor can understand how to find out the answers.

Figure 42. In the "Text Rain" unit, a frog character shows the pose for playing. This image helped children to adopt the same posture even for those who could not read the text.

Figure 43. These umbrellas helped to keep visitors at a far enough distance from the Kinect camera.

Recent challenges

JAWANET's next challenges are to distribute equipment to local places and to share the knowledge of how to make units by themselves.

Akira Sano, a member of JAWANET, has made a new device called "My Timeline Table". The word "My Timeline" refers to a personal list of actions which should be performed in the event of a flood disaster. The timeline needs to be made by each individual visitor because the situations differ for each person. This new device is a multimedia kiosk that shows various maps (normal maps, height maps, river maps, geology maps etc.) that is easily operated by using a game pad. It enables users to easily understand the characteristics of local areas, and make plans in discussions with residents. Until now, JAWANET made exhibition units that have been designed to be used anywhere, but this unit is able to be used locally according to the respective exhibition places. Also, JAWANET has open resources on how to make this unit via its web pages (Sano, 2018). At present (July 2019), some requests have come. We hope there will be many localized units by every institution for helping peoples' lives from disasters.

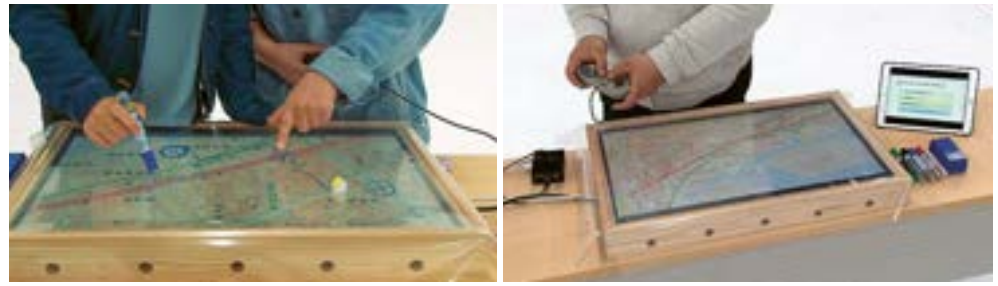

Figure 44. The "My Timeline Table" unit helps people plan how to escape when a flood occurs. Users can discuss how to escape by checking many kinds of maps: elevation map, road map, hazard map and an old geology map.

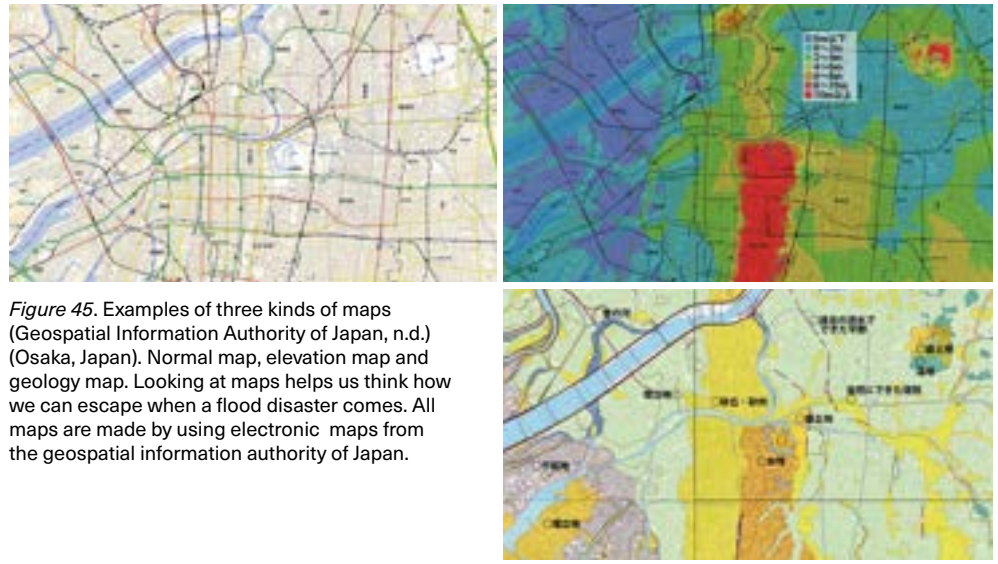

Figure 45. Examples of three kinds of maps (Geospatial Information Authority of Japan, n.d.) (Osaka, Japan). Normal map, elevation map and geology map. Looking at maps helps us think how we can escape when a flood disaster comes. All maps are made by using electronic maps from the geospatial information authority of Japan.

Figure 46. A JAWANET member shows how to use the unit and how to customize it.

Figure 47. Web page showing "how to make a my timeline table".

Conclusion

JAWANET has made three exhibitions for many institutions and visitors. If all people understand the proper information and knowledge of reducing flood disasters, the dangers of human casualties and damage would likely be eliminated. Through these activities, we could get meaningful comments and advice and the five tips from creating excellent water resources units presented here can be applied to other local presentations and exhibitions.

We hope JAWANET will keep constructing excellent exhibitions and providing rain and river information for the future.

Acknowledgment

This work was supported by The River Foundation of Japan and also supported by JSPS KAKENHI Grant Number JP26350252

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Chocolate Easter Eggs as Research Catalyst

INGE RÖMGENS

ABSTRACT:
This chapter reports on ethnographic research conducted in an artistic research project in the Netherlands. The aim was to gain understanding of how artistic research was being done in this project that was intended as a collaboration between theatre artists and academic researchers.
Following a box of Chocolate Easter eggs as an evocative object reveals how despite the intention to collaborate avoiding (stereotypical) assumptions of opposition and difference between the theatre practices and academic practices is easier said than done. Even though the discourse of art and science as two opposing cultures is increasingly criticized, especially in the context of artistic research practices, it is not immediately clear how to avoid it.
Without a clear framework for understanding artistic research collaboration, falling back to (familiar yet stereotypical and oppositional) categories of understanding practices seems unavoidable. Such (involuntary) (mis)understandings of practices put pressure on an intended collaboration, the pressure that researchers (artists and academics) perform in certain (different) ways. This pressure (relating back to the persistence, however unintentionally, of a 'two cultures discourse') is exactly what needs to be managed somehow in artistic research collaboration. The question is how.

KEYWORDS: artistic research practices, theatre practices, collaboration, overcoming Two Cultures discourse, trouble.

My presentation during the Hybrid Labs Symposium provided an introduction to the fieldwork I have conducted with a group of theater artists in an artistic research project called *Buren en Bagage* [*Neighbours and Luggage*] in the Netherlands. The project was carried out by a team of artists from the theater group *Het Laagland*. I joined the team to do participant observations to understand how artistic research was being done in this project and produce a poster. Inspired by Bruno Latour's famous metaphor of the 'black box' (1987), my poster had the shape of a black box (see image I). The black box represents my aim of shedding light on the work that is being done in practice, to create, maintain, break away from or creatively 'work around' assumptions of what is artistic and what is research in this artistic research. In other words, inspired by Latour's focus on the daily practices of scientists in the laboratory, my focus is on everyday practices and processes in an artist's studio during a research project.

Buren en Bagage starts in 2016 as an initiative of Ruth Benschop a lecturer from Zuyd University of Applied Sciences and Inez Derksen, artistic director of *Het Laagland*. In addition to the two initiators, two theater artists from *Het Laagland*, Kiki

van Aubel and Mayke Roels, are part of the core research team from the start. I join the team along with the Laagland's 'critical conscience' (as he calls himself with approval of the others), Joost Milde, who steps in for Inez in January 2018. The project officially has six months left at that point and the focus is on documentation of the project content and artistic research process. My task in the team is to support and advise the Laaglanders on doing documentation. In addition, my own research aims to understand how artistic research is being done in this project that is intended to be a collaboration between theater artists and academic researchers. What are assumptions about artistic and academic practices and how do these influence the course of this artistic research collaboration?

To synthesize the 80+ pages of my fieldnotes, I decide to focus on one specific object that keeps attracting my attention in different project-related activities, namely a box of sweets: *chocolate Easter eggs*. What is striking (and interesting) about

Figure 1. Poster in the shape of a black box as presented at the Hybrid Labs Symposium at Aalto University on May 31, 2018. Picture taken by the researcher.

the object is that it is nothing special. It is apparently trivial, neither theatrical nor academic. It is nothing I would usually pay a lot of attention to in a research project. Yet, it seems to play a prominent role in this specific artistic research project. Somehow the sweets attract my attention as a possible metaphor for what Star & Griesemer (1989) have defined as a *boundary object*. I had been reading about this concept in the context of interdisciplinary art-science collaborations and artistic research.. And even though I understand that the authors were probably not thinking of chocolate sweets when defining the concept, the sweets provokes a thought of objects that can inhabit 'different worlds' and as such contribute to processes of collaboration. Star and Griesemer define boundary objects as:

> scientific objects, which both inhibit several intersecting social worlds […] and satisfy the informational requirements of each of them […] both plastic enough to adapt to local needs […] yet robust enough to maintain a common identity across sites' (Star & Griesemer, 1989, p.393).

Obviously, I will not argue for chocolate sweets being scientific boundary objects. Yet, I wonder about their informational potential in the specific context of *Buren en Bagage*. How does the object inhabit 'different worlds', and what insights does it provide about (the assumptions of) the practices of research in those 'different worlds'? Thus, I decide to take the chocolate eggs seriously as what Sherry Turkle defines as an *evocative object*, an object that provokes thought (Turkle, 2007).

In what follows I will explain how following the chocolate Easter eggs raises awareness of the influence of a 'two cultures discourse' (Snow, 1959) on my assumptions about the nature of artistic practices in a research process. As such, they help to explicate what complicates rather than facilitates the collaboration.

Following the chocolate Easter eggs

The starting point for the journey with the sweets is marked by a meeting of the *Buren en Bagage* team (then consisting of Mayke, Kiki, Joost and myself) at Kiki's kitchen table on Monday evening, March 5, 2018. The meeting spot and time are chosen for convenience: an evening meeting in someone's home because of busy, hard-to-align daytime schedules. When planning the meeting, Kiki emphasizes that she will ensure the abundant availability of tea and candy. She says it in a joking way, but everyone in the team knows that she is serious. This is why I start thinking about sweets.

In every meeting until then (and after) an abundant availability of tea and candy are present. And, in fact, they are not present in the 'silent', unattended way I am used to from work meetings where people have tea without paying any specific attention to them. Here, the tea and candy have an explicit presence. Time is spent on extensive discussions of what types of tea are available and/or what types of candy. On March 13 I write in my notebook:

> *Candy is taken very seriously. Mayke brings a box of chocolate Easter eggs. Meeting starts again with (quite a long) casual conversation about chocolate.*

The teapot is never empty. To avoid this, there are usually two pots. On February 2nd, I write:

> *Random thought about the first three meetings: informal atmosphere during meetings (a lot of tea, cookies, chocolate, tissues available). The place where we meet at Het Laagland is called 'living room'.*

This entry shows that I interpret the tea and candy along with the 'living room' of *Het Laagland* as indicators of an 'informal' or 'personal' work atmosphere. I elaborated on the living room on February 28:

> *The living room feels a bit like the UCM common room, but much cleaner. It has big windows on one side with a big table where everyone meets for lunch. There are also couches with colorful pillows and two Ikea room dividers, one with children's books and the other – which attracts my attention every time – with all kinds of 'toi's' of performances. The latter looks a bit like an art installation… In the living room there's always something going on. People walk in and out. Sometimes laundry is drying.*

Having an 'informal work atmosphere' seems important for the artists. But there is something about this 'informal' atmosphere that I do not quite understand.

The many (and often long) informal conversations about personal tastes and preferences, such as about the chocolates, can take up a good part of a meeting. To me, the conversations feel both trivial and strangely intimate. Not immediately recognizing these kinds of conversations as *something I do when doing research*, I initially think of them as something that happens in the margins of a meeting, *around* rather than *as part of* the research. Like the small-talk between those who arrive early to a meeting and are killing time until everybody has arrived and *the real* meeting begins.

It is not immediately clear that the Laaglanders do not share my assumption. They seem to not make the same distinction as I do between what is part of a research-meeting and what is not. Within *Buren en Bagage* my involuntary (and implicitly assumed) distinction between *informal chit-chat in the margins of a meeting* and *the real content of a meeting* gets blurred. For, *the real content of a meeting* here often consists of *informal chit-chat about the researchers' personal lives*.

From the *personal columns* (a term used by the artists themselves) written by Kiki and Mayke as research output, it becomes clear that they are highly interested in sharing and analyzing personal experiences. And that the artists consider this part of their research. The columns are shared by means of the author reading them aloud to the research team during meetings. On several occasions the reader cries while reading, because their personal reflections are deeply emotional. Sometimes others cry as well, moved by the personal reflections of the reader. For me, these situations are difficult and a bit awkward. For example, on March 13 I write:

> *I find that difficult to respond to. Especially when it becomes emotional. After Mayke had finished reading, nobody said anything. Really for quite a long time. I thought 'I'm not going to be the first person to speak up, because what should I say?' I also thought 'Should I look at Mayke? That's scary! But I noticed that she was seeking eye contact with each of us. Eventually she broke the ice herself, telling us that she saw 'three very sweet and encouraging faces'.*

In addition to the insecurity of not knowing how to respond to the particular emotional situation, the difficulty for me lies in understanding the situation *as part of doing research*. I wonder about the relevance *as research* of the seemingly intimate and deeply personal details about the researchers' lives. It makes me feel a bit like an intruder to what seems like a close-knit group that knows each other very well.

When discussing this issue with the artists, it becomes clear that for them the openness and space to discuss what they call *whatever wants to exist* is highly valuable. Kiki and Mayke confirm that this is something they definitely recognize as '*something theater artists do and learn*'. They refer to both an acceptance of the emotionality of things and of crying as 'ok' and to using yourself and your own personal experiences as a vantage point in a work process. Kiki's response to a letter Mayke had written to her passport is interesting in this regard:

> *Finally, since a long time something that is really yours! This is good!'*

We discuss this a bit further and then Mayke adds:

> *If it's really personal, you can relate to it as a listener. What really comes from inside you, is good. We learn at school to start from yourself, from your own 'inner fire'.*

This way, my associations deriving from the chocolate sweets lead to some findings about the question of how research in theatre is done and what my assumptions about these practices are. Artistic research in theatre, I could say, is personal, very much about the researchers themselves and takes place in an informal environment that is deliberately made 'cozy' to encourage personal reflection and sharing of personal experiences. It is tempting to qualify this as *what is artistic* about the approach to doing research. Not just because it makes me feel like (and referred to by the other team members as) *the academic* who is unfamiliar with this kind of approach to doing research, but also because it connects to characteristics from art practices as defined in different streams of literature. Think of the literature following John Dewey's (2005 [1934]) perspective that art is about the creation of (a special kind of) experiences, that enable acquiring 'experiential knowledge'. That is: direct sensory knowledge about the world. Elliot Eisner (1991) in this regard speaks of the attention in the arts to qualitative aspects of the environment; aspects that can be grasped through the senses. This connects to the focus of the artists on creating an experience and the careful attention to the atmosphere and sensory qualities of this experience. My observations, then, confirm how *affect* plays an important role in the arts. How, in other words, the ways by which objects, situations or ideas become 'sticky' in that they are able to evoke certain feelings or emotions (Ahmed, 2010). This way, associations deriving from the attention to affective qualities of the research approach and environment enable the identification of a set of qualities of *what is artistic* about the artistic research.

Identifying *what is artistic* about the artistic research, however, evokes a sense of unease during my fieldwork. For, even though the topics I identify do not seem wrong or irrelevant, they narrow my focus to *a specific perspective* that increasingly alienates me from the Laaglanders. For example, when discussing what I conside the

'theatricality' of the content of *Buren en Bagage*[1] Kiki, Mayke and Joost all seem very puzzled (February 21, 2018). They wonder what I mean with theatricality. And I try to explain why to me the onmoeting (meeting) looks like a theatrical practice, as it mostly takes place in a giant chair that looks like it comes straight out of a performance (see Image 2). The chair literally is larger than life. Therefore, I involuntarily assume that the ontmoeting is a staged practice. The Laaglanders strongly deny this. They almost seem a bit offended. To them, the ontmoeting is nothing like a staged practice. They had never considered it in this way. At… All.

The chair, they explain, was chosen as a means to achieve the exact opposite from a staged setting, namely a closed-off cocoon that gives those who 'ontmoet' privacy. Because of its size the chair 'closes off' the conversation. It isolates the people in conversation in the chair from the world around them, both blocking noises from outside and ensuring that whatever is discussed remains inaudible outside the chair. Hence, even though the chair did have a past as a prop in a performance and the Laaglanders agree that the size attracts attention, it has an important new function in this project, namely to create the cozy, closed-off space that ensures the privacy that an ontmoeting needs.

The involuntary focus on identifying what is artistic about the artistic research yields *trouble* in that it alienates my position from those of the Laaglanders. Even though the plan was that we would all collaborate in this project *as researchers*, my reference to the Laaglanders as *artists* and their reference to me as *the academic* sets us apart. Even though nobody really makes it explicit, *the academic* and *the artist* are considered to somehow differ in fundamental ways, with each possessing distinct skills and qualities that are assumed even though not always explicitly or clearly defined and communicated.

That, however, such a neat distinction doesn't hold up becomes clear in the meeting where Joost (who reminds us from time to time that he considers himself neither artist nor academic) shares a reflection on the project. He calls Kiki and Mayke representatives of respectively the Enlightenment and Romanticism as distinct historical movements. The following excerpt from his reflective letter confirms my doubts about pinpointing specific *artistic* qualities of the artists' practices:

> *Kiki to me represents the Enlightenment… In which Reason is of key importance. […] Reason assumes logic, which is necessary to comprehend the world. [….] And that's why discussion, philosophy and analysis are crucial. These are your 'ontmoetingen', Kiki…'*

Joost's description encourages one to understand Kiki's art practice as grounded in reason, analysis and philosophical discussion. Conventionally, these would be seen as academic qualities. Therefore, the comment triggers reflection about what would

1 Content-wise, the research in *Buren en Bagage* focuses on the development of a specific type of practice, which had been defined within the research team before my arrival as the practice of 'ontmoeten'. Ontmoeten is Dutch for 'meeting'. In Dutch, the word can also be read with a pause between 'ont' and 'moeten'. In that case, it can be explained as 'not having to / not needing to…'. As such, the artistic research investigates the development of how different people can meet to discuss their personal perspectives on things that matter to them in their lives without a specific goal or agenda (in Dutch: zonder dat er iets moet). The idea is that this type of practice might facilitate understanding between people from different (cultural) backgrounds.

Figure 2. The chair in which many (however, not all) ontmoetingen take place. Before Buren en Bagage it had been used as a prop in a Laagland performance. Picture taken by the researcher.

usually be thought of as the academic or artistic characteristics of research. This is how I start to experience the blurring of the boundaries between *what is artistic* and *what is academic* in this research project.

Before entering the field in *Buren en Bagage* I had been warned that so-called *dualistic reasoning* is something to watch out for. As the MERIAN team[2] that I am a part of describes in their definition of the *Maastricht-style* of artistic research, the aim is to overcome 'a dualistic reasoning in which the worlds of art and academia are seen from the start as either fundamentally opposed or to be reconciled' (Benschop et.al., 2018). Following C.P. Snow's frequently cited lecture (1959), the *two cultures discourse* has been the subject of a contested debate about the (assumed) differences between the arts and the sciences. In his lecture Snow positions the arts and the sciences as binary opposites, two cultures that 'cannot talk to each other'. *What is artistic*, accordingly, is defined negatively, i.e. as *what is not academic* and vice versa. Even though recent scholars, notably affiliated with artistic research or studies of art-science practices have argued *against* this discourse[3], its influence is still noticeable, for

2 See Maastricht Experimental Research In and through the Arts Network (2024).
3 See e.g. Shapin (2008), Born & Barry (2010), Gere (2010), Vaage (2015).

example, in institutional separations, such as in the Netherlands between art academies and research universities. And, as I catch myself in this project, thus also in (tacit) assumptions brought by participants when joining projects.

Following my associations from the chocolate Easter eggs shows that *avoiding* (assumptions about) existing dualisms or oppositions between art and academia are easier said than done. Without clear reference points for what to expect in unfamiliar (research) practices, it is tempting to fall back on familiar categories. In my case, associations leading towards (stereotypical) ideas of *what is artistic* and *what is theatrical*. Involuntarily, however, this approach seems to push me away from the Laaglanders with whom I aim to collaborate rather than bring us closer. When I discuss this insight with the artists, they recognize it too. Mayke, for instance explains (personal communication April 23, 2018):

> *I sometimes struggle with this idea of needing to meet these external expectations. Of what is expected of me 'as the artist'.*

Mayke's comment reminds of an example Sarah Thornton (2014) provides when discussing the self-portrait, *I'm dying up here,* by the artist Tammy Rae Carland (2010):

> *'The scene [Carland's self-portrait] evokes many of the ancillary expectations that befall artists […] the pressure to speak, to be seen, to perform, to convince, to entertain'* (Thornton, 2014, p. 72).

