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M(ol)AR
HYBRID LANDSCAPE

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Abstract

M(ol)AR, HYBRID LANDSCAPE

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"M(ol)AR, HYBRID LANDSCAPE" is a site-specific, durational installation that emerges from research on antenna design and fabrication, radio exploration, and machine listening. This dissertation is an outgrowth of a series of artistic projects I developed at DXARTS, University of Washington, between 2020 and 2024.

This project revolves around fundamental questions: What is the role of technology in the paradigm of the Anthropocene? What possible futures can we speculate about by understanding and learning from nature's intelligence?

The installation is a fictional and hybrid landscape, a convergence of technological elements with natural ones: objects, sculptures, plastic, wires, speakers, computers, rocks, creatures, fluids, motors, and sensors. It juxtaposes electricity and water, plastic and salt, copper and sand, sound and objects, the inaudible and the invisible.

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Additionally, I would like to express my heartfelt gratitude to my family and partner, Mandy, for always being with me, supporting me, and advising me. Also, to my two children, Gaspar and Alma, for always being my most significant and loyal fans. To my parents and brother, despite the distance, I constantly feel their support and love.

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Dedication

To Mandy, Gaspar, and Alma

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Introduction

"M(ol)AR, HYBRID LANDSCAPE" is a site-specific durational installation of my research on antenna design and fabrication, radio exploration, and machine listening. The work was exhibited at Discovery Park, South Beach, in Seattle, in April 2024. This work is a consequence of a chain of different art projects that I worked on at DXARTS, University of Washington, between 2020 and 2023. Those projects provided a research process that allowed me to learn skills and build the main question that inspired this dissertation.

At the beginning of 2020, I developed an artwork called "The Ear." Initially conceived as a surveillance project, it evolved through different iterations into a cultural apparatus capable of engaging in dialogue with the social environment and creating narratives through listening conversations in the public space. This project marked the beginning of my research in machine learning and prompted reflections on the critical uses of AI, the notion of making art with AI, the concept of machine ontology, and the gaps and cracks in AI systems as avenues for finding creative and aesthetic paths. This project guided me to a specific question: What other sounds, beyond human voice, can AI analyze to make predictions, interpretations, and open up aesthetic paths?

Between 2021 and 2022, I developed a second project called "Imaginary Machinescape". Based on the idea of pushing AI to fail to escape literalness and efficiency, I explored radio signals to see what kind of information an AI could interpret. The results of these experiments were highly unexpected. Even though radio signals are mostly noise, the machine listening system most of the time recognizes those signals as natural sounds (rain, waterfall, animals, snakes, sea, water, among others), generating an intriguing cycle: Signals that inhabit space, originating from

natural phenomena and human activities (satellites, Wi-Fi, Bluetooth, electrical connections), are analyzed by AI and are misunderstood as natural soundscapes. This project fostered reflections on the intersection between nature and technology and the concept of extended ecology. Thus, the main question of this dissertation emerged: How can we speculate on a different future by understanding and learning from nature's intelligence? In this context, I began researching antennas and organic systems, leading to the idea of antennas based on seawater.

This dissertation narrates the entire process of "The Ear," "Imaginary Machinescapes," and other artworks in between that framed and supported the creation of the final artwork. Simultaneously, this document establishes the theoretical aspects from a historical, conceptual, and aesthetic perspective that support this research.

Chapter 1 - Historical and Conceptual Background

The first chapter contains the theoretical background of this dissertation. It introduces conceptual and historical perspectives and selected artworks that framed this research. In this sense, I have defined six main topics: **Acoustic Ecology**; **Listening** and **Extended Listening** through technological devices; **Radio Art** and exploration of electromagnetic fields; The idea of **site-specificity**, in the sense of how the place where an art piece is displayed gives specific meaning; The concept of **Sentient Machines**, from the perspective of machines connected, sensitive, and reactive to the environment; and **AI and Machine Ontology**.

1.1 Sound Ecology

1.1.1 The Sound as a phenomenon to understand our environment.

In the 20th century, efforts were made to explain sound phenomena beyond its physical connotation and musical language. One of the pioneers was the French composer Pierre Schaffer. In the 50s and 60s, by exploring and studying recorded sounds such as trains, animals, and others, he treated the phenomenon of sound as objects that could be analyzed and separated from their context. This revolutionary idea ushered in a long history of musical development where sounds were explored, transformed, and abstracted to compose a musical narrative. Similarly, just as a sculptor transforms a rock into something entirely different, regardless of its context or origin, acousmatic music or electroacoustic music emerged as a new understanding and utilization of sound in the second part of the 20th century. Despite this new perspective, which meant incorporating other types of sound beyond musical instruments, the idea of sound was only considered as a material, an object, or an ingredient for musical composition. However, it represented a significant contribution and set a precedent for future perspectives.

For this research, my interest lies in exploring sound and its contexts, source, territory, and locality. Sounds exist as a result of various phenomena, whether they be part of nature or human activities. As John Cage mentioned while looking through the windows of his apartment, sounds are "such as they are, just as a sound, without metaphors and representation"¹ While this might

seem simplistic, it underscores the idea that sound phenomena provide material to understand our environment, culture, and social constructions. Through the act of listening, we can grasp our environment and observe both the past and present, allowing us to speculate about the future. Therefore, the sound is in dialogue with its surroundings. From this perspective, attempting to disintegrate the sound phenomenon into objects or categories becomes meaningless. In simple terms, the aspect of sound in this research is viewed as a spontaneous sonic manifestation of physical, social, and natural phenomena.

In this context, Murray Schafer, reflecting on various sound studies conducted in the decades preceding the 1970s, states:

These researches are related; each deals with aspects of the world soundscape. In one way or another, researchers engaged in these various themes ask the same question: what is the relationship between man and the sounds of his environment, and what happens when those sounds change? Soundscape studies attempt to unify these various types of research. ²

Before the inception of the World Soundscape Project (WSP) in the 70s, the discourse surrounding sound encompassed two dimensions: musical expression on one hand and sound as a physical phenomenon on the other, thus involving compositional and acoustic (physics) perspectives.

¹ John Cage, "John Cage about Silence," YouTube video, 10:14, uploaded by jdavidm, July 14, 2007, <https://www.youtube.com/watch?v=pcHnL7aS64Y>.

² Murray Schafer, *The Soundscape: Our Sonic Environment and the Tuning of the World*, ed. Destiny Books (New York: Destiny Books, 1993), 4.

With the emergence of new recording technologies, the notion of analyzing our environment through listening arose, enabling us to "observe," through changes in sound, the impact of human behavior on our surroundings. Much like a photograph can document changes in a location by comparing images taken a decade apart, a sound recording could achieve a similar effect through listening rather than visual observation. The primary objective of the WSP, in consequence, acoustic ecology as a theoretical study and practice, was interdisciplinary research aimed at planning future environments for humanity through the understanding, interpretation, and speculation of the acoustic environment.

1.1.2 The sound and its surrounding

Beyond its functional aspect, these studies also raise questions about the accuracy of that methodology and the technical limitations of sound recording in transforming the multiple sound layers and the depth in the real world into a stereo image. Despite this, the WSP opened several research paths in ecological fields, design, architecture, and art practices.

In the article "Soundscape Ecology: The Science of Sound in the Landscape,"³ published in the journal *Bioscience*, the authors mention there are three dimensions in acoustic ecology:

1. **Biophony:** Referred to sounds produced by the biological organism.
2. **Geophony:** Referred to nonbiological sounds produced in the ambient, such as sounds of wind, rain, and thunder, among others.
3. **Anthrophony:** Sound produced by humans.

These three categories are essential for understanding the complexity of this study and, ultimately, for observing where this discipline is beginning to move. In this sense, from that perspective, there is an inquiry beyond representation, symbolism, or expressions; there is in sound an opportunity to reflect on what surrounds us, its relevance, its interconnections, and its triggers in their existence, whether humans, non-humans, or natural phenomena produce them.

1.1.3 Sound ecology as an interdisciplinary research

Sound has not been considered a significant phenomenon in studying our environment for decades. The dominance of visual observation has governed our perceptions. However, as I have mentioned, since the 1950s, there has been a crucial shift to allocating space for the study of sound in realms beyond music or physics, particularly from the 1960s within eco-acoustic and bioacoustic studies.

Recognizing that animals and most creatures communicate through sounds and that every physical phenomenon generates sound, acoustic ecology and their emerging fields offer a new perspective on understanding our world and expand sound studies into ecological, biological, and sociological domains. Consequently, sound and listening are gradually becoming a lens through which to view political aspects of human and social behavior, as well as the significance of our relationship with nature and the human impact on it: "Nature's sounds have been inextricably

³ Bryan C. Pijanowski et al., "Soundscape Ecology: The Science of Sound in the Landscape," *BioScience* 61, no. 3 (March 2011): 203-216, <https://doi.org/10.1525/bio.2011.61.3.6>.

linked to environmental quality. Because sound is a fundamental property of nature and can be drastically affected by various human activities, it is surprising that sound has not become a more universally appreciated measure of a coupled natural—human system".⁴

1.1.2 Environment: Sound, Space and Time

Furthermore, a specific sound feature provides a unique perspective for approaching environmental research and understanding: its temporal aspect. Sound waves are not static; they travel, move, and vibrate. Even a recording is not merely a passive archive; it is always alive. Every time a device plays a recording, it engages in a dialogue with the environment where it is heard, bringing the sound back to life. Sound is constantly in flux, and listening to sound is an active practice.

Simultaneously, there exists an intricate connection between time and space. Sound waves travel through space, and depending on the characteristics of that space, sounds will manifest differently. According to Salome Voguelling, the relationship between time and space is dialectical. Sound and time engage in a fluid dialogue in which "both extend each other and produce each other as an immaterial composite."⁵ The phenomenon of sound itself does not resolve this dialectic; instead, a third element synthesizes both. Dynamically, through the senses and subjectivity, listening constantly processes this phenomenon. At its core, listening is a dynamic interplay between time, space, and sound waves.

1.2 Listening and extended listening

1.2.1 Listening

New technologies provide new human physical characteristics, extending our senses' natural capacities and amplifying our perception of the world.

Barry Truax states that the senses are our physiological mechanism for understanding the information surrounding us. It provides us with a system that allows us to perceive the threats and the characteristics of the environment, giving us resources to survive and build our thinking, ideas, and concepts of the world. Despite these abilities, like all living things, human senses have their limitations concerning their biological capabilities. Human vision, for example, has a specific frequency and distance range. The ear can hear a particular frequency range (between 20 cycles per second and 20,000 cycles per second), delimiting the possibility of listening to certain types of sound at certain distances, leaving a large quantity of life events and situations out of our perception.