Thornton's use of the term 'pressure' is fitting. For, as the instances from my fieldwork suggest, (involuntary) assumptions and expectations about characteristics of a practice put pressure on an intended collaboration, the pressure that researchers perform in *a certain way*. This pressure (relating back to the persistence, however unintentionally, of a 'two cultures discourse') is exactly what needs to be managed somehow in artistic research collaborations. The question remains how.

With my presentation of the black box and this essay I am suggesting that finding ways to explicate the stubborn influence of the 'two cultures' and how it might manifest itself in practice is an important first step in trying to manage and overcome its influence in an artistic research collaboration. My future research seeks to further specify and add on to this thought.

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Figure 1. AnneMarie Maes. The Intelligent Guerrilla Beehive' – installation shot at the UN/GREEN exhibition in Riga, Latvia (2019) The Intelligent Guerrilla Beehive is a sculpture made from organic materials and enhanced with electronics. It provides the viewers an artistic visual and audio experience of activities in and around the beehive.

The Intelligent Beehive and the Genesis of a Microbial Skin

ANNEMARIE MAES

ABSTRACT:
For most of the past decade I have been growing, hacking, digitizing, building, and thinking about beehives – particularly those in urban areas. Collaborating with a team of biologists, I am reconceptualizing what a beehive is and what it can be.
The bio-art project The Intelligent Beehive monitors the behaviour of urban honeybee colonies as a source of inspiration for ongoing artistic research into issues of ecological, architectural and social sustainability in urban environments. Bees are bio-indicators. They reflect the health of their surrounding ecosystem as well as the cumulative effects of different pollutants. In many industrialized regions the colonies are threatened. Air pollution, the compromised state of their foraging fields, pesticides and parasites are among the main factors. To raise awareness about the disappearance of the honeybees, I imagined the concept of an Intelligent Beehive. It is a radically new beehive. Tailored to the needs of the bees (instead of those of the beekeeper), and augmented with supportive bacteria, it is intended to help the bees in their survival and pollinating tasks, and thus protect the biodiversity of the environment.
My Intelligent Beehive has been a starting point for exploring possible futures through artistic research on materials science and biotechnology.

KEYWORDS: biosensor, cyanobacteria, honeybees, sustainable beehives, photosynthesis, art-science.

The Intelligent Beehive Project

For a large part of the past decade, I have been growing, hacking, digitizing, building, and thinking about beehives – particularly those in urban areas. Collaborating with biologists, designers and engineers, I have been re-conceptualizing what a beehive is and what it can be. This has led to the speculative bio-art project 'The Intelligent Beehive'. The project imagines a new kind of beehive which is both a safe, healthy haven for swarming urban honeybee colonies as well as a device for monitoring their behavior. This long-term project has been an incredible source of inspiration for artistic research into issues of ecology, architecture and social sustainability of urban environments.

My research navigates between experimental urban horticulture, scientific research, and metabolic sculptures. My experiments connect living, intelligent systems and biotechnology with artistic and technological prototyping and experimentation. The toolset includes microbial life and material science in an attempt to develop bio-remedial beehives. It also includes various measurement and information technologies such as scanning electron microscopes (SEM), sensors, Big Data cloud storage, signal processing, and Artificial Intelligence. The artworks that result follow

a complex work-methodology combining first-hand observation in research gardens and rooftop apiaries, laboratory probes, and digital monitoring (Maes, 2013).

My work not only gives rise to fascinating images, useful ecological data and new ideas for building sustainable beehives. It is also a political statement, arguing for the integration of nature as a social/sensory/phenomenal living matrix. This matrix takes shape in collaboration with bees and their urban foraging. The resulting theory and practice emphasizes fairness to nature. Specifically, it draws attention to the fragile affinities between humans, bees, bacteria, and the urban neighborhoods they symbiotically inhabit.

The images in this paper will illustrate both the laboratory setting and some of the art works that have come out of the Intelligent Beehive project.

Most of the fieldwork is carried out in the Brussels Bee Laboratory, an open-air lab which includes a 750 m2 rooftop garden directly connected to my studio in the center of Brussels. The lab contains a section where I grow plants for my biological experiments, as well as a set of custom-made observation beehives that are augmented with monitoring technology and that are streaming huge datasets on bee behavior to local servers. Bees are important bio-indicators. They reflect the health of their surrounding ecosystem as well as the cumulative effects of different pollutants. Given the decline of bee colonies worldwide, it is important to map air pollution, the compromised state of their foraging fields and the presence of pesticides and parasites.

In cooperation with researchers from the Artificial Intelligence Lab of the Free University of Brussels (VUB) we started analysing this data using sophisticated pattern recognition, AI technologies, and we have used computer graphics for making these patterns accessible. The project has included an experiment in Deep Learning to interpret the activities in the hive based on sound and microclimate recording (Maes, 2015). The conclusions of these observations formed the basis for the development of the Intelligent Beehive, a project which will make the transition from green technology to biotechnology and grow a radically new beehive from scratch – a beehive that is tailored to the needs of the bees instead to those of the beekeeper. Adding symbiotic bacteria to the skin of the hive might create a favorable ecology to support the bee colonies in their survival and hence reinforce pollinating tasks and protect the biodiversity of the environment.

The Intelligent Beehive serves as a physical model for biological actions in conjunction with technological fabrication (3D printing, laser cutting, CNC milling). It is appropriate to envision a metabolic sculpture, a 'living machine' expanded by green technology (a solar panel, camera, Raspberry Pi computer) and by living technology: bacteria. This vision incorporates bacteria as contributing agents, enabling the Intelligent Beehive to autonomously interact with the bees, mites and urban environment. The intelligent device, combining nature and technology, calls into question not only machine-to-insect intelligence, but also questions how we deal with biological performance in hybrid materials (Maes, 2017a). The cellulose skin enveloping the beehive is augmented with a biofilm populated with colonies of bacteria. Their changing colors reflect the degree of environmental contamination.

Figure 2. Artworks resulting from the Intelligent Beehive research – © AnneMarie Maes
From left to right, clockwise: the Intelligent Beehive at Ars Electronica, 2017; the Intelligent Beehive at Ispra/Milano, Museum of Technology (2017); The Invisible Garden at the Green Light District, Kortrijk (2014); the Heart Beehive at Bozar, Brussels (2017); the Scaffolded SoundBeehive at Centro Luis Borges, Buenos Aires (2015); Hortus Experimentalis at SO-ON, Brussels (ongoing).

At the same time the device monitors the bees' microbiome. The prototype is placed into a sealed container to feed the bacterial colonies in a continuous way. The bees leave the hive via a tube (Maes, 2017b).

My motto for the design of the Intelligent Beehive was: grow a resilient structure and take nature as a parameter for form. Palynology (the study of pollen grains) offered a good starting point for the first blueprint drawings of the in-and outside. Pollen contains useful information on the environment, for a wide range of

purposes but, moreover, pollen are of an extreme aesthetic beauty and their functioning is full of interesting little tricks (e.g. ventilation/stomata, thermoregulation, reflective and absorbing textures, apertures, resilience) for survival. They turned out to be an incredible source of inspiration. To translate these natural qualities towards a prototype created with digital technologies I needed to make an in-depth study of pollen. I started to work with the Scanning Electron Microscope (SEM) at the Free University of Brussels (VUB). The SEM offers the possibility to visualize small 3D objects (particles) up to +20,000 magnification, ideal for studying and photographing

Figure 3. Clockwise, from left to right: The Laboratorium for Form and Matter, Brussels; Researcher/Beekeeper at work; streaming computer; Intelligent Beehive prototyping; bee colony observation and analysis.

small particles as pollen grains, and pollution particles, which are daily transported within the electrostatic fur on the bees' bodies. Working with the SEM gave me also a much better insight into the functioning and morphology of a bee, an important fact whilst developing a radical new hive that is bee-centred. When the bee lands upon the outer skin of the beehive, these pollution particles come in contact with the bacteria living in the upper biofilm layer which is enveloping the outer shell of the Intelligent Beehive.

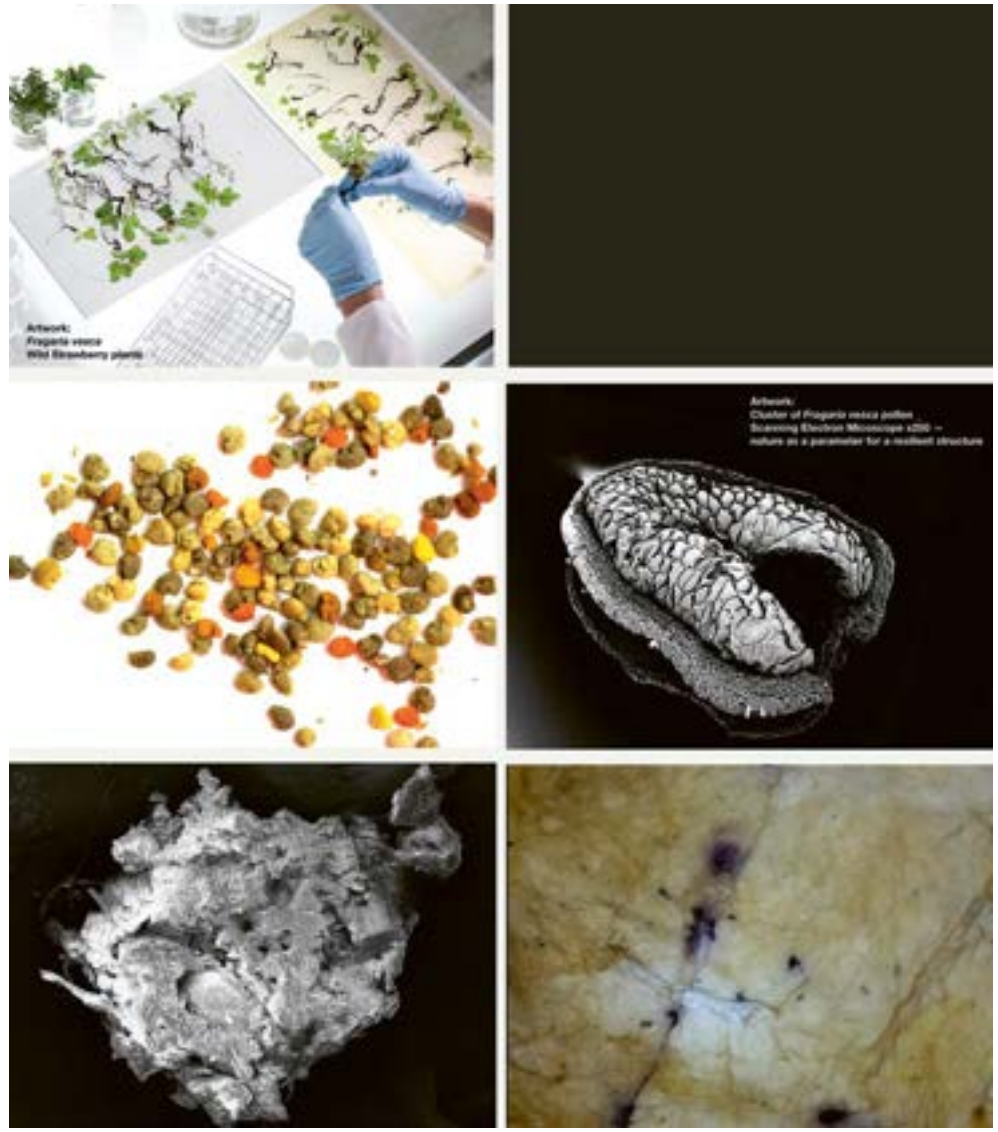

Figure 4. From left to right, clockwise: *Fragaria vesca* (wild strawberry) as source of inspiration; Scanning Electron Micrograph of *Fragaria vesca*; biofilm with *Janthinobacterium Lividum* on cellulose fabric; Scanning Electron Micrograph of pollution particle (x250); pollen collection.

Genesis of a microbial skin.

The research and development of the Beehive has been a constant exploration on the edge of art, science and biohacking. The goal is to provide a biological skin for a beehive, a skin that functions as an interface to compute and communicate the outer environmental data and the internal beehive signals.

I started to work with 'bacterial skins' as programmable material. A 'bacterial skin' (or cellulose skin) is a mat-like cellulose structure built of nanofibers. It is grown in a symbiotic action by bacteria and yeast cells. The Acetobacter xylinum bacteria produces a lot of cellulose; they are fed with a by-product of the yeast fermentation. Vice versa, the by-product of the bacteria fermentation feeds the yeast cells. The cellulose mat protects the fermenting sweet tea – the growth medium – from invasion by wild bacteria and yeast cells. The low pH of the culture disrupts the cell membranes of unwanted bacteria. Moreover, several of the healthy organic acids that create the low pH demonstrate specific antibacterial, antiviral and other antimicrobial properties. This is one of the main reasons why I choose to work with bacterial skins as a primary medium for growing the Intelligent Beehive.

I experimented with different technologies to create the skin: on a 3D printed skeleton (in chitosan), bacteria grow and from scratch they create a cellulose fabric which is later augmented with a supplementary biofilm with pollution-sensing bacteria. As such, the beehive becomes a sensing device. The double-layered skin of the Intelligent Beehive behaves as a bio-digital living system, the living matter itself (the bacteria) becomes the monitoring technology. In parallel experiments we investigate the possibilities of adding chitine/chitosan on top of the microbial skins, to enhance the skins' qualities of resistance, waterproofness and strength.

During the course of my research, I have combined organic components such as vegetal matter, pollen and chitin, with living systems such as bacteria and other micro-organisms. Biomimesis (the imitation of natural models for the purpose of solving human problems) has been used as a starting point for incubating ecological thinking on matter and form. I have experimented with micro-organisms and organic materials to create thin membranes grown by a symbiotic community of bacteria and yeast cells. Following this, I have researched how these fabrics could be enhanced through embedded electronics and living technology. (Maes, 2015). The main question was whether the microbial-grown skins would be a valuable host medium for biofilms filled with a different strain of microbes, useful for environmental sensing. If so, then the multiplexed membrane could become a real smart fabric with integrated elements for sensing and actuating, for computation and for communication. The double-layered skin of the Intelligent Beehive behaves as a bio-digital living system, the living matter (the bacteria) becomes the monitoring technology. Different qualities of microbial skin have been examined in terms of strength, water resistance and aspects of the host as growth medium for the bacteria. In parallel, experiments were investigating the possibilities of adding chitin/chitosan on top of the microbial skins.

The Lab experiments were carried out between 2015 and 2017 in the Brussels Laboratory for Form and Matter; in the Biohack Lab Barcelona and at the University Pompeu Fabra in Barcelona; as well as at the laboratory of Chemical Engineering of the Free University in Brussels. I grew hundreds of microbial skins in plastic containers of different sizes and in a range of different environmental conditions. It turned out to be evident that the warmer the temperature the faster the bacteria were layering their cellulose nanofibers that form the matrix of the skin. But also, the quality (freshness) of the mother (the scoby), the quality of the tea leaves in the growth medium (green, black or perfumed) and the airborne spores of yeast specific to the location in which the containers are stored for growth (conflictingly or harmonious) are important parameters for growing a healthy and strong membrane (Crum & LaGory, 2016).

Figure 5. From left to right clockwise: cleaning and testing wet cellulose skin; petri dishes with bacteria, samples and tests; inoculating cellulose skin with *Janthinobacterium lividum.*

To enhance the water resistance of the cellulose skin, I carried out a series of tests with different compositions of chitosan on top of the wet and dry samples of cellulose skin. Initially, the idea was to 3D print a complete chitin-skeleton for the Intelligent Beehive. The tests with different combinations of chitosan (mixed with different percentages of glycerol; with bacterial cellulose pulp or with crystal cellulose) have proven that working with chitosan is very complicated. The matter must

be heated up to 75°C and needs to be stirred for at least 5 hours continuously. 2D drawings that have been created with 9% and 12% chitosan mixtures, with a syringe as a simulation tool for a 3D print head, turned out to produce satisfactory results initially – but the outcome is still miles away from the strong material that we need to make solid 3D skeleton prints. Much more research (and much more money) is needed to raise this process up to the scale of a workable material. Instead, I have set up an experiment for growing bacterial cellulose immediately around a 3D object (Maes, 2015–2017b). A 3D-printed model of the Intelligent Beehive, slowly rotating in growth medium, gathered a 4mm microbial skin over the course of 4 weeks.

The last phase in the project was the search into finding the right strain of bacteria to populate the biofilm. Requirements are i) resilience in diverse environmental conditions and ii) color changing qualities when a specific ecological threshold is passed. To start this experiment, I left some wet cellulose skins in a beehive for a few days on which I was hoping to collect interesting bacteria in a natural way. I made several swabs of these skins, and these results were put to growth in a sterile container with medium. In a second phase I brought strikes of this medium to culture in petri dishes. Several strains of bacteria have been recovered from those samples but most of them were not useful for the experiment. After a series of attempts to make the bacteria grow on the cellulose skin, I have concluded that only the Lactobacillus plantarum and the Janthinobacterium lividum (2 strains that were bought) were able to survive on the skin. Bacteria from these 2 strains do not only grow into a biofilm, they also change color when a modifier threshold (pollution, pesticides) is passed. Following these results, I inoculated freshly grown skins with Lactobacillus plantarum bacteria and with the presence of X-gal (a modifier which is used in molecular biology to test for the presence of a specific enzyme) the bacterial colonies changed into a greenish-blue color, which is clearly visible on the skin of the little beehive model. As long as they are fed, the bacteria in the biofilm continuously renew into young generations, hence the cellulose skin acts as a crust that crumbles under ever new layers of bacteria. Thus, the Intelligent Beehive's outer skin is protected by a layer of living cells that constantly feed off the dead ones and thus cleans and repairs itself (Maes 2016–2018).

Conclusion

The Intelligent Beehive hypothesis is a proof of concept. Experiments conducted in the laboratory as well as in the field confirm that the physiognomy of the beehive-object meets the conditions that a colony of honeybees needs to survive in the wild. The cellulose skin, which envelops the beehive and which is built in symbiosis by *Acetobacter xylinum* bacteria and yeast cells, proves biotechnologically to be a good scaffold for growing biofilms of *Lactobacillus plantarum* or *Janthinobacterium lividum* bacteria. These bacterial biofilms react to environmental pollution thresholds by changing their color. As such, the outer skin of the beehive becomes a biosensor; it becomes an interface that visualizes the health status of the environment. A negative point is that neither *L.plantarum* nor *J.lividum* are resilient to extreme heat or humid

Figure 6. Clockwise from left to right: growing cellulose skin on a rotating object; bacteria hunting in the forest, *Lactobacillus plantarum* on dry cellulose skin; *Lactobacillus plantarum* on cellulose skin grown around an object and a 3D printed scaffold/skeleton of the Intelligent Beehive.

weather conditions. These bacteria only grow in a protected environment, and they need a steady flow of growth medium. A further search for the right bacteria strain is thus needed. Probably this problem can be solved with the implementation of synthetic biology. More research needs to be done into i) the water resistance of the cellulose membrane, as well for ii) 3D printing scaffolds with chitin/chitosan. We need support from a professional laboratory with the right high-end equipment to bring this experiment to a good ending.

Acknowledgements
DIY bioLab Barcelona (Dr. Núria Condé Pueyo, microbiologist and computer scientist) was the main partner regarding biological research for the Intelligent Beehive project. FabTextiles Lab Barcelona (Anastasia Pistofidou), part of the FabLab Barcelona helped out with digital prototyping. Members of the Brussels Urban Bee Lab that helped to realize several experiments include Vincent Malstaf and Joeri Bultheel. I also thank Dr. Laura Gribaldo, microbiologist at JRC Ispra, for her valuable support and advice and Dr. Alexander Lutz (VUB) for helping me out with the Scanning Electron Microscope.

Funding was received from the Flemish Ministry of Culture as well as from the Resonance Festival of the Joint Research Centre of the European Community in Ispra, Italy.

The Intelligent Beehive project was bestowed with a Honorary Mention in the Hybrid Art discipline of the Ars Electronica Festival 2017 in Linz, Austria.