Furthermore, the human brain filters the observed, smelled, or heard data, converting it into valuable information that depends on our interests, experiences, and circumstances. This generates a vision and perception of the world contingent upon our biological and psychological

⁴ Jianguo Liu et al., "Complexity of Coupled Human and Natural Systems," *Science* 317 (2007): 1513-1516.

⁵ Salome Voegelin, *Listening to Noise and Silence* (London: The Continuum International Publishing Group, 2010).

limitations: “Whereby the senses employed are always already ideologically and aesthetically determined, bringing their own influence to perception, the perceptual object, and the perceptual subject”.⁶

In this sense, the human ear has a physiological inability to block its function. Unlike the function of the eyes, where it is possible to stop seeing something by closing the eyelids, the ear, biologically, is always working. It is only likely to stop hearing if the brain decides to pay attention to something else. That means listening is not automatic, potentially, it is a conscious act to understand the world: “In this sense, listening is not a receptive mode but a method of exploration, a mode of ‘walking’ through the soundscape/the sound work. What I hear is discovered, not received, and this discovery is generative a fantasy: always different and subjective and continually, presently now”.⁷

In the mid-1960s, American artist Pauline Oliveros began to develop the concept of "deep listening." In essence, this idea refers to an attitude. To experience conscious listening is to act actively with the body, memories, and feelings; listening takes a position on how and why to use the ear.

Pauline Oliveros states that the idea of "deep" refers to those things that are difficult or impossible to understand or something that has unknown and different parts. "To listen or listen deeply for me is to learn to expand the perception of sounds to include the entire space/time and

⁷ Salome Voegelin, *Listening to Noise and Silence* (London: The Continuum International Publishing Group, 2010).

conscious sensory process toward approaching the world. It is confusing, filtered, and continuum of sound, finding the immensity and complexity as much as possible”.⁸

Oliveros states that the concept of listening requires an exploratory attitude towards the perception of sound in physical space. In this sense, listening is an active, unstable, untouchable, ephemeral, subjective; as Salomes Vogeling states, “listening is a practice about doubt”.

1.2.2 Extended Listening:

In 1996, the artist Stelarc implanted an ear made of human cartilage in his forearm. This 'third' ear could connect through Bluetooth and transmit what it heard. In light of what technology can do, what are the limits of the human body? How can we interpret the world from a sound perspective through technological listening devices?

The human body is an exciting field of study technologies have significantly influenced. Technological advances in human history have allowed us to improve our lives and provide solutions to medical problems. Still, they have also allowed us to extend human limits, giving a new context to reflect on the meaning of the body.

The relationship between humans and machines, in which technologies and devices act as an interface that extends our human abilities, allows for the amplification of human perception and

⁸ Pauline Oliveros, *Deeeepp LLiissttteniing Deeeepp LLiissttteniing* (New York: Deep Listening Publications, 2005).

the transformation, changing, and degrading of information from the environment. This could provide different and new interpretations or meanings of the world and also create new scenarios, symbols, and realities mediated by the technology itself.



Figure 1 - "The Third Ear" Stelarc

As a consequence of that exploratory attitude, in the sound field, from science to contemporary art, different experiments and projects have crossed the idea about how to amplify the sense of hearing, resulting in the extension of acoustic listening practice toward developing technologies around sound listening devices. The purposes of this extension include reaching unreachable worlds, creating interfaces between the human and inaudible layers of sound environments, amplifying the limitations and abilities of the body, and incorporating new sound dimensions to understand the physical world surrounding us.

One of the pioneering examples in developing sound listening technologies are the acoustic mirrors. After the First World War, between 1915 and 1935, Great Britain created a military architectural structure based on a concrete, concave, and parabolic design. Its shape allowed it to hear sounds at long distances and detect possible aircraft threats. During those years, tens of acoustic location devices were developed for the passive detection of aircraft by picking up the noise of the engines, from devices such as horns that worked like ear prostheses and body extensions to immense concrete structures that gave both acoustic gain and directionality, increasing the observer's ability to localize the direction of a sound.



Figure 2 - Acoustic Mirrors, Great Britain

With the advent of electronic sound technologies and the arrival of sound experimentation, this field moved from its scientific purpose to an artistic point of view, becoming one of the fields of study in the sound art aesthetic. One interesting project to highlight in this exploration is

“Binaudios: The Sound of the City”, by Dominic Wilcox in collaboration with the creative technologist James Rutherford. “Binaudios” is a giant listening cone that, due to its shape, can take sounds at long distances. At the same time, in 50 locations, these listening binoculars convert orientation into a soundscape. These sounds were pre-recorded or found historical sounds from the area, each coded to activate when the Binaudios pointed to the source. This project moves the acoustic microphone technology from military purposes to an aesthetic and educational experience, focusing on the place's sound perception and adding another dimension and layer, bringing historical sounds from the environment.



Figure 3 - Binaudios: the sound of the city”

From a different perspective, 'La Paracantora' by Chilean sound artist Nicole L'Huillier is another example of capturing environmental data through devices. Still, this project focuses on data sonification, which involves the computational interpretation of environmental information.



Figure 4 - "La Paracantora", L'Huillier Nicole

'La Paracantora' is a sculpture designed to sense various physical variables in the environment, including barometric pressure, altitude, temperature, accelerometer readings, electromagnetic fields, anemometer measurements, wind turbine activity, light levels, proximity, and vibrations. It

converts this information into sounds using synthesizers, samples, textures, words, and human voices, which are audible through speakers installed within the sculpture. This technological sculpture acts as a sensing station and a listening device, transforming environmental data into sonic expressions.

In other words, 'La Paracantora' represents a human interpretation of the environment through the sonification of physical data. The artist explains, "This sonic rite starts from the idea that there is no such thing as empty space. In places where the natural and technological collide, there are particular disturbances and radiations that are transduced by La PARACANTORA, a sonic artifact that acts as a medium between worlds. La PARACANTORA becomes a (technological) parasite of the place" ⁹

⁹ Nicole L'Huillier, "La Paracantora," 2019, <https://nicolehuillier.com/portfolio/el-poema-de-la-fabrica-cosmica/>.

1.3. Radio Art and the exploration of electromagnetic fields

1.3.1 Definitions

Defining the inception of an art movement is often a complex task. The Radio Art Manifesto by Tetsuo Kogawa, a highly influential figure in radio art, mentions that the first international festival of "radio art" took place in Dublin, Ireland, from August 12 to 18, 1990. While this event does not necessarily mark the absolute beginning, it certainly stands as a significant milestone, signifying the moment when radio art officially entered the annals of art history as a distinct field of creative expression.

Kogawa underscores that during this period, the concept of radio art primarily revolved around using existing radio stations as a medium to transmit experimental sounds or music. However, radio did not necessarily represent a new frontier for artistic experimentation at that time. He emphasizes the need for radio art to encompass more than mere transmission over the airwaves; it should embody innovation within the realm of art itself. To underscore this point, Kogawa advocates for the term "radioart" rather than "radio art" moving forward, signaling a shift towards a more dynamic and boundary-pushing approach to artistic exploration within the medium.

In this context, it is necessary to consider what radio art truly entails. According to Anna Friz, a radio artist and professor at the University of California Santa Cruz, many radio and transmission artists, including herself, work with what she terms "trailing-edge" media. They aim to critically

engage with prevailing myths, presenting wireless transmissions as time-based, site-specific encounters between individuals and devices across varying distances. Within this framework, the materiality of the electromagnetic spectrum is experienced within a constantly shifting transmission ecology, where both people and devices play integral roles.

Friz views the radio spectrum as a territory, a "site-specific encounter," essentially an ecosystem involving humans, electromagnetic waves, and technology (devices). This perspective on radio art opens up profound conceptual, philosophical, and political ideas. Despite being invisible and inaudible, the radio spectrum is considered a territory controlled by specific regulations, devices, technologies, and international agreements. Radioart transcends mere radio transmission; it involves critical engagement and experimental practice within the realm of electromagnetic waves.

As a further reclamation of radio as a medium, many artists move beyond the confines of the studio to create installations, performance works, and public actions. These endeavors not only focus on transmission or artistic content creation but also consider the material aspects of the electromagnetic spectrum and the interconnected circuits of people and devices that activate and reveal them.

In this sense, radioart is also inherently political. It involves intrusions, interruptions, and sometimes pirate practices within this regulated space. Moreover, it serves as a countercultural response to mainstream mass media communication. Ellen Waterman, professor at Carleton

University, Canada, states radio art “represents a disruption of, and provides a creative alternative to, commercial mainstream radio.”¹⁰

The global radio allocation is the most evident manifestation that proves the idea of the radio spectrum as political territory. Frequency bands are allocated to different services worldwide (worldwide allocation) or regionally (regional allocation). To achieve this, the world map is divided into three regions (Regions 1, 2, 3), as defined in the Radio Regulations. In the allocations table, there is a column for each regional allocation.