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How to Set the Table for Collaborations: Artistic Sensibilities and Methods

KRISTIN BERGAUST

ABSTRACT:
Can artistic methods and ways of engaging with the environment have an impact beyond the artwork's effect as a tool of communication or as an object positioned within the art context itself? Based on experiences and mapping of artistic practices from the site-specific Oslofjord Ecologies and other collaborations, the meaning and aesthetic value of the artistic method has become an inherent quality of the art work. After a process of mapping artistic interests and sensibilities, four conceptions were formed. By thinking through these, materiality, sensuous experience, performativity and construction of narratives, I look for artistic qualities or sensibilities occurring in contemporary art practices. From an ecological point of view, the understanding and interpretation of artworks and specific artistic processes along with theoretical inspirations and references could make artistic practice relevant across transdisciplinary collaborations.

KEYWORDS: Oslofjord Ecologies, artistic method, turn to matter, sensuous experience, performative practice.

Asking ourselves the unanswerable **what can art do?** we echo questions from many other fields of knowledge and professional expertise as we face the climate crises. I was curious about artistic thinking and methodology as a means to connect to a wider ecological context, not only looking for the specific and distinctive in eco-art or bio-art aesthetics. Can artistic methods and ways of engaging with the environment have an impact beyond the artwork's effect as a tool of communication or as an object positioned within the art context itself? This question arouse from working with diverse artistic fields and research interests in Oslofjord Ecologies, as well as from participation in the Renewable Futures network's activities (RF) and other artistic exchanges, research situations and meetings over the years. By taking an interest in a range of contemporary artistic practices as well as entering into transdisciplinary collaborations, I observed that the methods in aesthetic action and thinking might be as valuable in transdisciplinary communication as the artworks themselves. The implementation of an artwork, how and by what methods it is produced and presented, will be a layer in how the meaning is perceived. I found support in theory from different fields and examples from artistic works and practices. In the following, I will formulate some reflections from the perspective of a practising artist, curator and educator in an experimental art field. This article is an essayistic formulation of observations and ideas in the context of a specific environment, rather than a survey or an attempt at a general theoretical framework.

At a seminar on art and the climate crises, organized by BOA (Billedkunstnere i Oslo og Akershus), an artist's organization in Oslo, Dag O. Hessen professor of biology at the University of Oslo, suggested that art had an important function in formulating and disseminating content and topics in the ecological crises (BOA 2017). Since the gravity of the situation is hard to grasp through scientific research information alone, artistic expressions might access and affect humans on an emotional level that could motivate people differently. This is hard to disagree with, however, I was left with an unsatisfied feeling as art was being conceived as merely another communication tool, however effective. I found support in Sacha Kagan's belief that art has the "potential to be the active process of interdependences between different dimensions of human crisis that draws us into the search for pathways to a post-fossil fuel age, and on to a new era of human development based on an aesthetics of sustainability" (Kagan, 2012, p. 7). Kagan, an interdisciplinary researcher in ecology, art and sustainability, PhD of social sciences, argues for the role of art in transforming our ways of behaviour to reach a more sustainable existence. Such a sustainable aesthetic in what he calls a culture of complexity brings forward an optimistic vision of art that include its processes, poetics and aesthetic thinking, not only its objects or functions as commodities. I will let Kagan's idea of aesthetic sustainability as a "sensibility to patterns that connect" (Kagan, 2012, p. 32) inspire a further look at artistic methods, susceptibilities and qualities in Oslofjord Ecologies.

Oslofjord Ecologies as a Site

Oslofjord Ecologies is a site-specific project, although this is interpreted more as characteristics of the area than a strict geographical delineation. A project comprising more than fifty workshop participants, among them twenty exhibiting or performing artists in two exhibitions, produced a lot of material and documentation. In thinking of the artistic qualities and their intersections as functions in different contexts, the genealogy of the site-specific offered by art historian Miwon Kwon's in her seminal book *One Place after Another* (2002) is useful. Kwon suggests three instances of the site-specific. The first is the *phenomenological*, which is concerned with the physical and sensuous properties to be experienced in a site. Secondly, the *social or institutional* can be found in works that decode different sites and interests involved in the work of art, namely institutional critique. The *discursive*, which she poses as the third category, is linked to the present and to the two other categories. This entails how the art work relates to the actuality of a location (as site) and the social conditions of the institutional frame (as site). These are both subordinate to a *discursively* determined site that is delineated as a field of knowledge, intellectual exchange, or cultural debate. This may be created by the artwork itself or be a potential of the site that can be activated (Kwon, 2002). All three site categories can be found in Oslofjord Ecologies as intentions in the project lay-out and in the different artworks.

Figure 1. The Oslofjord Ecologies exhibition

Oslofjord Ecologies' Mapping of Sensibilities

Through mapping interests and backgrounds in a pre-project, *Ecotones*, the following four artistic strands of qualities were suggested: **materiality, sensory experience, performative practice and construction of narratives**. These qualities intersect; they could also be seen as sensibilities or interests, but not as clear-cut categories. Even if *Ecotones* did not go further than a field trip and mapping, these strands have lived on in recurring projects. The attempts to name and describe some trajectories of contemporary artistic practices stem from a sense of relevance also to other areas, from the vernacular realm, to research and education in view of the ongoing ecological crises.

Materiality

Materiality is essential to the relationship between humans and their environments. Artists who joined the mapping of *Ecotones* and later worked with *Oslofjord Ecologies* underscored the physicality and tactility in interacting with our surroundings that we all depend on as humans. This is not understood as a purely technical relationship, the act of preparing a material to utilize it for a purpose, but also as an interaction of pleasure or sensuous experience with a material. Kneading bread dough is something you have to do to make bread by hand, preferred by many for the pure pleasure of it, even if you have the choice of using a kitchen machine to do the

Figure 2. Be Extended: Oslo (2019). Photo: Line Lyngstadaas

kneading. Material-based art practices have become more prevalent within the contemporary art scene in recent years. There is a new emphasis on contextual aspects that relates to experimentation, conceptualization and narrative elements – what can be described as materialized narrations in which the act of crafting represents ideas of time and labour. An expanded view on materiality, often coined as New Materialism is emerging across arts, humanities and social sciences. This **turn to matter** is characterized by social production rather than social construction, inspired by feminist, queer, post-colonial and post-structuralist positions (Fox & Alldred, 2019). Multiplicity and diversity replace the dichotomies of, for instance, nature and culture, mind and matter, humans and non-humans. According to New Materialism thought, the world and history are created by a range of material forces that extend from the physical and the biological to the psychological, social and cultural. New Materialism opens up a multiplicity and diversity in a critique of anthropocentrism.

Sensory Experience

Sensory experience is again frequently discussed in contemporary art theory and often actualized in relation to ecology and human experience of nature, after being less prevalent and maybe overshadowed by a conceptual turn since the 1960s. The direct connection between the original meaning of aesthetics (aesthesis – the senses) and the function of art, is perceived by the German philosopher Gernot Böhme. Böhme envisions a renewed philosophy of aesthetics to encompass the sensory realm

at large. By including both nature and the man-made, such as urban architecture, design and advertisement, all of the environment can be attended to (Böhme, 2008). The interest in sensory experience can be seen as a complement to the interest in audience participation and a rethinking of the sensory as including more than visuality and sound. In Oslofjord Ecologies, the *Listening to the Fjord* boat trip was an example of the experiential as a common base from where different references were taken and works emerged. The senses can inspire direct engagement with environmental traits to create awareness, appreciation or critique of qualities in a specific environment. It might also lead to engagement with social situations, living beings, objects or materials and interactions. Ethics of care are often based in a sense of embodiment, a connection that is felt as a sensuous or bodily connection to a physical site, a place, objects or situation. Elin T.Sørensen's research project discussed in the article *Giving voice to the blue mussel* formulates a concept of care as leading to interspecies co-creation.

Performative Practice

Performative practice is an approach in which we consider elements from the perspective of how they are acted out and have an effect in the world. In actor-network theory, all events occurring within the social and natural worlds are considered to be continuously generated effects of the webs of relations that they are located within. Instead of asking why something happens, actor-network theory asks how it occurs, and studies how occurrences arrange themselves. The performative addresses how the materials of the world (social, technical, documentary, natural, human, animal) get themselves done and on how they go on shifting and relating themselves in the processes that enact realities and knowledge (Law, 2008). From this perspective, performative practice is not only a typically human behaviour, expressing and reflecting the intentions of humans, but also collaborative relationships between heterogeneous elements such as organisms, objects and sites. The performative is also prominent in bio-art and techno-ecological genres where processes in living material are displayed or made visible or audible as they happen in time. The direct experience of bacteria as electricity producers in Rasa Smite and Raitis Smits work *Biotricity. Fluctuations of Micro-Worlds* is an interesting example as it also offers numerous mediations of the process through sound, image and time-lapse documentation.

Construction of Narratives

Construction of narratives entails practices of assembling and appropriating material. Often documentation of various phenomena and historical documents will be archived and collected as a basis for constructing new narratives. As the art historian Charles Merewether expresses it: "the archive, as distinct from a collection or library, constitutes a repository or ordered system of documents and records, both verbal and visual, that is the foundation from which history is written." (Merewether, 2006, p. 10) The critic and writer Hal Foster (2004, p. 5) underlines the constructed in

the archive as a productive element in his analysis of art based on archival material when he writes: "[I]t not only draws on informal archives but produces them as well, and does so in a way that underscores the nature of all archival materials as found yet constructed, factual yet fictive, public yet private." (Foster, 2004, p. 5) From the Oslofjord Ecologies perspective, historical and cultural documents and items may be sources of information as well as material for artistic appropriation and storytelling. Gunhild Vatn's investigation of Norwegian oil aesthetics is an example of how historical material can be understood and contextualized to shed light on the ambiguous past and present of our fossil economy and its dissemination. In view of an uncertain time ahead, the narrative may also be a way to suggest a different future or imagine alternative solutions. The narrative strategy might also enhance, empower and give voice to living beings that are otherwise without a voice, as Sabine Popp's work with kelp and the discourses deriving from them does.

Co-creating with other living beings, whether human or non-human is immanent in the art works and activities throughout Oslofjord Ecologies, and philosophical inspiration could come from influences such as Donna Haraway's term *sympoieisis*, or "making-with" (Haraway, 2016, pp. 58–98). Informed by developmental biology as well as conflicted indigenous life practices and contemporary art, *sympoieisis* underscores the creative entanglement and interdependencies between all beings (or *critters* in Haraway's language), but also the interdependencies of how our stories are told and knowledge is constructed. In Haraways words: "We relate, know, think, world, and tell stories through and with other stories, worlds, knowledges, thinkings, yearnings. So do all the other critters of Terra, in all our bumptious diversity and category-breaking speciations and knottings." (Haraway, 2016, p. 97) This short summing-up of complex relationships can also provide a perspective on how ecology and art may come together in a more general sense. *Sympoieisis* points to qualities to be aimed at in artistic practices as well as in daily life. Through Oslofjord Ecologies conversations a metaphor for art's role in the transdisciplinary was suggested: to set the table as a host and facilitate others to work with us. This potential of instigating *sympoieisis* seems to justify or support the optimistic belief of Sacha Kagan in "a new era of human development based on an aesthetics of sustainability", which I leaned on in the introduction.

The interests or sensibilities mapped at the outset of this essay: **materiality, sensory experience, performative practice and construction of narratives,** can all be ingredients in artistic methods, as well as constituting part of other practices within research, professional realms or the everyday. Artistic practice can accordingly be characterized by methods invented by the artist while referencing other artistic practices, research paradigms and other aesthetic, theoretical and professional perspectives. The method carries meaning and contributes new layers of interpretation and reception to art as well as facilitating production in new ways. By allowing for inherent or possible production of meaning in the context of a site, artistic methods are open to interpretations. It might be that the methodological flexibility and inherent transdisciplinary openness are among the components artists can bring to the common metaphorical table. Throughout the Oslofjord Ecologies, the rhetorical

ring and totality of **what can art do?** is a conversation starter and motivator across disciplines, while at the same time inquiring into the singularities of art. By changing the question to **how does art do (something),** we seem to activate an array of suggestions and practical links to other fields of knowledge.

Acknowledgement
The article first was published in Oslofjord Ecologies.

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Lost Islands: Performative Expeditions at the End of the World

SAMIR BHOWMIK, JUSSI PARIKKA

ABSTRACT:
The island is a microcosm of entangled ecologies, histories and technologies, which also can act as a proxy for probing larger contemporary issues haunting human culture. To engage with this premise, we address "Lost Islands", a participatory performance project that was realized for the Helsinki Biennial 2021 on the island of Vallisaari. The project consists of a series of performative expeditions that explore the island's entanglements with nature and the disappearance of geographies under infrastructure. By analyzing the site-specific methods of immersion and participation with the material and digital culture of the island, the authors theorize on how performance as a critical environmental narrative can reframe the submerged aspects of the island as a site of labor and energy.

KEYWORDS: performance, infrastructure, energy, labor, digital culture, racial capitalism.

Guide: "Lets start with the end of the world. We are done with the golden spikes. We are done with the dying calls of white geologies. The so-called Anthropocene is long past. Let us imagine what we are left with is nothing but just this island." (Jemison, 2015; Yusoff, 2018).

Figure 1. A scene from Lost Islands. The Guide with the submarine cable.
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The guide pulls out a piece of a submarine cable from the sea, observed by an audience gathered by the seashore at the appointed time. The performance begins with the guide leading the group of attendees from the edge of the island to its innermost depths. The island is Vallisaari, a former military island in the Helsinki Archipelago in the Baltic Sea, and the scene is part of Samir Bhowmik's Lost Islands at the Helsinki Biennial 2021 (Bhowmik, 2021).

The project presents a series of performative expeditions that explore the island as a specific space of cables, signal towers, and other technological infrastructures and signs spread across a rural geography (Starosielski, 2015). Outside the white cube, the island serves as an outdoor performance and exhibition space that is narrated and performed with existing sites and ruins of buildings in order to meditate and reflect on the past, present and future of how humans subjugate nature with technology and infrastructure. The island has been for a longer period a particular topos of time – of another time and time out of joint. In this case though, the explicit aim of the narrative is to draw attention to the colonial roots of extractivism, technological acceleration, and environmental damage (Yusoff, 2018; Liboiron, 2021; Ghosh, 2021).

Consisting of site-specific performances combined with film and installation, the project explores such material and political underpinnings of digital culture in ways that also resonates with recent themes in media and art studies, for example, here, the contemporary condition becomes one of labor, infrastructure, and technology as those themes are teased out in an experiential form with a participatory performance (Bhowmik & Parikka, 2021). In other words, using immersive and participative methods, Lost Islands creates an intangible contact zone for participants and audiences beyond the gallery or museum space, yet is nonetheless an artificial space where arts of noticing are practiced (Tsing, 2015, pp. 17–25)

Guide: "This cable is our last connection to what remains of humanity. Rather this object of in-humanity is what we have to become familiar with. This becomes our only way to trace this lost island. And it has a fault that stretches over black and brown bodies… …like the seismic fault lines of the earth. It came from there, from under the water, traveling thousands of miles, through seas and oceans, coral reefs, islands and continents…a complex body of nature and infrastructure connecting us, humans and non-humans ali"e."

Lost Islands traces an imaginary route of submarine cables through Vallisaari. The performative expeditions re-enact a series of immersive scenes of land survey, mineral extraction, fabrication of technologies, and recovery of waste. The expedition moves through forests, ruins, (imagined) mines, lakes and bunkers searching for a cable line fault. The cable itself is a device that provides a narrative motif – the last connection to the outside world, a theme depicted in much of post-apocalyptic literature and cinema too where signal spaces are the last remnants of other islands and other places. Nevil Shute's *On the Beach* (1957) novel is a good Cold War period example. In Bhowmik's version, lingering and stranded bodies, both human and non-human are discovered, witness the damage to the land by machines.

Figure 2. A scene from Lost Islands. The Guide carrying the submarine cable through the island of Vallisaari, which is then handed off to the audience and the characters. ©Maija Toivanen/HAM/Helsinki Biennial 2021.

Unknown to the guide and the audience, four characters linger on various parts of the island, as remainders of a post-technological society of the present. They are the remnants of racialized labor – indigenous and immigrant people often from the Global South – who are essential in making the digital world. From miners, surveyors, fabricators, polishers, and scavengers, their bodies retain the memories of their roles and actions in the excavations, manufacture, and maintenance of the island. Their technical skills and knowledge help us to understand the materials available on the island, continuing their work as operators – not necessarily anymore of elaborate machines or the usual institutional functions as before, but still with references to a lingering legacy of an earlier racialized division of labor. They understand the life be taken care of alongside the unseen dangers, and ghosts that were present when the cable-line was constructed. Each contributes to or opposes the cable-line in different ways. Upon encounter, they perform and narrate to the guide and the audience their stories and experiences on the island through bodily enactments, installations and vocals at various locations. The island becomes many as it is divided not only by the dead labor of infrastructural remains but through the persistence of those voices encountered along the route. There is a shift in focus from extractive machines and bodies to their performative relations (Bhowmik & Parikka 2021). Characters activate particular processes and connect with multiple levels of nature and infrastructure – infrastructure becomes performed, it becomes people (Simone, 2004).Together they enact an ecology of relations.

Guide: "The blackness that exists in the geologic layers, has been appropriated, ...and carried forward in this cable. The cable tries to slither through the subterranean ...in close proximity of the black inferno, impersonating.....mimicking what it is not, Delivering oppression disguised as hope... So much so that this forced intimacy with the inhuman ...has been repurposed and reprogrammed for survival... But, if the oppressed body is just another form of information, then what use do we have of it anymore? If one is not the body..... then one can only be this cable."

Figure 3. A scene from Lost Islands. Performance by the "Miner" who measures the land. ©Maija Toivanen/HAM/Helsinki Biennial 2021.

The cable articulates the real and the symbolic as it acts as both an ephemeral and tangible body that connects nodes, with possible diversions, as well as leaks. The cable and the pipeline have become emblematic political objects of our period (Starosielski, 2015; Malm, 2021) as they give a material face to the otherwise often imperceivable structuring forces of different kinds of flows from oil to waste and from information to finance (Szeman, 2017).

What then is the cable as a poetic object in midst of this political ecology? At some points, it draws strength and then at other places it leaks away. Performances become encounters with the leakages. Artifacts and installations become physical manifestations of the various nodes. This mix of multi-sensorial, tangible and ephemeral interruptions along the route mutually co-constructs the themes, providing spontaneous opportunities for their elaboration. The audience becomes a key participant too as they help to trace the cable route, in relaying information, in gathering data, and furthermore processing it as a collective, generating internal discussion and reflection. The group becomes, gradually, a data assemblage (Kitchin & Lauriault, 2018) to use a term from recent years of critical data studies. In some

ways, the body or chain of participants themselves start to do the work of infrastructure in ways that resonates with the earlier point – they become participants in carrying the unknown flows of knowledge (or material) of the cable. This shift from operations to operators is thus emblematic of the broader inclusion of labor – and maintenance – into the communicative circuits of how we make sense of technical environments too. The ultimate goal is that this human cable then expands beyond Vallisaari, across the sea and reaches the mainland, as a way of dissemination of the contentious topics of this project.

Guide: "This innocent cable travels like an obsessed demon. It crawls through historical and intentional deformations of the earth...that press the in-human and human together. This contact with the earth was possible only with minerals .....minerals that were extracted by machines ...and work that subjugated humans. It was assumed that black and brown bodies could absorb everything:...exposure to toxic landscapes, to act as buffers against the slow violence enacted upon our earth. So, when we dig into the depths, what we find is fundamentally black. And, what we call utopia, is nothing but a black inferno (Wynter, 2003; Yusoff, 2018)."

Figure 4. A scene from Lost Islands. A performative encounter between two characters: the "Fabricator" and the "Polisher" by a fallen tree. ©Maija Toivanen/HAM/Helsinki Biennial 2021.

Much of our thinking about the role of the performance, narrative, and real and imagined objects of *Lost Island* resonates with John Durham Peters' argument that "We know and use nature only through the artifacts we make – both out of nature and out of our own bodies – and these artifacts can enter into nature's own history" (Peters, 2015). This resonates closely with the concept of medianatures (Parikka, 2015; Parikka, 2018, pp. 251–253) where our epistemic and aesthetic notions of nature

are framed through (advanced) media technologies that themselves are reliant on the very same flows of nature (materials, energy, externalization of waste) in a recursive chain of operations. The submarine cable has become today a part of so-called nature, as part of terraforming the sea, as something that is dependent on extractivism. Both extractivism and terraforming entangle geologies, technologies, and populations, not to speak of all things inhuman. While the notion of terraforming comes to the fore mostly in both 20th century science fiction and in recent years of speculative design (Scharmen, 2021; Bratton, 2020), it can be tracked back to histories that relate to paleoclimatologic accounts of agriculture, and even more so, colonial contexts of "infrastructuring": such ecological interventions were central to colonialism, European settlement in Americas and Australia, enslavement of large populations, and such artificial territories of imprint as sugarcane and other plantations around the world (Kamugisha, 2016; See also Parikka, 2023).