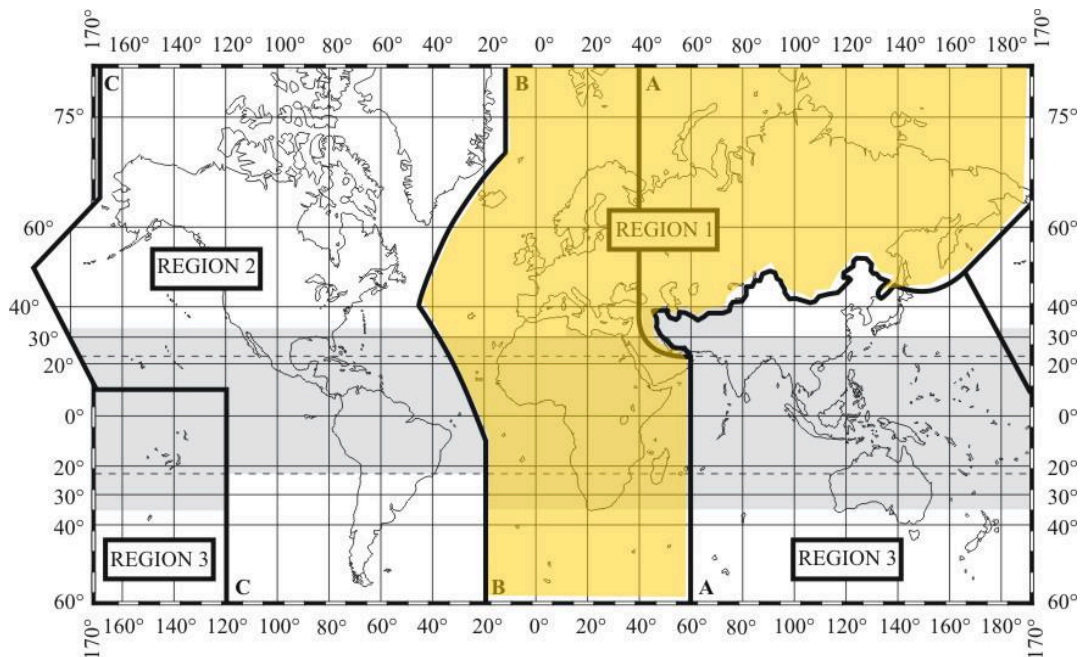


Figure 5 - Regional Radio allocations

¹⁰ Ellen Waterman, "Radio Bodies: Discourse, Performance/Resonance," in E.G. Jensen and B. LaBelle, eds., *Radio Territories* (LA/Copenhagen: Errant Bodies Press, 2007), 118-134.

If we wanted to highlight a pioneer in radio experimentation, it would be John Cage. At least two of his works center around radio, one more closely related to transmission and the other to using antennae and electromagnetic waves.

"Radio Music" (1956) was an experimental composition that used the radio as an instrument. It comprised a series of instructions for changing dials and adjusting the volume of a radio, performed by eight interpreters. This piece delves into sound indeterminacy, randomness, and the unexpected. Significantly, it marked one of the first times that radio sound texture was considered part of an artistic exploration.

PART A OF RADIO MUSIC to be played alone or in combination with Parts B-H. In 4 sections (I-IV) to be programmed by the player with or without silence between sections, the 4 to take place within a total time-length of 6 minutes. Duration of individual tunings free. Each tuning to be expressed by maximum amplitude. A _____ indicates 'silence' obtained by reducing amplitude approximately to zero. Before beginning to play, turn radio on with amplitude near zero.

-JOHN CAGE
SONY PGM. REC.
MAY 1956

I	(I cont.)	(IV cont.)
105	107	91
_____	_____	_____
125	69	146
55	107	69
_____	II	_____
91	56	_____
60	124	97
69	125	_____
76	_____	91
112	120	156
56	55	_____
_____	56	55
86	125	155
73	69	128
127	84	_____
73	120	138
148	III	_____
76	76	107
109	IV	_____
63	99	99
67	_____	_____
91	69	153
86	_____	63
73	_____	_____

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Figure 7 - Extract of Radio Music sheet

In 1966, John Cage, experimental musician David Tudor, and dancer Merce Cunningham collaborated to create the piece *Variation V*, which incorporates antennae as sensors, allowing the dance movements to modify the resulting sounds.

In this sense, *Variation V* is one of the early experiments involving antennae within the art context. While the Theremin also utilized the electromagnetic field to modify sound signals, it primarily focused on developing a musical instrument rather than exploring the aesthetic expansions of electromagnetic waves.



Figure 8 - Variation V Performance, 1966

In the late 1970s, the musician and composer Christina Kubisch began experimenting with phone amplifiers, enabling her to delve into the world of electromagnetic fields. Essentially, she created wire installations through which current passed. By utilizing these phone amplifiers, the audience could access the sounds produced by the electrical current through the cables.



Figure 9 - Il respiro del mare, 1981

In the 1980s, she became interested in the sound of electromagnetic fields generated by human activity, and more specifically, generated through the electronic devices around us. The performative experience of walks around the city was captured by sensitive wireless headphones,

In the 1980s, the experimental musician Alvin Lucier began experimenting with electromagnetic waves. Lucier's exploration was more directly related to the radio world. He designed an antenna capable of picking up signals from the radio spectrum.



Figure 11 - Alvin Lucier, Sferic

Alvin Lucier's creation of "Sferic" in 1988 marked his exploration of the field. He was particularly interested in capturing the sounds produced in the ionosphere, known as sferics. These sounds originate from natural phenomena such as solar storms or other cosmic events.

Lucier's intention was simply to record these sounds and make them accessible to the audience, inviting them into a world of imagination and speculation about these cosmic phenomena. This

work holds a significant place in the history of radio art, as it represents a moment when these types of noises or signals transcended the realm of science and entered the world of art: "If you put an antenna and a receiver, then you can hear them, they are very beautiful. That is all I have done, that is to make it available to people to hear. Very simple." ¹²

In the 1990s, with the advent of the internet, a new territory of exploration emerged: internet Radioart. In 1995, the radio artist Tetsuo Kogawa initiated his internet project called Polymorphous Space, sparking discussions about the essence of radio and the dichotomy generated by radio on the internet, namely, the local versus global divide. In his manifesto, Kogawa stated: "My experience with the Internet ensured that the authentic function of a transmitter (computer) is not to cast but to vitalize, and the transmitting size of 'local or global' is not so important. Every local unit of transmission is translocal and it contains something global in it. This is quite natural in the area of organic cells from the perspective of molecular biology."

¹³

Despite the technical distinction between analog radio and internet radio, where internet radio is essentially data transmission rather than traditional radio waves, projects such as Radio Farm in New York, Radio Aporee in Berlin, and the international network Radia, among others, have found a space to thrive on the internet. These platforms host a wide array of individual and collective artistic projects, encompassing experimental transmission, sound recording, experimental lectures, and even experimental music.

¹² Alvin Lucier, "Sferic," 1981, accessed June 21, 2024, <http://alvin-lucier-film.com/sferics.html>.

¹³ Kogawa Tetsuo, "Radioart Manifesto," 2008, accessed June 21, 2024, https://translocal.jp/radioart/20080710AcousticSpaceIssue_7.html.

From my perspective, in terms of broadcasting experimentation, the Internet opened up a rich and also a massive field. This is perhaps due to the essence of the Internet, which emphasizes free access, globality, and technical simplification, thus reducing the technical barriers associated with traditional radio transmission devices and democratizing and expanding the idea of exploration and experimentation through radio as an artistic language.

1.4 The place of Art: context and public space

1.4.1 The Postautonomy and the space of art

In his book "Art Beyond Itself: Anthropology for a Society without a Story Line," the Argentinian philosopher Nestor Canclini argues that art has entered a "post-autonomous" moment, in which art no longer enacts the problematic of transgression against the limits posed by museums, institutions, and the conventions of art practice. Instead art faces "uncertain localization," a new relation between place and artistic production in which art is produced and circulated through a shifting range of embodied, electronic, and other media.

It's fascinating to observe how the meanings of art galleries and museums have evolved over the years. Walter Benjamin, a prominent German philosopher and cultural critic, provided notable insights into museums and galleries, particularly in his essay "The Work of Art in the Age of Mechanical Reproduction." Benjamin explored how art reproduction through technologies like photography and film altered the traditional aura and authenticity associated with original artworks. He highlighted the shift of art from ritualistic, religious, and aristocratic settings to more democratic ones, galleries, and museums, imbuing these new exhibition spaces with political significance.

From Canclini's perspective, after the avant-garde movement, which challenged the technical, conceptual, and linguistic boundaries of art, the space of art became more perplexing. The avant-garde art movements not only pushed the limits of art itself but also transformed the entire

art system, including exhibition spaces. Canclini argues that the avant-garde artist's obsession with breaking barriers led to the validation of any manifestation as art simply because it was displayed in a gallery. From Duchamp to Andy Warhol, the intention was to desacralize the art system, yet these manifestations ultimately reinforced the art institution by defining galleries as places of validation.

However, what happens when the idea of transgression fades away? Canclini refers to the Art of Postautonomy as a perplexing space and practice that extends beyond traditional language boundaries, incorporating hybrid practices that intersect disciplines such as art and technology, art and science, and art and anthropology, among others. This results in a blurry boundary between art and various other fields.

Simultaneously, as a consequence of this restructuring, the place of art undergoes a crisis or, in a more positive light, an expansion:

“Parece una paradoja: los artistas salen de los museos para insertarse en redes sociales (arte sociológico, arte etnográfico, acciones postpolíticas y postindustriales), en tanto actores de otros campos mantienen la respiración del arte y se comprometen con sus aportes: filósofos, sociólogos y antropólogos piensan a partir de innovaciones artísticas y curando exposiciones; actores políticos y movimientos sociales usan performances en espacios públicos; los mercados del arte se nutren con inversiones legales e ilegales”

[“It seems like a paradox: artists leave museums to insert themselves into social networks (sociological art, ethnographic art, post-political and post-industrial actions), while actors from other fields maintain the breathing of art and commit to their contributions: philosophers,

*sociologists, and anthropologists think through artistic innovations and curating exhibitions; political actors and social movements use performances in public spaces; “Legal and illegal investments nourish art markets”]*¹⁴

1.4.2 Machines and the Space

In this context, Fluxus stands out as an artistic movement that challenged conventions, including traditional art spaces. The Fluxus ethos emphasized the art of action, urging artists to venture beyond conventional venues and redefine art in dialogue with their surroundings.

Nam June Paik, a key figure in Fluxus and a pioneering South Korean artist in video and new media art, epitomized this approach. In 1964, he created his Robot K-456—an anthropomorphic creation assembled from assorted materials, including metal scraps, cloth, a data recorder, walking wheels, and a loudspeaker broadcasting John F. Kennedy's speeches. These materials exemplified Paik's enduring fascination with transforming mundane, disposable objects into aesthetic expressions associated with cutting-edge technologies.

¹⁴ Nestor Garcia Canclini, "Arte y fronteras: De la transgresión a la postautonomía," *E-MISFÉRICA* 7, no. 1 (Visualidades Inestables, Universidad Autónoma Metropolitana, Mexico).



Figure 12 - Robot K-456, New York

Indeed, while Robot K-456 has been exhibited numerous times in galleries, it was initially conceived to be performed on the streets—where the city itself served as its natural environment.

In the words of Paik, "I imagined it would meet people on the street and give them a split-second surprise, like a sudden show" ¹⁵

From this perspective, the location where the artwork is displayed engages in a dialogue with the artwork itself, situating it within the realm of real life, with random passersby as its audience.

This imbues the artwork with deeper meaning regarding the relationship between technology and humans. Rather than being solely an object to be contemplated within the controlled environment of a gallery space, when Robot K-456 interacts with the urban landscape and its inhabitants, it blurs the boundaries between art and reality, enriching the viewer's experience and engagement with the piece.