Amitav Ghosh argues that "the explicit aim was to turn territories that were perceived to be wastelands into terrain that fitted a European conception of productive land" (Ghosh, 2021). The notion was that the land was savage, wild, and vacant, because it was neither tilled, nor divided into property. At the same time, other bodies were considered savage, wild and vacant. Among a repertoire of operations from bureaucracy to extraction, a significant element of such colonial power functioned by way of planting and creating plantations. Terraforming was formalized with the land being gridded, numbered, and assigned values. This involved also the physicality of labor – including enslaved labor by way of bodies, muscular energy, protein and carbohydrates that echo Achille Mbembe's thoughts about the racial regimes of energy and labor (Mbembe, 2019; see also Silva, 2017). This genealogy of the project of terraforming enframes the world, the world-as-resource, in which landscapes (or planets) come to be regarded as factories and Nature is seen as subdued and cheap (Patel & Mooore, 2017).

Guide: "We are walking on an island, that is no longer one that we belong to.... or escape to.... To route the cables, the land was gridded and exploded, ...old trees and soft vegetation destroyed. Excavators, trenchers, bulldozers, drifters... ...and rock drills had invaded the landscape. Just like, back in the past, the ancestors of these earthmovers, had drilled away the bedrock,...flattening the ground, filling up the sea and 'reclaiming' territory that never was part of the continent. The topography is now changed,...the rains run to new man-made routes....the underground network of trees are all in disarray ...the relationships with the soil are displaced....now entangled with unknown flows."

Land and sea as media have been the intense focus and bedrock of industrialization and construction of infrastructures since the Industrial Revolution. What was once only about the manufacture of products and the construction of highways, rails and bridges for resource extraction and exploitation has now extended to invisible submarine cable networks under the sea, remote data centres and telecommunications infrastructures to shape our digital culture. Topographies and terrains have disappeared in this quest. Islands that once housed diverse ecosystems lie buried under

Figure 5. A scene from Lost Islands: A performative encounter between three characters: the "Miner", the "Fabricator" and the "Polisher" by a toxic lake. ©Maija Toivanen/HAM/Helsinki Biennial 2021.

power plants; undersea data cables and gas pipelines divide the ocean into exclusion zones; deep- sea mining and mineral extraction leave giant holes in the ground. Furthermore, the city expands into the sea through extensive land reclamation, leading not only to hardening of the shorelines that violently offload toxic runoffs into the sea, but also to disturbance of the chemical composition of water, gradually destroying marine habitats. Such islands – natural or artificial, or all artificial with varying degrees of intensity – are emblematic of both the hinterlands of capitalism (Brenner & Katsikis, 2020) and extended urbanism. Islands are emblematic stop-overs in the historical networks of trade routes and how planetary circulation of goods and enslaved peoples came to define also accumulation of wealth. As such, the relation of property and territory is a significant part of the idea of islands as sites of connection – or in this performance, as sites of disconnection too where the haunting continues with operations and operators that seem displaced but continuing a repertoire of actions and gestures learned across hundreds of years.

This angle to the artifice of islands begs the question as to how we can reformulate, retheorize the island – how does this theorization work in relation to the space of the performance, and how the performance can help to reframe these submerged aspects of island as a site of labor and energy?

Lost Islands challenges the way we think about the disappearance of not only islands or geographies under infrastructure but also racial capitalism in relation to technological supply chains as well as broader discourses such as of geoengineering. If one considers it as an environmental narrative it is populated by an

awareness of "anthropogenic alterations, strange agencies, and precarious human and nonhuman lives" that Stacy Alaimo (2016) calls for as the substantial base for critical environmentalisms.

Guide: "Islands are nothing but in a state of submergence. oppressed bodies struggle for surface, to even exist. The light that transmits through the cable re-arranges the light around us. Technology cuts our ties to the land. And leaves us dislocated. These toxic bodies are just the ghosts of technology ...and geology's material modes of dispossession (Yusoff, 2018). Re-inscribing geology as a property of the human, you have to think about its former lives of inscription, ...not just those we currently search for (Yusoff, 2018). To run that beam of light through a glass fibre, ..one also has to encounter its side-effects."

Figure 6. A scene from Lost Islands. A performance where the characters raise a radio balloon. ©Maija Toivanen/HAM/Helsinki Biennial 2021.

According to Pugh and Chandler, "islands, whether overtly or tacitly and across a range of contemporary works – have generated new or alternative approaches to being and knowing in the Anthropocene" (Pugh & Chandler, 2021). Islands are not merely blank spaces for the development of contemporary thought – the fantasy and literary trope of an isolated or uninhabited island is part of the troubling legacy of earlier periods. This particular geographical form exists at several scales from small isles, rocks, and atolls to the size of a continent. Changing perspective, the earth can be said to be collection of islands. They are surrounded by water as they foster unique ecosystems. Islands feature as premodern and modern, including their central role as part of the emergence of modern forms of biological thinking, not

least Charles Darwin's Galapagos expedition focusing on the question of "isolation". Islands are also key sites and proxies of larger planetary issues of global warming, rising sea levels, waste, and disruptive weather patterns. At the same time, the environmental elements (of the island) have expanded from being perceived as mere natural ecology to infrastructural nodes. This is one emblem of how they become also artificial, as connected, as technological. Human-induced climate and geological change, the hallmarks of the Anthropocene might be better understood by multi-scalar approaches to the island not as an isolated ecosystem, but connected to larger planetary infrastructures.

Islands are also anthropogenic recording devices. To encounter and study the island (as a microcosm of entangled ecologies, histories and technologies) is one way to probe the larger contemporary issues haunting human culture. For instance, the logics of infrastructure and extractivism as inscribed onto its landscapes and architecture can be examined to uncover correlations with its bodies of labor, its organisms and its weather (Arboleda, 2020). To conceive of natural landscapes as inscriptions and as sensorial surfaces starts to speak to an alternative formulation of both data and witnessing (Offenhuber, 2019; Schuppli, 2020; Bhowmik & Parikka, 2018). As Kathryn Yusoff writes, such a form of inscription can also become a proxy way of framing different scales of anthropogenic impact: "The catastrophe of climate change is excessive and will inscribe all earthly space. It is earth writing writ large." (Yusoff, 2009, p. 1010. See also Gil-Fournier & Parikka, 2024).

As a recording device, Vallisaari contains the inscriptions of both human and non-human agents – from the sonic scape of endangered bats to the pulsating flow of information and energy deep in the grounds of the island. As a stage and context for performance, it offers a heterogenous terrain, containing forests, ponds, decrepit military bunkers, rocky shorelines, abandoned buildings and wilderness trails. History collides with the present, nature confronts infrastructure, along with their actors and agents. Thus, the island serves not only as an outdoor exhibition space, but also a performative infrastructure to meditate and reflect on the past, present and future of how humans subjugate nature with technology and infrastructure.

Guide: "The infrastructure of the wired has transformed and now celebrated as wireless-ness. But the wirelessing of the Planet and the island has only enslaved it further. Before we were chained as labor to the land, now we are chained from the skies above."

Helsinki and its surroundings are a case in point of an extended urbanism with an archipelago of natural and artificial islands. While the whole area, like any other urban and sub-urban area, could be coined as a proxy of Anthropocene, measured through air and soil and other chemical and physical changes, we can focus on Vallisaari as a specific case of an Anthropocene island (Pugh & Chandler, 2021). It is replete with natural and infrastructural entanglements, elements of medianatures as mentioned earlier (Parikka, 2018, pp. 251–253). As one of the most bio-diverse islands in the Helsinki archipelago, it has over 415 existing species. A diverse ecosystem has prospered in the lush forests, meadows and ponds combined with the

Figure 7. A scene from Lost Islands. The final scene of the performance where all the characters let go of the submarine cable and gather to acknowledge the futility of reaching the other shore.
Photo Credits: Samir Bhowmik, Christopher L. Thomas.

ruins of fortresses, caves and buildings. The unintentional re-wilding of Vallisaari has continued, entangled with the legacies and leftovers of military infrastructure that also for a long time included military waste such as ammunition (Bhowmik, 2020). In between military occupations and abandonments, the island was transformed into an ecological paradise, now to be once again drawn into the sphere of the infrastructural by culture and tourism development (Bhowmik, 2020). As such, part of this echoes the theme of exclusion zones and their relation to "rewilding", as in the case of Chernobyl after the 1986 nuclear accident. Of course, Vallisaari is not a contaminated site of such proportions as Chernobyl and our intention is not to lessen the much more significant levels of contamination at the Ukrainian nuclear site. But we can draw a series of images – of sites and landscapes as images – that constitute the islands of "zones" across the planetary surface with varying levels of contamination or other forms of waste that define their role as both memories of the past slow violence of technology (Nixon, 2011; Parikka, 2016) and as sites of an on-going or projected development.

Biennials, of course, are one face of such development with an often difficult relationship with themes of sustainability. As such, one can see that the Helsinki Biennial also operationalises the island as infrastructure that needs water, data, and energy to sustain it as a site of exhibitions (Bhowmik, 2020). In the view of Helsinki Biennial 2023 there is also, however, sustained awareness of such key conditions as part of the curatorial thinking, with a recognition of the needed subtlety in how the natural environments can be framed through artistic and curatorial interventions.

As such, the question for artistic and curatorial thinking is about how to be aware of such sensitive locations as Vallisaari, not as "pristine nature" nor as mere

resource, but as an entanglement of nature and infrastructure. Water, sewage and data infrastructure, including submarine cables and 5G towers, co-inhabit the island with the many species and vegetation. Histories of colonialism, war and occupation mingle with issues of Baltic Sea contamination, along with shipping routes and submarine cable landings. The natural aspects of the island are irrevocably connected with the built environment. Although, extensive application of land-reclamation in Helsinki is yet to extend to Vallisaari and the neighboring Suomenlinna, they are for all purposes infrastructurally 'reclaimed' (by data, water and sewage networks) and connected to the 'mainland' fabric of the city. While other culturally 'insignificant' islands in the Helsinki archipelago have been long since been absorbed into the city limits by continuous infill of the sea, and as a result disappeared, and retain traces as a place name or rocky outcrops, or in archives.

Guide: "Everyone hopes for an island. At some point or the other. Whether it is black or white. Sometimes you search for your island and conquer it, ….and sometimes the dream of the island is just a symbol …for what is one step beyond reach… …you think of privacy, remoteness, intimacy, …a rounded whole without bridges or fences. ..Sheltered and isolated by the water..that appears to be the only open horizon given to you." (Jansson, 2019)

Acknowledgements
Parts of this essay have appeared in a panel talk "Calculation Otherwise" in Transmediale 2022 in Berlin. The narration of the guide was performed in the Lost Islands performative project during the Helsinki Biennial 2021. Jussi Parikka (Aarhus University, Denmark) who advised on the script of Lost Islands was instrumental in the form and flow of the project. We appreciate the significant contributions of performers Esete Sutinen, Jani Toivola, Amira Khalifa, Geoffrey Erista and dramaturge Michelle Orenius in the performance planning and choreography of Lost Islands. We also express gratitude to the project members, including Hanne Jurmu, Pauliina Sjöberg, Christopher Thomas, Roxana Sadvokassava, Viljami Lehtonen, Tero Kaipanen, Ulla Varis, Oskar Koli, Ville Hyvönen, Emmi Holopainen and Warda Ahmed. Thanks to the curatorial team at the Helsinki Art Museum. Funding was provided by the Kone Foundation for the artistic research. Jussi Parikka wishes to acknowledge the support by the projects Design and Aesthetics for Environmental Data (AUFF) and Operational Images (Czech Science Foundation, 19-26865X).

Note
The narration of the guide was inspired by several literary and academic voices including Kathryn Yusoff, N.K. Jemison, Tove Jansson, and Sylvia Wynter. Portions of the narration are direct quotes and others as adaptations that have been composed into an accessible narrative text. These authors have been cited in the references below.

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4

DEEP HYBRID – LATEST DEVELOPMENTS

Rasa Smite, Raitis Smits. Deep Sensing. RT-32 Revisited, 2002–2022.
Decolonizing Ecologies, Riga Art Space, Latvia, 2022–2023. Photo: Kristine Madjare.

Rasa Smite, Raitis Smits. Deep Sensing, 2023.
MEET Digital Culture Center, Milan, Italy. Courtesy of the artists.

Rasa Smite, Raitis Smits. Deep Sensing, 2023.
MEET Digital Culture Center, Milan, Italy. Courtesy of the artists.

Rasa Smite, Raitis Smits. Deep Sensing, 2023. Convergence: Artistic Explorations from Nature to Society exhibition, 2024. Zone Sound Creative, Taipei, Taiwan. Courtesy of the artists.

Deep Sensing: Back at the Irbene Radio Telescope (or Why Isn't Earth Enough? Visualizing Data to Discover the Unknown)

RASA SMITE, RAITIS SMITS

ABSTRACT:
Deep Sensing traces its origins back to the legendary sound art and radio astronomy symposium "RT-32. Acoustic Space Laboratory" organized by RIXC artists 20 years ago at the Irbene radio telescope in Latvia, after its abandonment by the Soviet armed forces. Re-engaging with the site 20 years later, the artists first tried to understand the captivation of this massive antenna today, when, after the grandiose space conquest plans of the 20th century, we have finally "landed on Earth" – or, if not, as French philosopher Bruno Latour remarks, "at least we have been pointed in... another direction" – as climate change and environmental issues keep becoming more and more pressing here. Yet, we ask, why is the Earth not enough?
Moreover, these giant radio telescopes not only look upwards, they are the unique points of convergence for cosmic rays reaching Earth's surface. In the new visualization, the radio telescopes are no longer represented as massive objects, but as immaterial point clouds that rotate, leaving and crossing traces, following the flow of cosmic particles that fly from the Sun to Earth, impact ionospheric clouds, interact with the Earth's atmosphere and create terrestrial wind patterns.
The artists use radio astronomy data from our Solar System, combined with environmental recordings from the Irbene radio telescope site, to create an immersive soundscape and the 'sensorialized' data experience. Hence, Deep Sensing strives to push the boundaries of climate science by investigating its correlations with space research, while contextualizing these interactions in a socio-ecological and geopolitical perspective.

KEYWORDS: climate change, weather data, radio astronomy, art and science, immersive visualization.

> As everybody learned at school, when the position of the Earth in the cosmos is modified, a revolution in social order might ensue. Remember Galileo: when astronomers made the Earth move around the sun, the whole fabric of society felt under attack.
>
> Bruno Latour (2020, p. 12)

Deep Sensing is an artistic exploration of the return to the Irbene Radio Telescope, which, twenty years ago, hosted the legendary radio astronomy and sound art symposium *RT-32: Acoustic Space Laboratory*, organized by RIXC (Smite et al., 2002). Back

then, only a few years had passed since the scientific community and the general public had learned about the existence of this secret object. After the collapse of the Soviet Union and the withdrawal of military forces from Latvia in 1994, the facility was taken over by Latvian scientists. The giant thirty-two-meter antenna was designed to receive signals from the depths of the universe, but was once used mainly for espionage and to receive the first satellite signals.

With renewed interest and a little caution, we returned to the Irbene Radio Telescope last summer to find out what role this isolated communications facility and Soviet military legacy plays today – when, after the grandiose twentieth-century plans for space conquest, socio-ecological issues here on Earth have become more pressing. Today, Donna Haraway talks about the art of living on a "damaged" planet (Haraway, 2016); Félix Guattari puts forward new "ecosophies," explaining that ecology concerns not only the environment but also the social and mental worlds, and that it is as relevant in the natural as in the virtual world (Guattari, 2008); while Bruno Latour calls for an awareness that it is time to return "down to Earth," asking, "landing on Earth? [...] Aren't we already on Earth? Well, not quite! [...] It seems that in the past there has been some misinterpretation of what it means to be earthly (Latour, 2020, p. 13).

So why is the Earth not enough (for us)? Why is our imagination once again sparked by this robust design – the huge antenna in Irbene? We are once again joined by scientists from the Ventspils International Radio Astronomy Centre (VIRAC) as we walk through the rooms of the RT-32 radio telescope, seeking to understand its fascination twenty years ago and today.

The secret past

Information about the antennas built in the 1970s and the existence of the Soviet space communications center "Zvjozdochka" (Little Star), located in a restricted area in the North Latvian forests near Ventspils, only came to light in 1993. Initially, there were three antennas. The smallest, RT-10 (10 m in diameter), was taken by the Soviet occupation army when it retreated. Thanks to pressure from the international radio astronomy community, the Soviet army refrained from blowing up the two largest antennas, RT-16 and RT-32, and they came under the supervision of the Latvian Academy of Sciences.

As these antennas are still classified in Russia, it was almost impossible to find out more precise information about when and for what purpose they were built. When the Soviet occupation army retreated, it left no technical documentation, no construction drawings, and no specifications for the control mechanism. Negotiations with institutes in Russia for access to this important information have always proved fruitless. For our first multimedia study, in the early 2000s, we even went to Moscow to interview Dr. Polak, one of the lead designers of the Irbene antenna, who was then working at the Melnikov Central Research and Design *Institute of Steel Structures* in Moscow. This was also in vain.

Edgars Bervalds, a Latvian scientist and the first director of the radio telescope, told us that such antennas were built in the Soviet Union in the 1960s and 1970s to provide Soviet spacecraft with radio communication. However, it is unlikely that they were used for radio astronomy. In the 1980s, these large antennas were mainly used to intercept satellite radio transmissions between the Soviet Union, Europe, and North America, to locate submarines in the Baltic Sea, and to take precise measurements of the globe for the purpose of mapping the trajectories of jet weapons.

In the post-Cold War era, this is one of the few examples in Europe of a secret military base being turned into a civilian research institute. At times, the restoration and preservation of these radio telescopes became rather dramatic. The antennas had been left by the armed forces without functioning electrical systems and technical documentation was lacking. Plates were damaged, metal debris had been thrown into mechanical devices, nails had been driven into cables, and acid had been frozen into electronic devices. Scientists at VIRAC, together with other Latvian institutes, made considerable efforts over several years to determine the parameters of the antenna and gradually restore its various functions (Smite et al., 2002).

In August 2001, when the antenna was operational and scientists could finally use it for radio astronomy observations, we organized the international sound art symposium *Acoustic Space Laboratory*, together with RIXC. More than thirty sound artists, radio amateurs, activists, and researchers from different countries and continents gathered at the RT-32 radio telescope in Irbene to explore together the possibilities that the giant RT-32 antenna offers for artistic and creative activities.

First there was sound

Thinking back even further: sound and radio waves were what interested us most at the very beginning of our joint creative activity, in the magical 1990s, with the meteoric rise of the Internet. To us, sound, with its spatiality, immersive environment, and rhizomatic non-linear structure, meant all those qualities we could only imagine, as they were not available to traditional practices of visual art. Before that, we had both spent many years studying traditional academic art, which does not use experimentation, does not deal with conceptualization, and does not bother with contextualization because it is based on intuition and learned aesthetic skills. But sound literally opened our imagination. Sound, together with technological inventions – from the Internet to antennas, from radio transmitters to receivers, from microphones to loudspeakers – allows us to discover something physical and spatial that cannot be seen, but can be experienced. The space created by sound, and even more so by radio waves, is boundless, filled only by the electromagnetic wave flows that surround us, the Earth, and the universe.

In the early days of the Internet, when streaming media was still in its experimental phase, we started monthly "Internet radio compilations," which were like a journey into sound art in the teeming online world where you could find live club radio, techno recordings, sound art broadcasts, FM radio archives, online sounds from American police scanners, free radio stations, etc., all on one platform. This

sonic mile was fascinating and we published it on the website we created, building a picture of the current Internet moment and using sound as its vehicle.

As a result, in 1997 we launched the *Xchange* Internet Radio Network project, which brought together sixty Internet sound initiatives from around the world. Our weekly joint live streams were an even more special experience: first we put out an invitation to join on the Xchange mailing list, then we coordinated the creation of a joint streaming loop via a chat channel. Every Tuesday night we would start the live stream from Riga with ambient sounds, pre-recorded urban soundscapes, or live jam sessions, and then the next location – Ljubljana, Berlin, London, Banff in Canada, or Adelaide in Australia – would pick up our "signal," remix it, add their own sound, and send it back online. As the loop was closed and the sound continued to travel, we heard our input pass through the World Wide Web of Internet servers, coming back with a slight (seconds to minutes) delay, creating a multi-layered noise echo effect.[1]

We almost physically experienced this virtual, even in a sense conceptual, electronic media space, or as we called it, "acoustic cyberspace."[2] This experience was only possible because it is sound, or "acoustic space," unlike the visual world, that has properties such as immersion, affect, memory recall, surroundings, spatiality, and immersion. By using sound as a medium and these properties on the Internet, we were able to create a sense of virtuality as a space that can be similarly experienced in Virtual Reality.

Eric Kluitenberg, a Dutch theorist and our collaborator, conceptualized these experiments. Suggesting the phrase "media without an audience," he explained that it was pure pleasure, fostered by the sense of acoustic space, and by creating and sharing it in a community, with no interest in creating either content or aesthetic works. Kluitenberg has also explained that the participants in the Xchange network created a strong feeling based on their being in a network in which the relationship between origin (the transmitter) and destination (the audience) is blurred. While traditional audiences may tune in and listen, they are not taken into account in the structure of the event (Kluitenberg, 2000).

Xchange's sound experiments continued to challenge the boundaries of "acoustic space" beyond the Internet, and in 2001, artists, activists, and researchers collaborated with radio astronomers and experimented with the antenna capabilities at the Irbene Radio Telescope in the symposium *Acoustic Space Lab*. The participants divided into groups, using the antenna in three main ways: the "acoustic experiments" group recorded ambient sounds using the antenna as a giant microphone; the "satellite technology" group installed their own radio receivers to pick up signals from communication satellites; and the "radio astronomy" group worked with scientists to scan different objects in the Solar System, picking up signals from the Sun, Venus, and

1 As one of the pioneers of Internet broadcasting, our *Xchange* Internet radio community project from Latvia received the Ars Electronica Award in 1998.

2 Eric Davis, author of the cult book TechGnosis, contributed to the conceptualisation of "Acoustic Cyberspace" and was a guest speaker at the Art+Communication festival in 1998, where he applied Marshall McLuhan's theory of "acoustic space" to the new "cyberspace" of the Internet.
See https://techgnosis.com/acoustic-cyberspace/ and
https://www.marshallmcluhanspeaks.com/lecture/1970-living-in-an-acoustic-world/

Mars. The data was immediately processed by artists and musicians in a temporary media laboratory set up at the RT-32 radio telescope at the symposium venue, creating sonorous and noisy industrial soundscapes, radio broadcasts, and sound artworks.

The multimedia research conducted at the time, which looked into the antenna's secret history, and the artists' experiments at the Irbene Radio Telescope are both included in a two-part video that was exhibited in the *Decolonial Ecologies* exhibition.

Returning after twenty years

Today, back at the Irbene Radio Telescope, nothing seems to have changed: turning off the road and driving through the forest, where the silicate brick buildings abandoned by the Soviet occupation army still stand, reveals a grand view of the monumental antenna. However, much has changed: The fascinating, if slightly outdated, RT-32 antenna still serves the science of radio astronomy, even though similar antennas of this old generation are often discontinued or used for commercial purposes (e.g., to broadcast football matches to Africa, as at the Signalhorn centre in Switzerland). These first-generation (1970s) parabolic antennas, RT-32 and RT-16, have been refurbished and upgraded, two new-generation arrays have been installed, and scientists from all over the world are using these radio telescopes in various global space research projects, delving deeper and deeper into the universe.

It is the new generation of antennas, networked together, that now heralds a resurgence in the science of radio astronomy as they reach ever further into the universe. Scientist Vladislavs Bezrukovs is a researcher at VIRAC, part of Ventspils University College, where he focuses on observations using various radio telescopes, with his main research interest lying in astronomy and astrophysics. Bezrukovs explains that "with these telescopes, we see signals from all over the universe. The farthest we can see are active galactic nuclei, supermassive black holes" (Smite & Smits, 2022). By following the observations described by Bezrukovs, our imagination can also travel to the farthest reaches of the universe.

According to Bezrukovs, the size of the antenna matters: the larger the antenna, the greater the sensitivity and the weaker the signals (i.e., from farther away) that can be received. Currently, the Irbene telescopes are heavily used for networking. Several radio astronomy antennas located in different countries together form a single global VLB (Very Long Baseline) network. Bezrukovs explains that "the larger the size of the virtual telescope and the distance between the telescopes, the more sensitive the instrument is and the higher the resolution of the data and objects that we capture, so we can see more detailed objects at greater distances." The scientist adds, "at the moment, we are already using almost the entire size of the Earth as a single virtual telescope. We stop here a bit, because we have almost nowhere to go. The next step is to go into space and, of course, the question is what kind of telescope we want to build there. Just as there are LOFARs (new arrays of antennas) on Earth now, in space we could deploy such an array of elements, for example beyond the orbit of Mars, creating a virtual telescope that would already reach the size of the Solar System" (Smite & Smits, 2022).

However, since we ourselves are still here on Earth, we wonder whether radio astronomy might have something in common with the study of the Earth's climate, and whether there are such interdisciplinary astronomical studies analyzing the impact on Earth's nature, weather, environment, well-being, etc.? Bezrukovs replies with an example, explaining that "we can observe and track the winds of Space, or the streams of cosmic particles flying from the Sun towards Earth. Combining solar radiation, space weather, the ionosphere, and the influence of the ionosphere on the troposphere and the Earth's winds in an interdisciplinary study could yield interesting correlations" (Smite & Smits, 2022).

Further developing the idea of how radio astronomy could be linked to climate change research, the scientist explains what potential processes on the Sun could be studied and compared with those on Earth:

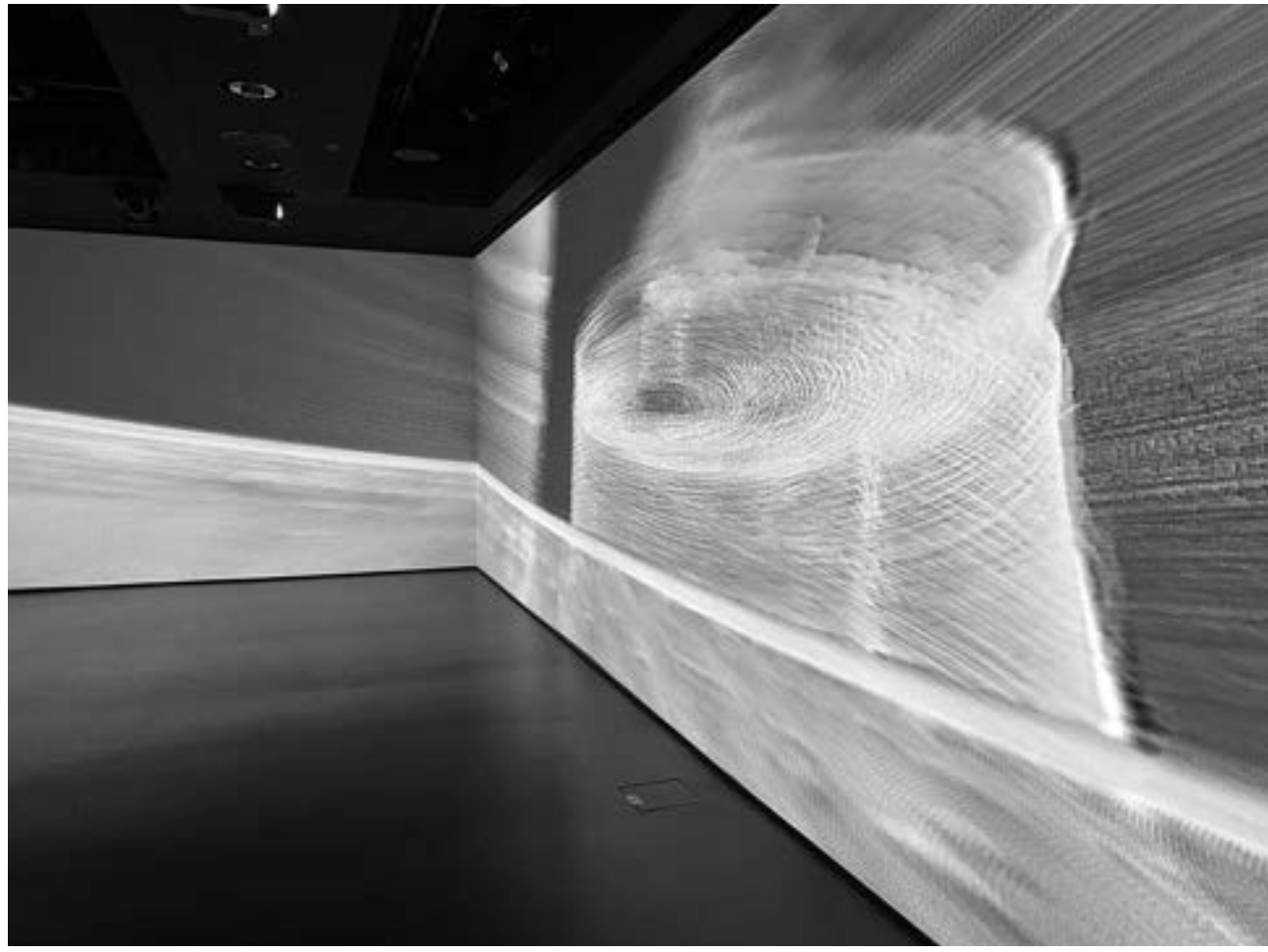
> For us, one of the directions is solar research. But in this case, we are using the RT-32 telescope to study not flares, but sunspots – magnetic fields in the Sun's corona, which are actually quite far away. The layer closer to us is the solar wind and space weather, which directly affect the Earth's ionosphere and troposphere. For example, a flare on the Sun causes a solar storm near us if the Sun happens to be turned towards Earth at the time (Smite & Smits, 2022).

Accordingly, since scientists can see the processes that occur in the Sun's corona, they can track the solar winds and the ionospheric effects on Earth. Only further out (or rather closer to us, the Earth), the effect on climate as such might be quite difficult to study, but it would be interesting material for interdisciplinary research.

Uncovering the unknown by visualizing data

Asked whether it is possible to detect something unknown with a radio telescope, Bezrukovs replies that "in principle, yes, we are always looking for something we don't really know yet. The problem is that the amount of data is enormous and you also need to understand very precisely how to process it." Scientists work with huge amounts of data – both in spectral terms, with hundreds of megahertz of data being recorded, and in temporal terms, with thousands of hours. This data is collected from multiple antennas and the observations are then made with very high sensitivity, meaning it is possible to pick up even some very low-power signals.

Yet the problem is that this huge amount of data needs to be processed. Bezrukovs mentions that this requires artificial intelligence algorithms and special neural networks to, as in this case, develop patterns (models) to try to find, for example, signals emitted by extraterrestrial life. For example, if the entire wide spectral range covered by different antennas could be "seen" simultaneously, overlaying megahertz, gigahertz, and terahertz and including them all in one "view," a kind of 3D structure would emerge. In turn, combining several instruments (e.g., low frequency telescopes, optical telescopes, X-ray telescopes, etc.) and data from multiple sources, scientists could draw more accurate conclusions about the objects they are studying.



Rasa Smite, Raitis Smits. Deep Sensing, 2023.
MEET Digital Culture Center, Milan, Italy. Courtesy of the artists.

Referring back to our early projects and the *Acoustic Space Laboratory* experiments twenty years ago, we ask Bezrukovs about space hearing; specifically, whether science has advanced there too. The scientist explains that "listening with a radio telescope is actually quite difficult, because basically we are detecting a radio signal, and it is mostly white noise." Instead, Bezrukovs notes that "since we have to analyze the signals we detect anyway, the best way is to visualize them, because when you look at the image you immediately get a better idea of the processes that are going on" (Smite & Smits, 2022).

The development of digital technologies such as LiDAR, drones, or photogrammetry, as well as the possibilities of visualizing 2D and 3D data (making invisible processes visible), has also almost revolutionized the development of visual culture and the creation of a new artistic aesthetic. In our latest work, *Deep Sensing* (2022), we aim, as with our previous work *Atmospheric Forest* (2020), to combine a

relatively fixed structure (like a forest) with processes that are dynamic and invisible but that can be observed and analyzed based on data; that is, interpreted – both visually and sonically.

In *Deep Sensing*, by combining modern "remote sensing" scanning technologies (LiDAR, drone recordings, photogrammetry) with data from observations made at the Irbene Radio Telescope, we visualize the movement, dynamics, and changing positions by capturing the near and far signals that "collide" in this antenna. The antenna in the projection represents the convergence of cosmic rays at this one particular point on Earth, where the electromagnetic wave streams from the Sun, planets, and stars in our and other galaxies, and the mysterious black holes that have broken through the densely coated orbits of Earth's satellites and radio signals "meet."

In the visualization, the gigantic antenna is no longer revealed as a massive object, but as an immaterial point cloud rotating to trace the antenna's trajectory as it follows the signals of cosmic objects. By changing the materiality of the radio telescope, by transforming it into a point cloud, the antenna itself becomes a collection of immaterial particles and waves. By becoming the opposite of its own solid iron construction, the immaterial representation of the antenna point cloud seeks to reveal its essence. The visualization of the antenna's movements in *Deep Sensing* interacts with sound, in which data from the observations made at the Ventspils Radio Telescope are sonified together with environmental recordings; further emphasizing the antenna's immateriality, it is immersed in a soundscape in which the patterns of the interpreted signals merge and interact.

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Deep Sustainability to Offer a Holistic Approach to Ecological Problems

MAIJA DEMITERE

ABSTRACT:
This paper introduces the concept of Deep Sustainability, conceptualizing how the idea of deep sustainability has evolved in various theories and philosophies. The paper is based on works of such authors as Félix Guattari, Timothy Morton, Arne Næss, James Lovelock, and Donna Haraway.
This paper offers an approach to the promotion of more sustainable human interactions with the environment through a re-evaluation of views and habits on a global and personal scale, considering how individual choices can influence the overall health of the planet, as well as concisely looking at what choices are made, and what parts of our decision making are influenced by the general state of the society today.
Holistic approaches to environmentalism are viewed through such ideas and movements as mental ecology, Dark Ecology, and Next Nature.
With this paper I am mapping the context to describe my own artistic practices, and to offer a practical solution to a holistic approach to positively influence e global ecological issues, using the ideas, texts, and lessons of philosophers, researchers, scientists, and writers that have created the knowledge base we have today.

KEYWORDS: Deep Sustainability, Deep Ecology, eco-art, ecology, eco-philosophy

I
Deep Sustainability Explained

The term Deep Sustainability in my research is partially inspired by the Deep Ecology ecosophy of Arne Næss. The key word deep is used as the opposite to shallow – suggesting something real, genuine, valuable – better than before – sustainability.

Deep Ecology is a phrase coined by the Norwegian philosopher Arne Naess in 1972, further developing ideas of the political movements around the 1960s for a more conservative approach to preserving the environment. The word ecology comes from the natural sciences, where it is used to refer to the ways in which living things interact with each other and with their environment. Deep Ecology seeks to do this by focusing on deep experiences, deep questioning and deep connections that together form an interconnected system. Each of these gives rise to and sustains the other, until the whole system is, as Naess would say, an ecosophy: an evolving but coherent philosophy of being, thinking and doing in the world that embodies ecological wisdom and harmony.

One of the main principles of Deep Ecology is the notion that everything has value in itself, regardless of its usefulness to humans. Deep Ecology proposes that humans have no right to reduce species diversity, and that we require a substantial decrease in the human population to ensure quality of life for all organisms. Deep Ecology talks about appreciation of the quality of life rather than adhering to an increasingly high standard of living, as the constant growth of the human economy has had adverse effects on all other organisms and the planet. Deep Ecology recognizes that ideological, political, economic, and technological structures create the framework of our lives and therefore they must change (Naess, 1973).

In Deep Ecology, there are no isolated objects; objects are nodes in a huge web of connections. This sense of identification includes a heightened sense of empathy and a heightened connection to non-human living beings. According to Deep Ecology, the physical and psychological well-being of each individual human being and of human beings as a whole depends on the well-being of nature. This results in a natural inclination to protect the lives of others. The realisation emerges that other beings – from microbes to multicellular life forms, to ecosystems as a whole – are involved in the process of unlocking their innate potential. Naess calls this process self-realisation. For Naess, for humans, self-realisation involves the development of a broad identification in which self-consciousness is no longer limited by the personal ego but encompasses the larger whole. Naess called this expanded self-consciousness the ecological self. As all beings strive in their own way to achieve self-realisation, we realise that they are all endowed with intrinsic value, independent of any economic or practical value that humans may ascribe to them. Human life and the life of other beings are fundamentally equal in principle. This eco-centric perspective is in contrast to the anthropocentric view, which attributes intrinsic value only to humans, valuing nature only insofar as it benefits our species (Naess, 1973).

Gaia Theory, introduced by James Lovelock and further developed by Lynn Margulis, and the principles of Deep Ecology, developed by Naess, are linked to how we understand the Earth and the life it sustains. Although the origins of Gaia Theory and Deep Ecology are philosophically and scientifically different, there are conceptual similarities and commonalities between the two.

Gaia Theory was proposed in similar time period and socio-economic climate as Deep Ecology. Gaia Theory proposes that the Earth functions as a single, self-regulating system made up of all living organisms and their inorganic surroundings. This system helps to maintain the conditions for life on the planet. According to this perspective, the biological and geochemical components of the Earth are tightly integrated to form a complex, interacting system that can metaphorically be considered as a single organism. One of the key aspects of Gaia Theory is the assumption that life has a major impact on the Earth's environment, helping to regulate the global climate and the Earth's chemical composition, thereby maintaining conditions favourable to life.

Both Gaia theory and Deep Ecology emphasise the interconnectedness and interdependence of all living and non-living components of the Earth. Both offer as a solution a holistic view of ecology, in which man is not separate from the

environment, but part of it. Both perspectives encourage a shift in human behaviour towards a more sustainable and environmentally friendly practices, recognising the impact of human activity on Earth's systems.

Gaia Theory is based on scientific research aimed at understanding the processes that regulate the Earth's ecosystems, often through modelling and empirical studies. In contrast, Deep Ecology is based on an ethical, philosophical and activist approach that questions deeper values and norms regarding the interaction between humans and the environment.

In Gaia Theory, the Earth is often personified as a kind of self-regulating organism, a metaphor that emphasises the participation of life as a whole in shaping its environment. Deep ecology, while emphasising the agency and value of individual beings, is usually more concerned with the moral, ethical and practical implications of such interdependence.

Deep Ecology is important in my research as the proposed holistic approach can be seen and recognised in most, if not all, movements, philosophies, and writings related to the field of ecology.

I use the term sustainability rather than ecology, as sustainability is conceptually closer to the urban environment and the everyday habits of people, while ecology is more concerned with philosophical reflection and resistance – ecosophy, ecofeminism, etc.

Sustainability is often a broadly used term, mostly associated with economic, environmental, and agricultural contexts. It describes the organisation of processes and use of resources to ensure long term viability and growth. The term "sustainable" is also used to describe profit – the potential for long-term profitability and investment returns in various industries.

As I do not think it is possible to change the public perception of the term sustainability, I propose to use the term deep sustainability which offers a different perspective – providing a holistic approach to processes and activities, and a re-evaluation of all human activities, including economic and personal choices.

In my artistic practice and research, when working with the public and other artists, I have come to the conclusion that the public is not interested in abandoning the idea of continuous growth in order to promote a healthier global development, e.g. biodiversity conservation or reduction of resource consumption, as it is clear that to do so would mean the re-consideration of continuous economic growth and would mean the loss of everyday comforts.

During my discussions with the public and students (art and design students – so not the average person, but more liberal and open-minded than most), and during my interviews with artists, and from my observations at exhibitions, workshops and masterclasses, it is clear that each individual recognises that consumer culture and the constant push towards endless growth is the basis for continuous fatigue, burnout, anxiety and stress in everyday life and that it affects each individual's well-being. Each individual, in a superficial and general way, criticises consumer culture and endless economic growth. In my observations, however, I have to admit that these insights do not have a long-term impact on the daily lives of those involved in my

project. On some level it also creates an eco-chamber where people just repeat the general criticism they have heard in media or have seen in their social media feeds.

II
The Holistic Approach

Many philosophers, writers, artists, and other thinkers working with topics related to ecology, are discussing the importance of a holistic approach. A holistic approach requires a holistic view of ecology, ecosystems, the interrelationships between systems, policies, beliefs, people, economies, traditions and different organisms. A holistic approach emphasises that it is not possible to solve a single problem or situation without looking at the conditions and influencing factors at different scales, particularly the so-called planetary scale. For example, it is not possible to save a single endangered species, or to solve the effects of climate and/or pollution in the territory of a single country.