In the 1960s, Swiss artist Jean Tinguely expressed a disdain for displaying his art in traditional museums. His sculptures' scale, materials, and meaning inherently demanded non-conventional spaces. Many of his self-destructing machines were performed outdoors. While there were certainly technical and safety reasons for this choice, it also illustrates that the nature of some works clamors to exist outside of the gallery and museum walls. These works take on special significance in specific locations, fostering a different connection and interaction between the artwork and its audience.

In 1962, NBC invited Jean Tinguely to visit Las Vegas and create artwork there. He collected discarded items from the city dump, such as bicycle wheels and shopping carts, and fused them

¹⁵ Nam June Paik, "Life and Technology: The Binary of Nam June Paik," *Gagosian*, 2018, <https://gagosian.com/quarterly/2018/10/16/life-and-technology-binary-nam-june-paik/>.

to create sculptures in the Flamingo Hotel parking lot. Then, on March 21, Tinguely lined up seven sculptures on Jean Dry Lake Bed in the desert southwest of the city and detonated them with dynamite, firecrackers, and smoke bombs. An audience of journalists recorded the event, titled "Study for an End of the World, No. 2." The desert area resembled Yucca Flats, a site used for atomic testing in the 1950s.



Figure 13 - Tinguely, Las Vegas

From a vastly different perspective is the sound artwork "Times Square" by Max Neuhaus (1977). Situated at the north end of the triangular pedestrian island between Broadway and 45th

and 46th Streets in New York City, Max Neuhaus's Times Square emanates a rich harmonic sound texture.

Originally installed at this location from 1977 to 1992, the Times Square Street Business Improvement District (BID) collaborated with MTA Arts for Transit and Dia to reinstate the project in May 2002. Visitors and residents of Times Square can now experience the artwork 24 hours a day, seven days a week.



Figure 14 - Times Square, Max Neuhaus

What makes this work particularly intriguing is how the architectural characteristics of the location allowed Neuhaus to design a specific artwork. The sound that emerges results from the interaction between the sound itself and the space it occupies. Due to the environment's material,

dimensions, and resonant qualities, the resulting sound possesses its own unique characteristics. In this case, "Times Square" is a prime example of sound art, where the sound is filtered and specifically amplified by the site's architectural features, creating an aesthetic connection between the location and the artwork.

In the 1960s, a group of architects, poets, and researchers embarked on an educational and architectural experimentation endeavor amid the dunes in a rural area near Valparaiso, Chile. Hosted by the University Catolica de Valparaiso, this group explored space, materials, architecture, and culture, creating a surrealistic landscape called "Ciudad Abierta" (Open City).

Open City stood as one of the most enduring educational projects of its time, encouraging students and professors to break free from the confines of traditional classrooms. Instead, they explored reality and its specific conditions, learning through hands-on experience and investigating the landscape's potential for creating a distinct kind of architecture. The project yielded various outcomes, predominantly architectural experiments, art installations, and oversized experimental structures that functioned as speculative games, conducted as real tournaments in different locations across the city of Valparaiso, including the beach and dunes. Subsequently, Manuel Casanueva, one of the project's creators, compiled these creations into a book of photographs and documentation titled "Libro de Torneos" (Book of Tournaments).

These creations were intricately connected to the territory in every dimension, aiming to understand, observe, and study the place. From my perspective, this project addresses the fusion of space and the critical concept of disruptive architecture—a critical perspective on urbanization

and the interconnectedness of objects, design, architecture, and human life with the space and its natural surroundings. Casanueva aptly described the project: "Some are completed houses, while others were left deliberately unfinished, forming sculptures that dot the landscape like mysterious remnants of a lost modernist empire. Every building responds closely to its context, defined by the subtle curving geometry of the surrounding dunes".¹⁶



Figure 15 - Libro de Torneos

From Nam June Paik to the Open City project reveals how artwork takes a different meaning when they are inhabiting a specific place. In some instances, art projects are designed for a

¹⁶ The Angry Architect, "Chile's Ciudad Abierta is a Surreal Architecture Experiment Hidden in the Hills," *Architizer*, accessed June 21, 2024, <https://architizer.com/blog/practice/details/ciudad-abierta/amp/>.

specific location, they are projects that probably are inseparable from the place. Others that the location re-signifies and contributes to give sense to their existence. The thing is, in the end, for this research and final art project, the decision about where the installation is displayed is essential. The space will contribute to its design, conceptualization, and intention for the audience experience.



Figure 16 - Libro de Torneos

1.5 Sentient Machines

1.5.1 Why sentience?

From my perspective, machines, in a conceptual approach, embody two main aspects. Firstly, they are functional—they serve a purpose and perform tasks. Secondly, they are aesthetic—they provoke, inquire, and are intricately connected with the environment, sensing or responding to external variables. In this sense, machines are sentient objects capable of forming relationships with their surroundings through mechanical components and digital sensors and actuators.

This perspective on machines aligns somewhat with the idea of machine autonomy. However, it goes further by conceptualizing machines as entities in their own right, independent of their creators and limitations. While it might be tempting to equate this view with the humanization of machines, I see it as more of an exploration of machines' own definitions—a move towards understanding machine ontologies.