A holistic systems approach is not possible at local, national or even a global level, because different levels of decision-making and executive bodies are responsible for different issues and different aspects; each phase of the problem is considered and decided separately. A holistic approach would be possible at the global policy level, but there it remains as recommendations, while national government priorities will always be a balancing act between economic growth, voter satisfaction and minimal inclusion of global recommendations to mitigate climate change on the agenda.

A Comparison of Holistic Ideas

Arne Naess's Deep Ecology is based on the principles that all living beings have value, regardless of their usefulness to humans. It promotes the idea of biocentric equality, highlighting the fact that humans are only one of many elements in a larger ecological system. Deep Ecology calls for a change in the hierarchical relationship of humans with the environment in search of harmony. Deep Ecology advocates radical changes in policy and practice to promote biodiversity and ecological integrity.

Timothy Morton's concept of Earth Magnitude looks at global warming (Morton consistently uses the term global warming) and other environmental crises, which he considers to be hyper-objects – phenomena that are so widespread in time and space that they exceed our ability to comprehend their size, significance and impact, and certainly transcend the boundaries of any particular area. Morton's ideas suggest that traditional local or immediate environmental concepts are inadequate in the face of such pervasive problems and call for a more integrated, global approach to ecological thinking.

James Lovelock's Gaia Theory uses scientific methods, data, observation, combined with philosophy, in an attempt to prove that the Earth functions as a single, self-regulating system made up of physical, chemical, biological and human components. Gaia Theory is closely linked to the philosophy of Deep Ecology and offers a view, difficult for natural scientists to accept, that the Earth is a living whole in which humans are an integral part, influencing and being influenced by the Earth system.

Bruno Latour proposes the idea of Earth politics or Earth as a political actor (terrestrial politics), as another voice on the global political stage that should be taken into account in political decision-making. This perspective shifts the focus from the global or universal to an Earth perspective, focusing on tangible, concrete interactions between humans and their immediate environment, and calls for a rethinking of politics to include non-human subjects.

Donna Haraway's making kin calls for a re-evaluation of how we form relationships, proposing that the most meaningful relationship a person has is with their family, their kin, and that people should change their attitudes by welcoming all kinds of beings into their family, forming kinship relationships with a wide spectrum of life forms. Kinship building includes the idea of choosing to form kinship bonds (oddkin) beyond traditional biological or national ties. Kinship building is Haraway's call to build meaningful, respectful and ethical connections not only between people but also between species, thereby transforming our collective life on Earth in ways that are sustainable and fair. This approach calls for a fundamental rethinking of our role and responsibility in the biosphere, in tune with broader environmental and philosophical movements that challenge an anthropocentric worldview.

On the other hand, Sacha Kagan criticises the oversimplification of taking a holistic approach as it ignores details. He also points out that the results of a holistic approach cannot be evaluated and therefore cannot be proven to have had the desired effect (Kagan, 2011).

In my research I avoid proposing global, radical change, but rather focus on individual responsibility that could influence the work of local organisations, businesses and administrations. Individual sustainability, in my view, can start with the ability of each individual person to identify their daily habits that affect their individual well-being and to replace some of these habits with healthier choices, for example, gardening and cooking. The habits that affect each of us today are universally associated with stress and burnout; and each of these habits can also shape positive change for the ecology.

Bruno Latour, in Back to Earth, satirically but aptly points out that no politician would be elected if their slogan was anti-growth. Latour explains that we do not have the vocabulary to talk about a situation other than endless economic growth. And in our communication and language, we see everything that is not promoting growth as promoting regression (Latour, 2018).

As part of my research, I have been looking for ways to shape the discussion in the wider community by creating works in public spaces. I always pay very close attention to make sure not to make my works moralistic, not to point out "bad habits", not to lecture people on how to live better, but to focus on what changes in everyday habits might be beneficial to each individual person, and to the planet as a whole. This approach parallels Morton's idea of "Earth Scale". Morton proposes a shift in mindset – each small everyday activity, seen on the planetary scale, becomes significant (Morton, 2012).

III
Mental Ecology

Mental ecology is a term in psychology and philosophy that describes human thought processes and how they relate to the environment and the world around us. It should be emphasized that the term has no direct connection with ecology, the environment, nature, the climate crisis, etc.

Eco-psychology or ecopsychology is a field of psychology that seeks to combine ecology and psychology. Eco-psychology includes, for example, forest therapy, nature therapy, ecotherapy, shamanism, spirituality, outdoor activities, and the cultivation and restoration of the relationship between man and nature. I have included and described this concept here, but it is only superficially included in my research; while eco-psychology seeks to reconnect people with nature, its focus is on people and, apart from certain methods (eco-design, ecovillages), it seeks only to improve human well-being (mostly with the overarching aim of restoring the individual's capacity to be productive).

The term mental ecology cannot be attributed to a single inventor or to a specific point of origin, as it combines concepts from a variety of fields, including psychology, ecology and systems thinking. However, several thinkers have made significant contributions to the development and popularisation of the concept, each adding their own unique perspective on what mental ecology might entail:

- Gregory Bateson is often associated with ideas closely related to mental ecology through his work on the interrelationship between the mind and the environment, which is comprehensively presented in his book "Steps Towards an Ecology of Mind" (1972). Beatson's approach emphasises how mental processes reflect wider ecological systems and vice versa, positing a deep interconnectedness between psychological processes and environmental contexts.
- Felix Guattari, in his "Three Ecologies" (1989), expands the concept of ecology to explicitly include psychological or mental aspects, introducing the interrelated concepts of social, environmental and mental ecology. His framework provided a political and philosophical approach to understanding and addressing the interdependent crises of the environment, society and the human psyche.
- Urie Bronfenbrenner, although not directly using the term mental ecology, developed a theory of ecological systems in psychology, which is also in line with the ideas of mental ecology. Bronfenbrenner's theory proposes that human development is influenced by different types of environmental systems, which include both microsystems and macrosystems, emphasising the complex interactions between the individual and their changing environment.

Gregory Bateson, a researcher in anthropology, cybernetics, linguistics and social sciences, uses the term mental ecology to describe the ways in which the human mind, especially habits, are influenced by its environment. His concept of mental ecology is an integral part of his broader philosophical inquiry into the patterns that bind living beings together in a shared environment.

In his book "Steps Towards an Ecology of Mind" (1972), as well as in various lectures and papers, Bateson describes the idea of mental ecology as meaning that the mind is not limited to the individual, but involves relationships and interactions with wider systems, including the environment and social, cultural systems and traditions.

This concept is linked to ecological thinking, emphasising the interconnectedness and interdependence of all life forms and their environment. Bateson was particularly interested in models that connect different levels of biological, psychological and social systems, emphasising feedback loops and the importance of recognising destructive developments that can lead to systemic crises. Bateson's work raises questions about taking responsibility for the environment, suggesting that solving ecological problems requires changes not only in physical practices, but also in the ways we think about our relationship with the world around us. Beitson believes that improving our understanding of the interconnectedness of all systems can lead to more sustainable and viable ways of living more ecologically.

Bateson does not use the term mental ecology, but his work explores and expands on the ecological aspects of mental processes and the wider implications of these processes for understanding human behaviour and environmental impacts. His contributions in this area have influenced many in ecological research, systems theory and other fields, forming the basis from which the idea of mental ecology could be developed.

Bateson's 's mental ecology is based on the idea that the mind is not confined to the individual but is distributed in systems that encompass interactions between individuals, societies and their environment. Here are some key points:

- Mind and nature are inevitably linked through a series of interactive systems that have an ecology of organisation charts.
- Understanding the interconnections and interdependencies between ecosystems, including human communities and the biological environment, is essential. Bateson believed that failure to understand these interconnections leads to a range of contemporary crises, from environmental degradation to social conflict.
- He argued that understanding patterns and how they form meta-patterns can help people to make more informed and ethical decisions and to develop a deeper understanding of complex systems.
- By identifying recurring patterns across disciplines, for example tree growth patterns, neural network structure and social community organisations, Bateson believed that we can gain insights into the nature of learning and adaptation in different systems. This approach is fundamentally ecological, in that it argues that everything is interconnected.
- Bateson's concept of meta-models encourages a holistic view of the world, where understanding meta-models helps us to manage and interact between the micro (individual models) and macro (model-models).
- Bateson's mental ecology encourages a holistic view of human activity and its impact on the environment, encouraging awareness not only of direct material impacts but also of more nuanced system dynamics.

Félix Guattari uses the term mental ecology to describe the ability of an individual to use his or her mind consciously to separate his or her thoughts and values and environmental influences from those around him or her, from mass media, advertising and political influences.

In Guattari's book "Three Ecologies" (1989), a chapter distinguishes between three different ecologies. Environmental Ecology describes man's relationship with the natural world and the physical environment. This includes ecological balance, (environmental) sustainability and the impact of human activity on the planet. Guattari emphasises the importance of preserving and respecting the environment to ensure the long-term well-being of people and the planet. The second ecology is Social Ecology that describes the relationships and structures in human society. SocialEcology includes areas such as politics, economics, culture and social justice. Guattari writes that we need to consider how societal structures and power dynamics affect our interactions with each other and with the environment. By studying and transforming unjust and exploitative social systems, it is possible to achieve a more just and sustainable society.

The third ecology is Mental Ecology that refers to our inner, spiritual world and the impact of media, information and culture on our thoughts and emotions. Guattari focuses on the manipulative influence of mass media on the individual's perception of reality, and on their ability to deal with environmental and social problems. Guattari describes the importance of critical thinking and creativity, and the need for people to change their relationship with the media in order to promote positive change. Guattari introduces the concept of ecosophy, or ecological philosophy, which interweaves ethical, aesthetic and practical dimensions to create a holistic approach to sustainable living.

Guattari's Mental Ecology is a call to action, encouraging us to rethink our approach to ecological issues, incorporating psychoanalytical and social analytical perspectives. Guattari argues that environmental problems cannot be solved by technological solutions alone; they require a profound transformation of mentality and values. This includes challenging capitalist values, criticising the capitalist system for its role in ecological degradation and urging a shift towards a more sustainable, community-oriented economic model.

Guattari's Mental Ecology offers a holistic perspective that not only addresses environmental problems, but also the socio-political and personal changes needed to sustainably manage the planet's resources. It encourages a profound rethinking of the relationship between self, society and the environment, suggesting that sustainable solutions require changes at all levels of human experience.

Bateson's work emerged in the context of anthropology, linguistics and cybernetics, which influence his approach, with a focus more on communication patterns and the epistemology of systems understanding. While Guattari, who came from a background in psychoanalysis and philosophy, focused more on political theory, subjectivity and critiques of capitalism.

The two authors also have different contexts for their work. While Bateson worked mainly in the mid-20th century, Guattari was active in the late 20th

century, strongly influenced by French post-structuralism and the political turmoil in Europe in the 1960s and 1970s.

Guattari is explicitly political, engaging directly with activist movements and political struggles, especially in France, while Bateson, while mentioning practical implications, often works in a more academic, theoretical way.

IV
Next Nature

Next Nature is a concept and a movement that explores the relationship between people, nature and technology. The idea is promoted by Dutch design and technology researcher Koert van Mensvoort.

According to Next Nature (Van Mensvoort, 2006) human nature is deliberately or coincidentally created – whether it be cities, logistics systems, workplaces, traffic jams or supermarket queues. Humans are neither able nor willing to live in the true green nature, so it is necessary to develop a different view of ecology, because neither climate change, nor the extinction of animal and plant species, nor water and environmental pollution, nor the threat to the very human ability to survive will convince the modern cultural (fast) person that these processes are killing the planet and everything in it. Van Mensvoort proposes the need to revise the term nature to include the perspectives of the modern human, and that the experience of nature today is merely recreational.

Real nature is a human interpretation and exists only in the human relationship to it. Next Nature proposes that how we distinguish between the natural and the cultural is important as it allows us to see the human perspective and to better understand what our place in nature is. In advertisements, cars always drive through beautiful, unspoilt landscapes. It is strange that in this fictional countryside there are no billboards or advertisements to be seen, while in our living space logos and brands are everywhere; we can probably distinguish them better than birds or tree species (Van Mensvoort, 2006).

For the "real" nature, the individual is irrelevant; human survival depends entirely on the development of human culture and technology. For the modern person, wild nature, nature beyond human control and culture, is the choice of which road to drive on, which time of day to drive somewhere to best avoid traffic jams, which petrol station to use to get the best price, which customer card to carry in their wallet (frequently used). For this modern human, nature is not forests and meadows, but rather the kitchen garden or a park – spending time in nature is to take a break for maybe a day or two; it is not a fight to survive in the wild.

V
Dark Ecology

Dark Ecology begins in darkness as depression. It cuts through the darkness as an ontological mystery. And it ends as dark sweetness (dark chocolate). Ecological consciousness is a loop because human actions have the form of a loop – ecological and biological systems are loops (Morton, 2018).

Climate change is a symptom of industrialisation, and industrialisation is a symptom of massively increasing agriculture. We can say that this increasing agriculture is caused by capitalism, but it should also be seen as a loop: the acceleration of agriculture and subsequent industrialisation are symptoms of capitalism.

Morton argues that the current understanding of the distinction between culture and nature is in fact a distinction between agriculture and nature, created by agricultural enterprises and systems whose mission is to dominate nature by any means necessary (Morton, 2018).

The meaning of nature, according to Morton, is dangerously overestimated, because nature cannot be defined: it is something that happens to human-constructed space; nature tries to reinvent the human-constructed system as a planetary system.

Compared to Van Mensvoort's idea that nature for the modern human is not green, Morton believes that all nature is man-made: "Anthropocene did not destroy nature. Anthropocene is nature in its toxic nightmare form" (Morton, 2018).

Ideologically, separating nature from humans – natural nature from culture – leads to a clearer understanding of the habits of society and human communities, what is changeable and what is learned, what is local and what is what seems to be universally accepted today (the new normal).

VII
Deep Sustainability and Art Practices

A holistic approach to examining the relationship between humans and ecology underlies the work of all the philosophers and thinkers described in this paper, each in their own way, each with their own level of intensity, looking at the interdependence of the planet and all its inhabitants, not just humans but all beings and systems, upon each other.

Until now I have described all the different aspects we need to consider when talking about Deep Sustainability – the holistic approach, the focus on the individual's perspective and motivation, the confusing omnipresent and undefinable notion of nature and our role in it. With this I have tried to describe how I see my artistic practices withing the field of Deep Sustainability, and to better understand the meaning of eco-art today.

First, Deep Sustainability requires a holistic approach to access impact. In my art practice and in evaluating artworks in the context of art history, to me it is important to evaluate the practical application of an artwork in a broad sense. For

← *Figure 1*. Aquaponics system growing plant at Liepaja ZIIC Nature House

me, an ecological artwork must be useful in some way – not literally as utilitarian interior design, but in a broad philosophical sense – an ecological artwork must address a problem by offering a prototype, challenging beliefs, habits and traditions, or drawing attention to an issue that is relevant to the artist, a social group, society as a whole or the planet. It is this desire, this obsession to create works of value, that led me to gardening and the use of plants in my art practice.

When working in the field of Deep Sustainability, I'm challenging the individuals' views and habits through DIY. The ideal outcome from my practices would be a better understanding of the impact of an individual's personal choices on the planet.

I see DIY as an everyday creativity, as an approach to life that is available to everyone. I offer gardening and food as my example of a holistic approach to solving ecological problems. Realistically, the world will not go vegan in the foreseeable future, nor will we abandon our everyday consumerism practices of fast living, fast fashion, supermarket and convenience foods to opt for local, fair, ecological products. But through creativity and DIY we could keep our hands busy in the garden or in the kitchen, so we would have less time to shop online for new clothes.

I see gardening and cooking as the perfect creative outlet to be introduced into anyone's daily lives to create a positive change on a planetary scale.

Acknowledgement

Maija Demitere is a research assistant at RTU Liepaja Academy. This paper has been developed as part of her doctoral research at RTU Liepaja.

This doctoral research process was supported by the Liepaja University project "Development of Liepaja University Academic Staff in Strategic Specialization Areas – Natural Sciences, Mathematics and Information Technologies, Arts, Social Sciences, Business and Law" (ESF project no. 8.2.2.0/18/A/021).

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Splintered Realities

RIXC Art Science Festival 2022
August 25 – October 15, 2022
Kim? Contemporary Art Center, Riga, Latvia
festival2022.rixc.org

Artists:
Debbie Ding / DBBD.SG (SG),
Jacob Kirkegaard (DK),
Mario Klingemann (DE),
Hayoun Kwon (KR),
Memo Akten (TR/US),
Laurent Mignonneau &
Christa Sommerer (AT),
Alvis Misjuns (LV),
Jurģis Peters (LV),
Sahej Rahal (IN),
Allison Stewart (US),
Sabīne Šnē (LV),
Theo Triantafyllidis (GR/US)

Curators:
Raitis Smits, Rasa Smite (LV/RIXC)

The Splintered Realities festival was an attempt to engage with the "splinters" of our contemporary condition, further affected by an ongoing war in Ukraine, post-pandemic realities, media ubiquity, and social division. It featured artworks by international artists who explored the transformative potential of art and extended reality, grounding their 'realism' in the perspective of 'naturecultures' – in the spirit of Guattari's ecosophy, Latour's 'terrestrial coexistence,' and Haraway's 'arts of living on a damaged planet.'

The exhibition took place as part of the festival in 2022, Riga, Latvia, organised by the RIXC Center for New Media Culture. It showcased artworks by 13 international and Latvian artists who viewed current world processes from a techno-ecological perspective, studying the acoustics of spaces in Chornobyl's exclusion zone, virtually immersing themselves in the depths of soldiers' memories, and visualising our readiness for various cataclysms – from earthquakes and hurricanes to war laws and even the zombie apocalypse. Furthermore, artists employed and trained artificial intelligence to delete images of people captured in photos and, using artificial neural networks, created entirely new and unusual aesthetics of portraits based on restored old photos. Visitors also had the opportunity to interact with "extraplanetary systems" created by artificial intelligence, generating temporary and constantly changing selfies from virtual flies.

Debbie Ding / DBBD.SG. Void, 2021. Splintered Realities exhibition, Kim? Contemporary Art Centre, Riga, Latvia, 2022. Photo: Kristīne Madjare

Debbie Ding / DBBD.SG
Void
2021

Void is a poetic immersive VR experience where you find yourself in a boat in the sea at night, exploring a mysterious lost floating city and searching for the baby faces floating in the waters. The ruins reveal themselves to be composed of decimated 3D scans of HDB void decks (an open space found on the first floor of most Housing Development Board flats in Singapore), like the eroded pilings of an ancient underwater city. Void is a novel exploration using the VR game medium to represent a personal experience of working motherhood.

Jacob Kirkegaard. AION, 2006. Splintered Realities exhibition, Kim? Contemporary Art Centre, Riga, Latvia, 2022. Photo: Kristīne Madjare

Jacob Kirkegaard
AION
2006

AION (Ancient Greek αιων = “infinity”, “eternity”, a time span beyond human understanding) is a portrait of four abandoned spaces inside the so-called “Zone of Alienation” in Chernobyl, Ukraine; a dripping swimming pool, a ruined concert hall, a mould-infested gymnasium and an old village church. In each space, the artist put up a microphone and a speaker, started the recording and left. After ten minutes, he returned, stopped the recording and played it back in the same space. With each new layer, the subtle sounds of the room were enlarged and deepened until they finally turned into one humming sound with many overtones – the voice of the room itself.

Mario Klingemann. Neural Decay_3174, Neural Decay_6117, Neural Decay_756, Neural Decay_4257, 2017. Splintered Realities exhibition, Kim? Contemporary Art Centre, Riga, Latvia, 2022. Photo: Kristīne Madjare

Mario Klingemann
Neural Decay_3174, Neural Decay_6117, Neural Decay_756, Neural Decay_4257
2017

Neural Decay is a series of unique prints generated by custom-trained generative adversarial networks (GANs). Reminiscent of miniatures or early studio photographs, these machine-generated portraits have an otherworldly quality. Large round eyes stare out from mask-like faces, while the image textures and metal surfaces allude to the passing of time. They appear to be headshots from a bygone age, yet the characters portrayed are perhaps not quite human. Neural Decay is an example of what Klingemann refers to as "Neuralism," art created using artificial neural networks.

Hayoun Kwon. 489 Years, 2016. Splintered Realities exhibition, Kim? Contemporary Art Centre, Riga, Latvia, 2022. Photo: Kristīne Madjare

Hayoun Kwon
489 Years
2016

489 Years is transcribed according to the testimony of a former soldier in South Korea, Kim. It gives us access to the Korean Demilitarized Zone (DMZ) between North and South Korea and makes us immerse in the heart of the personal memory of a soldier. He tells us about his experience in a research mission and the amazing discovery he made in the field full of mines (mines laid by South Korea with no record of where they were placed). He speaks of a place where people are forbidden, a place where nature has totally reclaimed its hold.

Memo Akten. All Watched Over By Machines Of Loving Grace / Deeper Meditations #1-#6, 2021.
Splintered Realities exhibition, Kim? Contemporary Art Centre, Riga, Latvia, 2022. Photo: Kristīne Madjare

Memo Akten
All Watched Over By Machines Of Loving Grace / Deeper Meditations #1-#6
2021

Taking its title from the late American poet Richard Brautigan's 1967 poem, *All watched over by machines of loving grace* is a short experimental film about our obsession, fetishization, and deification of technology. In our ongoing race to optimize and computerize, to 'move fast break things' in devotion to our holy missions of 'growth' and 'progress', we often fail to see – let alone foresee – the undesirable consequences of our misjudged narrow intelligence. As the boundaries between 'nature' and 'artificial', between 'human' and 'technology' are imaginary and non-existent, our efforts to tame nature and subdue her to our will, are in fact an endeavor to tame and imprison ourselves.

Laurent Mignonneau and Christa Sommerer. Portrait on the Fly, 2015. Splintered Realities exhibition,
Kim? Contemporary Art Centre, Riga, Latvia, 2022. Photo: Kristīne Madjare

Laurent Mignonneau and Christa Sommerer
Portrait on the Fly
2015

The interactive installation consists of a monitor that shows a swarm of a few thousand flies. When a person positions him or herself in front of it, the insects try to detect his or her facial features. They then begin to arrange themselves so as to reproduce them, thereby creating a recognizable likeness of the individual. Posing in front of the monitor attracts the flies. Within seconds they invade the face, but even the slightest movement of the head or of parts of the face drives them off. The portraits are thus in constant flux, they construct and deconstruct. *Portrait on the Fly* is a commentary on our love for taking pictures of ourselves (Selfie-Culture), it has to do with change, transience and impermanence.

Alvis Misjuns. Peace on Web, 2022. Splintered Realities exhibition, Kim? Contemporary Art Centre, Riga, Latvia, 2022. Photo: Juris Rozenbergs:

Alvis Misjuns
Peace on Web
2022

Peace on Web offers a place where you can escape from influencers and ads. *Peace on Web* allows you to slow down and lets you evaluate what is most important today. Friends and new acquaintances can join you and hang out. So as not to disturb the peace and the serene passing of time, each friend is provided with a pre-prepared avatar that harmoniously fits in the environment, for example, a twig, rock leaf, and other objects that seamlessly blend in with the surroundings. To preserve peace and order, verbal and text communication is unavailable in the virtual space. *The Peace on Web* artwork is created in reaction to the attempts by such companies as Meta, Microsoft, Nvidia, and Google to create a metaverse that combines various communications platforms, industries and payment systems.

Jurģis Peters. Alternative Realities, 2022. Splintered Realities exhibition, Kim? Contemporary Art Centre, Riga, Latvia, 2022. Photo: Juris Rozenbergs

Jurģis Peters
Alternative Realities
2022

Seeing the Russian military invasion in Ukraine, it is clear that the inaccessibility of objective information and outright misinformation has caused a large part of Russian citizens and their supporters elsewhere in the world to live in an alternative reality, where, referring to Orvel, 2+2 = 5, and Russian army troops are liberators. It is similar to the situation of the Russian army soldiers themselves – when going to war (at least during its beginning stages) they either did not realize the true geopolitical situation or believed in an alternative reality, created by the misinformation narrative. *Alternative Realities* is an installation that consists of found images of fallen Russian army soldiers. Referring to the usage of various algorithms in disseminating misinformation, the artist has used machine learning tools to delete the soldiers from these images.

Sahej Rahal. finalforest.exe, 2021. Splintered Realities exhibition, Kim? Contemporary Art Centre, Riga, Latvia, 2022. Photo: Kristīne Madjare

Sahej Rahal
finalforest.exe
2021

The artwork is a possible dialogue between planetary and 'extraplanetary' systems. We find ourselves witnessing an AI simulation that follows a creature wandering a virtual biome. This creature is driven by a collection of multiple AI scripts that are attached to the virtual bones within its calcified petroleum body. Each of these scripts is capable of 'listening' to the physical world outside the program, by picking up audio cues through the computer's microphone. This audio feedback interrupts the movement of the wandering creature, and when inputs above a certain intensity are registered, it emits a burst of molten black petro-forms. In, the body of this petro-being, the hierarchy of mind, limb, and ear has collapsed, making them indistinguishable from each other. They act as a consortium of ungoverned organs, that collectively bring this creature to life, between the porous boundaries of mythic and machinic worlds.

Sabīne Šnē. Grey Gold, Black Lakes, White Latex, 2022. Splintered Realities exhibition, Kim? Contemporary Art Centre, Riga, Latvia, 2022. Photo: Kristīne Madjare

Sabīne Šnē
Grey Gold, Black Lakes, White Latex
2022

There are seventeen rare-earth elements in the periodic table. They are metallic minerals that can be found in the Earth's crust and are widely used in the manufacturing of various technologies, for example, computers, phones, hybrid cars, internet cables, etc. In his book *A Geology of Media*, new media theorist Jussi Parikka suggests to think of technologies as extensions of Earth. Everyone who uses technology also uses minerals – they provide communication, cloud accounts, movement, and progress towards more nature-friendly industries (and they are the reason why this artwork exists). The extraction of rare-earth minerals for manufacturing the technologies is an infrastructure which transforms the Earth, shapes the economy, changes lifestyles, and exploits resources.

Allison Stewart
Bug Out Bag
2014–2016

Earthquakes. Superstorms. War. Martial Law. The Rapture. The Zombie Apocalypse. The *Bug Out Bag* contains the essentials needed to sustain life for 72 hours, or to possibly begin a new civilization. Each bag becomes a portrait of its owner, showing us their fears in the face of environmental and political change. While traveling America, the artist has met veterans, self-subscribed Preppers who live "off grid", a public school teacher, and a man who will sell your cat a *Bug out Bag* for $90. Most are community minded but some are fiercely independent. At its most extreme, the new self-reliant American no longer experiences transcendence in nature, but instead, escapes to nature in an effort to hoard and protect their property. Living off the grid has become a capitalist enterprise, banking on the fears and desires for stability.

MM's Bug Out Bag, 2015
MM is a veteran and his bag includes several weapons, hand tooled knives given to him by a fellow soldier in Afghanistan, three pairs of socks, waterproof paper and pens, an extra phone, instant coffee packets, marijuana, a beer, and a cigar.

Sam's Bug Out Bag, 2014
Sam is a dad in California and his bag includes a variety of foods, walkie talkies and radio for communication, a deck of cards, and wine, which Sam heard counteracts the effects of radiation poisoning.

Jeff's Go Bag, 2014
Jeff's Go Bag includes a bulletproof vest, a gas mask, and a bulletproof helmet. It was designed to get him to his car, where he had guns, knives, an axe, camping gear, water, and food. He also had property off grid where he would bug out to when SHTF (shit hits the fan).

Mike's Bug Out Bag, 2015
Mike lives in Texas. His bag contains only Tequila & Phenobarbital. His plan is to find a shady tree and escape the Apocalypse entirely.

PBJ's Bug Out Bag, 2016
PBJ lives in Georgia and their bag includes signal flares, maps, a compass, a first aid kit, tampons, fishing gear, a large mouse-trap, tools, GU energy gels, and several types of cord.

Daisy's Bug Out Bag, 2016
Daisy is a trained Disaster Dog. She is trained to help her family in emergency situations, including search and rescue. She carries supplies for herself as well as for her family. The bag includes the book Family Disaster Dogs, written by her trainer Amber Higgens.

Theo Triantafyllidis
Radicalization Pipeline
2021
Sound by Diego Navarro

Two seemingly endless hordes clash into a violent free-for-all, swinging large melee weapons and shouting with distorted voices. A wide range of characters – from citizen militias to fantastical creatures – enter the screen only to kill each other, wave after wave, sinking their virtual bodies slowly into a muddy landscape. The mood occasionally lightens up by the medieval covers of familiar pop songs that complete the soundscape conceived by the composer and sound designer Diego Navarro. Looking at phenomena such as the rise of QAnon, the artist suggests connections between gamification, fantasy, and political radicalization.

← Theo Triantafyllidis. Radicalization Pipeline, 2021. Splintered Realities exhibition, Kim? Contemporary Art Centre, Riga, Latvia, 2022. Photo: Kristīne Madjare

Crypto, Art and Climate

RIXC Art Science Festival 2023
September 20–November 11, 2023
National Library of Latvia, Riga
festival2023.rixc.org

Artists:
Memo Akten (TR/US),
Nico Angiuli (IT) &
Katerina El Raheb (GR),
Emanuel Gollob (AT),
Nicolas Gourault (FR),
Carolin Liebl &
Nikolas Schmid-Pfähler (DE),
Rosa Menkman (NL),
Joana Moll (ES),
Paula Nishijima (BR/NL),
Jurģis Peters (LV),
Anna Ridler (UK/US),
Līga Vēliņa (LV),
Ieva Vīksne (LV),
Zane Zelmene (LV)

Curators:
Raitis Smits, Rasa Smite (LV/RIXC)

The RIXC Art Science Festival edition in 2023, entitled The Crypto, Art and Climate, took place in Riga, Latvia, to discuss how the landscape of art and culture was changing, influenced on one hand by the development of artificial intelligence, blockchains, and immersive technologies, and on the other by pressing contemporary challenges – environmental issues and climate change. At that time, not only the RIXC Festival and the digital arts but society as a whole focused on a range of new technologies – blockchain networks, Web 3.0, NFTs, artificial intelligence and machine learning, virtual and augmented reality, and the vision of the metaverse – that were reshaping the landscape of art and culture while raising new environmental concerns.

The exhibition addressed the following questions: How did crypto art relate to climate change? Could artificial intelligence offer solutions to environmental problems that human intelligence had so far failed to resolve? Furthermore, would the persistent ignorance of our natural environment ultimately compel us to transition to a metaverse – a virtual world providing an idealised digital simulation of our real world?

Memo Akten. Distributed Consciousness, 2021. Crypto, Art and Climate exhibition, National Library of Latvia, Riga, 2023. Photo: Kristīne Madjare

Memo Akten
Distributed Consciousness
2021

Distributed Consciousness is a multi-faceted work that spans themes of biological and artificial intelligence, distributed computation, distributed cognition, cryptography, evolution, phenomenology, ecological awareness, climate change, activism, and cephalopods. It began as an NFT collection featuring 256 unique cephalopod-like "Tentacular Critters" created using custom artificial intelligence software, each concealing cryptographically encoded text which was generated with AI. When revealed, these images together form a manifesto. The manifesto is a human-machine co-creation meditation on consciousness, free will, life, death, art, technology, ritual, ecology, economy, and sustainability. The work exists as two NFT collections (Tentacular Critters, and Verses) which has been adapted to a Virtual Reality installation; and numerous immersive, physical, multi-screen video and sound installations with large LED screens, LED ribbons, mirrors, and sound.

Photo: Juris Rozenbergs

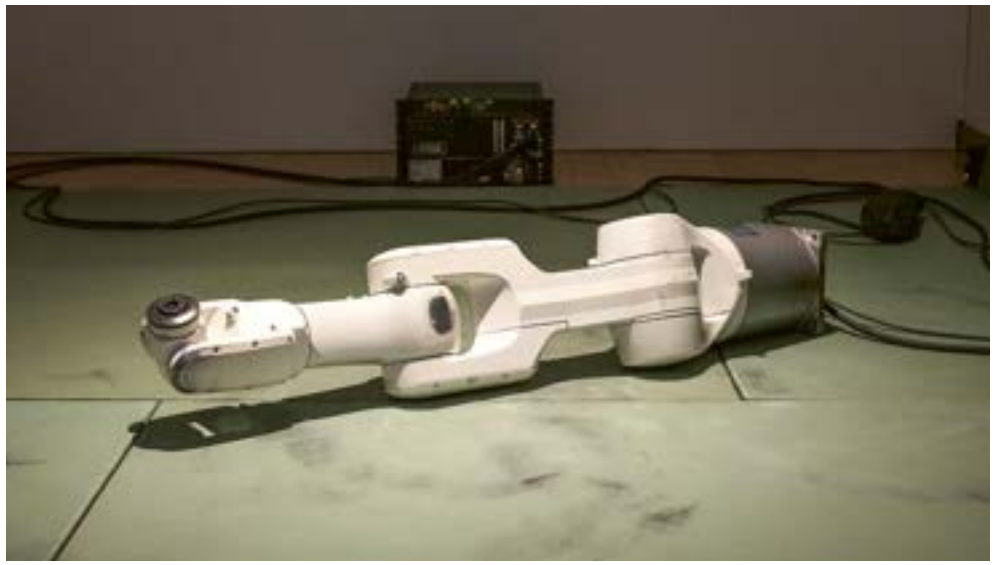
Nico Angiuli, Katerina El Raheb. Amazon Dance – The Picking Algorithm, 2021. Crypto, Art and Climate exhibition, National Library of Latvia, Riga, 2023. Photo: Kristīne Madjare

Nico Angiuli and Katerina El Raheb
Amazon Dance – The Picking Algorithm
2021

Amazon Dance is a video performance that is a part of a research that aims to study algorithms used in factories such as Amazon, for finding the minimum time and the most efficient way to arrange and deliver items in large warehouses, which is a costly and time consuming process. Although many of these tasks are performed by humans, their routes are perfectly predetermined based on algorithms and their movements are specific to achieve the goals of each shift: picking the maximum number of products.

The performance questions whether human labor or robotics is more cost-effective in corporate contexts and how this relates to the human body in motion. Algorithms are transformed into a choreographic "score," a structured plan guiding dance movements, effectively expressing abstract computing concepts through bodily motion. The performance features "human machines" enacting warehouse stages and cyclically depicts these actions, lasting an hour.

Photo: Juris Rozenbergs



Emanuel Gollob. *dis*arming, 2023. Crypto, Art and Climate exhibition, National Library of Latvia, Riga, 2023. Photo: Kristīne Madjare

Emanuel Gollob
***dis*arming**
2023

*dis*arming is a performative exploration of the relationship between detached robot arms, artificial environments, and human observers, as well as a search for potential future roles of robotics and AI in our society. Learning and unlearning of locomotions in post anthropocentric environments and times. The work playfully explores the ambiguity of disarming as a process of physical detachment and emotional attachment.
Locomotion can be seen as a primal (post-birth) instinct and ultimate act of independence. A robotic limb, somehow detached from a human-constructed technological body, tries to find concepts for advancing movements even though it initially wasn't made for locomotion – vulnerable yet determined. Parallel to a familiar dystopian plot of technological autonomy and the feelings going with it, witnessing these first clumsy tries may awaken compassion or even a certain emotional bond. *dis*arming paints a picture of a relational world with and between independence and still connectedness.

Nicolas Gourault. Unknown Label, 2023. Crypto, Art and Climate exhibition, National Library of Latvia, Riga, 2023. Photo: Juris Rozenbergs

Nicolas Gourault
Unknown Label
2023

Unknown Label is a video installation exploring the daily experience of online micro-workers from the Global South who annotate images for self-driving cars. It investigates the power asymmetries and neo-colonialist exploitation involved in the manual labor necessary to train AI systems. The artwork reveals the hidden crowd that works with these operational images and helps shape how machines see the world. A digital collage, layering together fragments of annotated images and a virtual map of the world as seen by self-driving cars, creates a space where the viewers can share the vision of otherwise invisible data workers. The video installation thus raises the question of how to reappropriate these operational images which depict and categorize the world we live in without our prior knowledge or agreement.

Carolin Liebl, Nikolas Schmid-Pfähler. Fading Substance, 2023. Crypto, Art and Climate exhibition, National Library of Latvia, Riga, 2023. Photo: Kristīne Madjare

Carolin Liebl and Nikolas Schmid-Pfähler
Fading Substance
2023

Fleshy-looking anamorphic objects reminiscent of organs or photophobic deep-sea creatures are floating in an artificial environment. We watch them as they slowly age, become porous, and finally dwindle away – observing these bodies decay is a remarkable visual experience. The footage was shot in a laboratory setup in which a small sculpture was immersed in a cylindrical container filled with caustic soda. The object is made of polylactic acid (PLA for short), a biodegradable plastic derived from plant-based raw materials. The decomposition, superficial at first, gradually distorts the sculpture until it finally breaks down into lactic acid and then into carbon dioxide and water. The disintegration process, which extended over several months, is documented minute by minute; due to the caustic bath, it occurred much faster than in nature. As a long-term research project, the *Fading Substance* installation addresses our approach to biodegradable plastics and examines the temporal and chemical processes involved in the decomposition of PLA plastic in a visually palpable way.

Photo: Juris Rozenbergs

Rosa Menkman. Refractions in Light and Time, 2022–2023. Crypto, Art and Climate exhibition, National Library of Latvia, Riga, 2023. Photo: Kristīne Madjare

Rosa Menkman
Soundtrack by Debit
Refractions in Light and Time
2022–2023

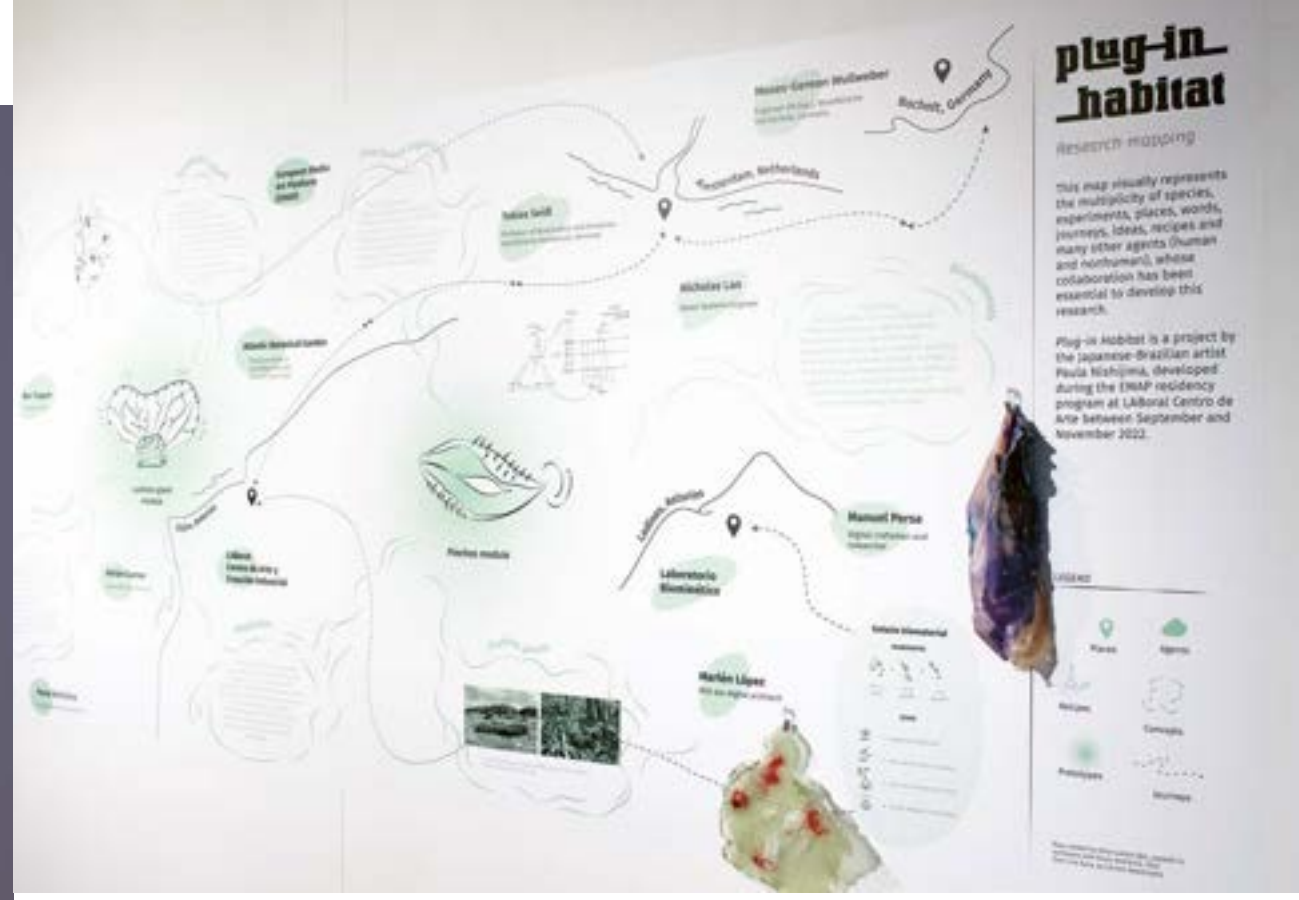
In the summer of 2022, Menkman was traveling the Mediterranean to learn about three Cyclopes lineages. Cyclopes are famous mythical creatures, known for their gargantuan physique and single round eye. However, beyond their most famous features, and maybe a name born by a single Cyclops, little about them is known. In fact, Cyclopes seem shrouded in mystery, sparking general questions such as: Where do contemporary Cyclopes live, and how do Cyclopes perceive the world?

In this chapter of an ongoing work in progress, the Angel of History, tells about her search for a certain Cyclops. The Angel of History is known to look backward. But after a century of its conception (in a painting by Paul Klee) the Angel is tired of seeing the past and looks for new ways to sense, or possibly even see the future. When she learns about the cyclops Odin, who traded an eye to see his future demise, she sets out on a journey to find and learn from the cyclops' vision.

Joana Moll. The Hidden Life of an Amazon User, 2019. Crypto, Art and Climate exhibition, National Library of Latvia, Riga, 2023. Photo: Kristīne Madjare

Joana Moll
The Hidden Life of an Amazon User
2019

The Hidden Life of an Amazon User aims to shed light on Amazon's often unacknowledged but aggressive exploitation of their users, which is embedded at the core of the so-called internet companies' business strategies. Such strategies rely on apparently neutral, personalized user experiences afforded by attractive interfaces. These interfaces obfuscate sophisticated business models embedded in endless pages of indecipherable code, all of which are activated by user labor. In turn, these strategies have a significant energy cost, part of which is involuntarily assumed by the user. To put it bluntly, the user is not just exploited by means of their free labor, but is also forced to assume the energy costs of such exploitation.



Paula Nishijima in collaboration with Biomimetic Laboratory (Marlén López and Manu Persa). Plug-in Habitat, 2022-ongoing. Crypto, Art and Climate exhibition, National Library of Latvia, Riga, 2023. Photo: Kristīne Madjare

Paula Nishijima in collaboration with Biomimetic Laboratory (Marlén López and Manu Persa)
Plug-in Habitat
2022-ongoing

Plug-in Habitat is based on the question posed by the architectural neo-futuristic group Archigram in the 1960s: what would happen if the whole urban environment could be programmed and structured for change? The notion of an architecture that adapts to change is also embodied in the intelligence of plants – whose structure is modular and distributed, without a central control, but with a cooperative organisation that adjusts to altering conditions in their context. In *Plug-in Habitat*, Paula Nishijima investigates adaptive strategies of plants as well as their relationship with other species and the environment. The artistic research is translated into an interactive installation composed of one living organism, a cushion plant and two artificial modules. The modules in the exhibition receive information from the plant about how it adapts to the changes in the environment – and respond to each other in a feedback loop of interactions that regulates the whole system. *Plug-in Habitat* aspires to a more organic, self-organised way of building through change – instead of resistance to it.

Jurģis Peters. Memories of The Distant Future, 2023. Crypto, Art and Climate exhibition, National Library of Latvia, Riga, 2023. Photo: Kristīne Madjare

Jurģis Peters
Memories of The Distant Future
2023

Inspired by Italo Calvino's book Invisible Cities, *Memories of The Distant Future* delves into the fluidity of memory and the transformative nature of perception. Utilizing LIDAR-scanned subjects from the author's personal archive, generative AI is employed to reimagine these scans, infusing them with fragments of imaginary Venetian architecture and other elements akin to Invisible Cities. This fusion not only mirrors the ever-evolving nature of our memories but also underscores the impact of AI on our cognitive processes. Just as Marco Polo's cities morph and evolve in the mind's eye, our memories, too, are not static; they are living entities, constantly reshaped by time, experience, and now, by the algorithms that increasingly mediate our reality. The piece serves as a meditation on the malleability of memory in the digital age, where the boundaries between the real, the remembered, and the AI-generated begin to blur.

Anna Ridler. Myriad (Tulips), 2018. Crypto, Art and Climate exhibition, National Library of Latvia, Riga, 2023. Photo: Kristīne Madjare

Anna Ridler
Myriad (Tulips)
2018

Myriad (Tulips) is an installation of thousands of hand-labeled photographs of tulips; these photographs were later used as the dataset for Mosaic Virus 2018 and Mosaic Virus 2019. By choosing to make the dataset an artwork it draws attention to the skill, labour and time that goes into constructing it, whilst also helping to expose the human element in machine learning, usually hidden by algorithmic processes. By creating her own dataset, it forces the artist to examine each tulip and subsequent image, and inverts the usual process of creating this type of large dataset, which are usually built using mechanical turks and imagery that has been scrapped from the internet.

Photo: Juris Rozenbergs

Līga Vēliņa. Shifted Realities, 2023. Crypto, Art and Climate exhibition,
National Library of Latvia, Riga, 2023. Photo: Juris Rozenbergs

Līga Vēliņa
Shifted Realities
2023

In the wake of the industrial revolution, and particularly in the 20th century, with rapid technological progress, people have thought about the possibility of artificial intelligence (AI), and interpreted it in the form of science fiction writings. Often AI was portrayed negatively as a force that could control, harm, or enslave humanity. Finally, at the beginning of the 21st century artificial intelligence is present in our everyday lives. In everyday life we come across artificial intelligence tools: Chatbots, AI assistants, and other AI tools have become common, allowing us to manipulate text, code, generate art, transform sound, and even train AI with our voices. As we once interpreted artificial intelligence, now it's interpreting us – humans. In search of new ways and means of expression, the artist draws from images generated by AI, specifically generative AI, which typically produces two-dimensional visuals, and transforms them into three-dimensional objects. This transformation adds depth and physicality to these AI-generated images, making them more tangible.

Ieva Vīksne. Unravel, 2023. Crypto, Art and Climate exhibition,
National Library of Latvia, Riga, 2023. Photo: Juris Rozenbergs

Ieva Vīksne
Unravel
2023

This is an invitation to a voyage of an algorithm. Embodying the dataflow, roaming the different tasks until the machine is trained successfully. In each step we will tackle a specific step of algorithm training: data collection and processing, feature extraction, training a classifier and testing the algorithm.
Through this experience we will see how a computer learns to recognize and differentiate an image of one object from another – the thing we do in a blink of an eye. We don't fully understand how our own natural intelligence works, because it is the result of millions of years of evolution. But we can trace the algorithms and the training process of artificial intelligence and this is a step towards unraveling the "black box" of intelligence. This is a VR portrait of an algorithm for image recognition. Some of the imagery is generated using AI.

Photo: Kristīne Madjare

Zane Zelmene. Synthetic Visions, 2023. Crypto, Art and Climate exhibition, National Library of Latvia, Riga, 2023. Photo: Kristīne Madjare

Zane Zelmene
Synthetic Visions
2023

← *Synthetic Visions* is an AI-based installation, where the robotic sculpture *Robo Sage* embodies the essence of collective knowledge powered by Chat GPT and AI image generators. Surrounding displays project celestial visuals, unveiling thematic sections that delve into cosmic wisdom and human understanding. Robo Sage shares profound insights, inviting viewers to delve into the interplay of AI, science, and art in our cosmic expedition. The installation seeks to evoke curiosity, inspire wonder, and foster meaningful dialogue, prompting introspection about our place within the vast universe. By celebrating AI's potential to unravel the mysteries of existence, *Synthetic Visions* imparts a profound sense of cosmic connectedness, igniting a deep appreciation for the boundless allure of the cosmos, and leaving an indelible impression on all who encounter its transformative presence.

RIXC Art Science Festival 2024: Symbiotic Sense(s) is supported by

STATE CULTURE CAPITAL FOUNDATION
RĪGA
Co-funded by the European Union
EMAP
Ministry of Culture of the Republic of Latvia

Symbiotic Sense(s)

RIXC Art Science Festival 2024
October 24–December 7, 2024
National Library of Latvia, RIXC Gallery and Neiburgs Hotel, Riga, Latvia
festival2024.rixc.org

Exhibition artists:
Tatsuru Arai (JP/DE)
Po-Hao Chi (TW)
Santa France (LV)
Sasha Litvintseva & Beny Wagner (UK/DE)
Me AndOther Me / Cenk Güzelis &
Anna Pompermaier (AT/IT)
Mónica Rikić (ES)
Raitis Smits, Rasa Smite (LV)
Studio Above & Below (DE/UK)
Sabīne Šnē (LV)
T(n)C (DE/HU)

The RIXC Festival 2024, at the intersection of art, science, and technology, explores concepts and visions of a *symbiotic future* through the lenses of sensory perception, extended cognition, and the evolving role of artificial intelligence, which may ultimately be shaped by natural or collective intelligence.

Symbiosis, originally a biological term, has expanded to describe interconnectedness across species and systems, incorporating new ideas in both art and science. Positioned between symbiotic art aesthetics and innovative scientific paradigms, the festival aims to develop and explore concepts for *symbiotic thinking* – fostering collaboration between nature and culture and balancing individual responsibility with collective action to envision a more symbiotic future.

The notion of a *sixth sense* based on symbiotic perception forms the foundation for new ideas and utopian visions of a symbiotic future. This is not just metaphorical – recent scientific discoveries suggest that this sense may indeed be a symbiotic one.

For example, *magnetoreception* allows certain organisms, such as birds and fish, to navigate using the Earth's magnetic field. Douglas Kahn expands on this by introducing *solarception* (2022), in which the human eye functions not only as an organ for vision but also as a solar sensor, synchronising us with planetary cycles. This concept of symbiotic sensing is even more pronounced in the plant world and ecological systems. For instance, *holobionts* (a term coined by Lynn Margulis in 1991) refer to a host and its associated microorganisms that interact to contribute to the overall function of the system. These symbiotic senses are also key to understanding concepts such as extended cognition, offering a new perspective on how we coexist with other species and within planetary systems.

The Symbiotic Sense(s) exhibition showcases artists engaging with these ideas, exploring the boundaries between self and other, human and machine, and the natural and artificial. The exhibition features contributions from artists affiliated with the European Media Art Platform (EMAP), alongside works by renowned Latvian and international artists.

Reference:
Kahn, D. (2022). Solarception: a new sense in the eye. In: Green Revisited, Acoustic Space 19 / Renewable Futures 4, pp. 275–282, RIXC.

Tatsuru Arai
Face Of Universe
2023

Artist Tatsuru Arai is researching flowers in cities around the world and creating works that make full use of A.I. technology. In this project, he conducted a survey focusing on plant geopolitics, topography and ecosystems in the urban and rural areas of each city, and based on the differences and distribution of each region. The wild flowers that coexist in the urban area are part of the history of the ecosystem born from the nuclear fusion energy of the sun, and may be the “face of the universe”.

Tatsuru Arai's main artistic theme is to present the fundamental physical nature of the universe in the form of perceptual experiences. His attempt is to realize the perception of music through a non-auditory sense by extracting and visualizing the geometric structure of music. Creating a way to experience a part of the nature of the universe through sound is his idea of the ultimate artistic work.

Produced during the EMAP residency at CIKE, Košice, Slovakia.

Po-Hao Chi
Hydrospheric Sketch: A Sensorium of Moisture
2024

Hydrospheric Sketch explores the sensory experience of humidity within the hydrosphere, inspired by the evolving relationship between people, water, and urban development in Taiwan's Xizhi district, historically known as "Tsui-Tng-Ka," where river and sea tides once converged. Over time, human interventions like flood control and urban expansion have distanced the district from these natural rhythms.
The new name, Xizhi, meaning "end of tides," reflects the hope that floods would finally cease in this area, signaling both a geographical shift and a fading connection to the water that once defined the region and its community.
The artist incorporates recordings and footage of hydrological nodes, real-time environmental data, and AI-generated documentary visuals based on local interviews to form a conceptual "sketch" that delves into the trade-off of development, the symbolic significance of water, and the gradual fading of cultural memory.

The installation assembled several water-related elements to explore how everyday appliances – such as dehumidifiers and humidifiers (crafted from flood mud) – and smart home devices mediate and augment our sensory experiences.

NCAF 國藝會

Santa France
Still Life with Fruiting Bodies
2024

The two still life compositions explore the tradition of foraging for mushrooms within a consumer-driven world. Drawing from personal experience of mushroom hunting from an early age and nostalgia for field guide books, the diptych examines how this sustainable practice has become intertwined with modern consumer excess. The curated objects reflect the paradox of overconsumption, where rarity fuels desire, leading to cycles of exploitation and scarcity. While mushrooms naturally connect vast underground networks, this interconnectedness starkly contrasts with the isolation of overconsumption, where individuals grow distant from the origins of their food and environment, urging reflection on our impact on the natural world.

Commissioned by RIXC Art Science festival 2024.

Sasha Litvintseva and Beny Wagner
My Want of You Partakes of Me
2023

My Want of You Partakes of Me interrogates digestion as the fundamental condition for being in the world, a process of physiological, psychological, spiritual, literary and political dimensions. Multiple storylines trace the poetics of incorporation as a matter of metamorphosis and decay, the philosophy of matter and imperial conquest, industrialisation and annihilation, poetry and parenting, love and citation.

Produced during the EMAP residency at IMPAKT, Utrecht, the Netherlands.

Me AndOther Me
(Cenk Güzelis and Anna Pompermaier)
in collaboration with Valdemar Danry
Be My Guest!
2024

Be My Guest! is a collective mixed-reality dinner event hosted by AI. The installation rethinks an age-old gathering ritual: a dinner with friends, where an AI, named Parasite, becomes the host and co-creator of the spatial experience and physical objects. The collective dinner transforms the private setting of home into a public domain, mirroring our current condition of dwelling in multiple realities and investigating how we inhabit and interact within networked virtual spaces, and how we foster parasitic relationships with AI systems, redefining the fabric of communal gathering in the digital age. What happens when species meet?

Produced during the EMAP residency at iMAL, Brussels, Belgium.

Mónica Rikić in collaboration with Gema FB Martín
Hipèrbole
2023

Hipèrbole is a mechanical and algorithmic experiment dedicated to design and develop an alternative cognitive machine, built from handcrafted electronics. This machine intentionally diverges from the predominant use of mainstream AI techniques, such as Machine Learning. Instead, it aspires to be recognized by the audience as cognitive, emphasizing its operational characteristics and code structure. In this installation, both the code and the machine are visible to the audience. The main goal of the proposal is to challenge the predominant role of spoken and written language in cognitive expression and human-machine communication. The primary artistic strategy for experimentation involves designing diverse mechanical personalities that allow the devices to communicate and assume roles, encouraging audience recognition as similar and different, but non-threatening. The ultimate goal is to evoke perceptions of existence and consciousness in these mechanical organisms.

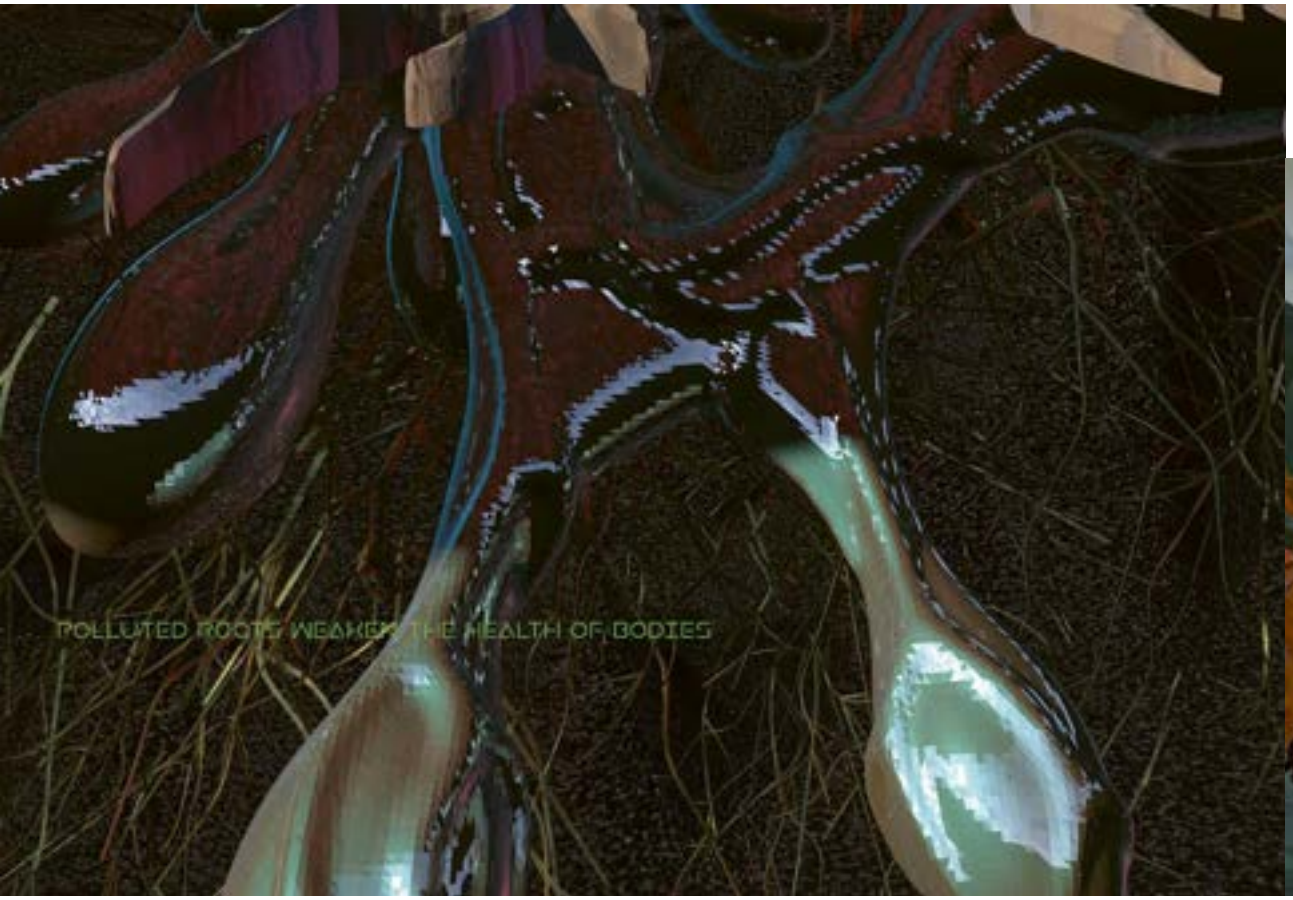
Produced during the EMAP residency at Hexagram, Montreal, Canada.

Studio Above&Below in collaboration with Yau Fan
Meditative Cohabitation
2023

Meditative Cohabitation is an audio-visual experience investigating multi-species communication in future cities through the means of advanced technologies. Grounded in bio acoustics recordings and 3D scans of the biotop of Marais Wiels which is located in the heart of the urban landscape of Brussels, the immersive installation invites the audience to meditate between multispecies sounds and a responsive multiscreen landscape.

The project aims to engage with interspecies realities through Games Engines and AI technologies to declare the need of interspecies acknowledgement within our design process and datasets in order to build empathy and purpose for advanced technologies to serve more than human lifeforms.

Produced during the EMAP residency at iMAL, Brussels, Belgium.



Sabīne Šnē
We Belong to Them
2024

Trees are one of the shapers of our world, making diverse landscapes possible. With their deeply rooted collective generosity, they not only take care of one another but also create weather, build the atmosphere, heal, and shelter more creatures than people can count.
The work focuses on six interconnected scenarios caused by the global climate crisis that impact trees: soil pollution, air pollution, rising temperatures and drought, loss of biodiversity, pest and disease proliferation, and shifts in growing seasons.

3D scans of trees taken in rural areas in the western part of Latvia are combined with speculative environments created using worldbuilding methods. The texts were written while wandering through forests, thinking on how to translate more-than-human voices for humans and contemplating the fact that without healthy forests, there is no future for us.

Commissioned by RIXC Art Science Festival 2024.

T(n)C
Retraining Laziness
2023

Fueled by an economic system that evaluates each individual based on their productivity, humans and machines are in competition with each other. In an effort to improve in order to stay relevant and benefit the society they belong to, they find themselves in a constant mode of self-exploitation. One works because one can, and not because one must. But due to an anomaly a robot abandons the assembly lines to explore an idle and independent existence.
The video series *Retraining Laziness* follows a conversation between a human worker and a malfunctioning robot as they discuss unhealthy production conditions and their own relationship to work and time.

Produced during the EMAP residency at at FACT, Liverpool, United Kingdom.

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