In 2020, amidst one of the most challenging years in recent history, the International Symposium of Electronic Arts (ISEA) posed a fundamental question: "Why Sentience?" They conceptualized sentience around the notion of interspecies symbiotic relationships, emphasizing that "living together, however, involves sensing together."¹⁷ In this context, sentience is not merely about the capacity for feeling; it encompasses interconnections, relationships, community-building,

¹⁷ Christine Ross, "26th International Symposium on Electronic Art ISEA2020," *Proceedings* (2020): 7, https://isea2020.isea-international.org/PROCEEDING_041120_LR.pdf.

ecosystems, otherness, and the interactions between humans, non-humans, plants, bacteria, and even machines. It's about how consciousness and awareness of one's environment lead to a shift in paradigm.

1.5.2 Machines and sensitive aesthetics (SENSING, REACTING, MOVING)

In 1966, the artist Tommas Shannon created an early work of cybernetics and interactive art called "Squat." Through a live plant, the audience was able to control a robotic structure by triggering a voltage variation using the plant as a capacitive sensor.

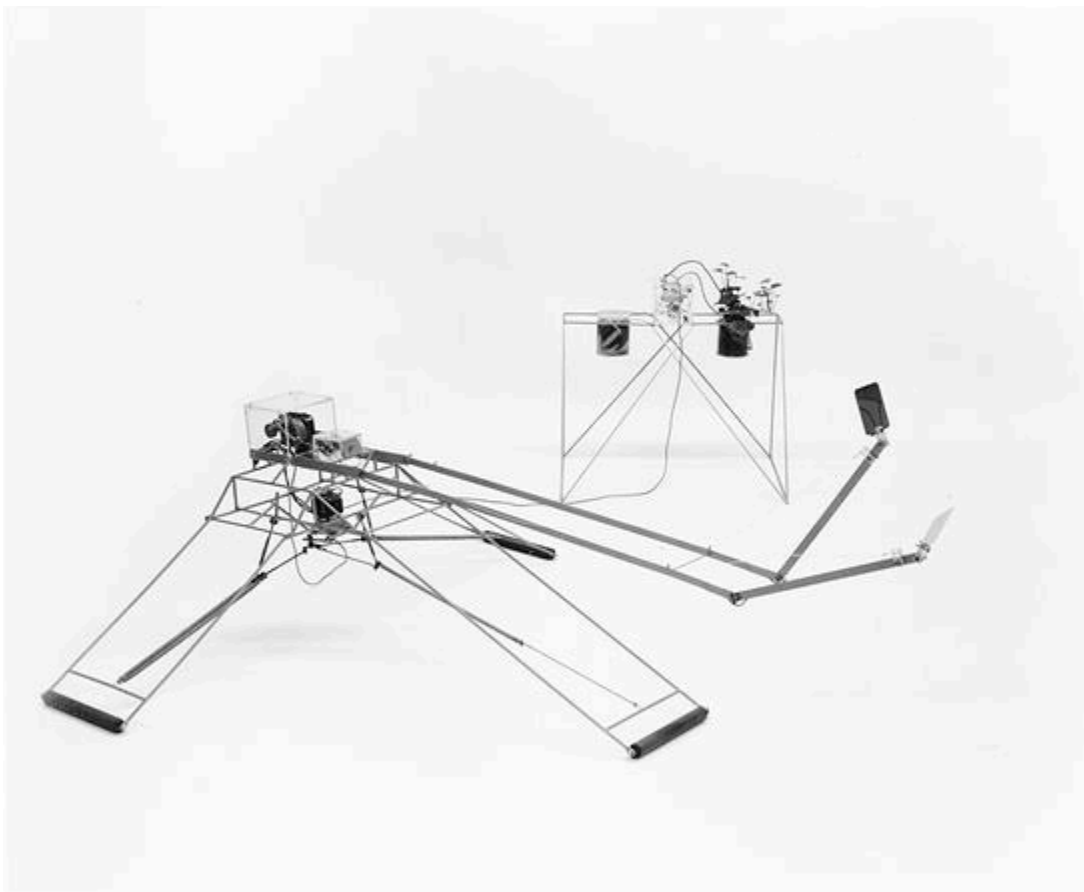


Figure 17 - Squat, 1966

This robotic structure moved its arms, retracting and extending its parts in response. This project sparked intriguing reflections and questions. As Edward Shanken states, "Joining organic and inorganic elements, the hybridity of the work opens up questions about the interplay between nature and artifice, between humans and machines. The simple connection the piece makes between these elements suggests that they should not be seen as opposites, but rather part of the same overarching system." ¹⁸

In 1970, the cybernetic artist Edward Ihnatowicz created the most significant and recognized work of his career: the robot called "The Senster." This work was a large-scale hydraulic machine capable of sensing the ambient sound and the motion of people around it. Moreover, it could move in response to the data captured by its sensors, facilitating direct interaction between the environment and the human variables present within it.

"The Senster" marked a significant milestone as it was the first robot controlled by a computer. It utilized microphones as motion radar and incorporated motors within the context of a large-scale robotic sculpture. This pioneering artwork laid the groundwork for a trajectory and development of machines capable of sensing the environment and reacting to it, which would become one of the pillars of new media art in the subsequent decades.

¹⁸ Edward Shanken, *Art and Electronic Media*, Thames & Hudson Themes & Movements series (London: Thames and Hudson, 2009), 143.

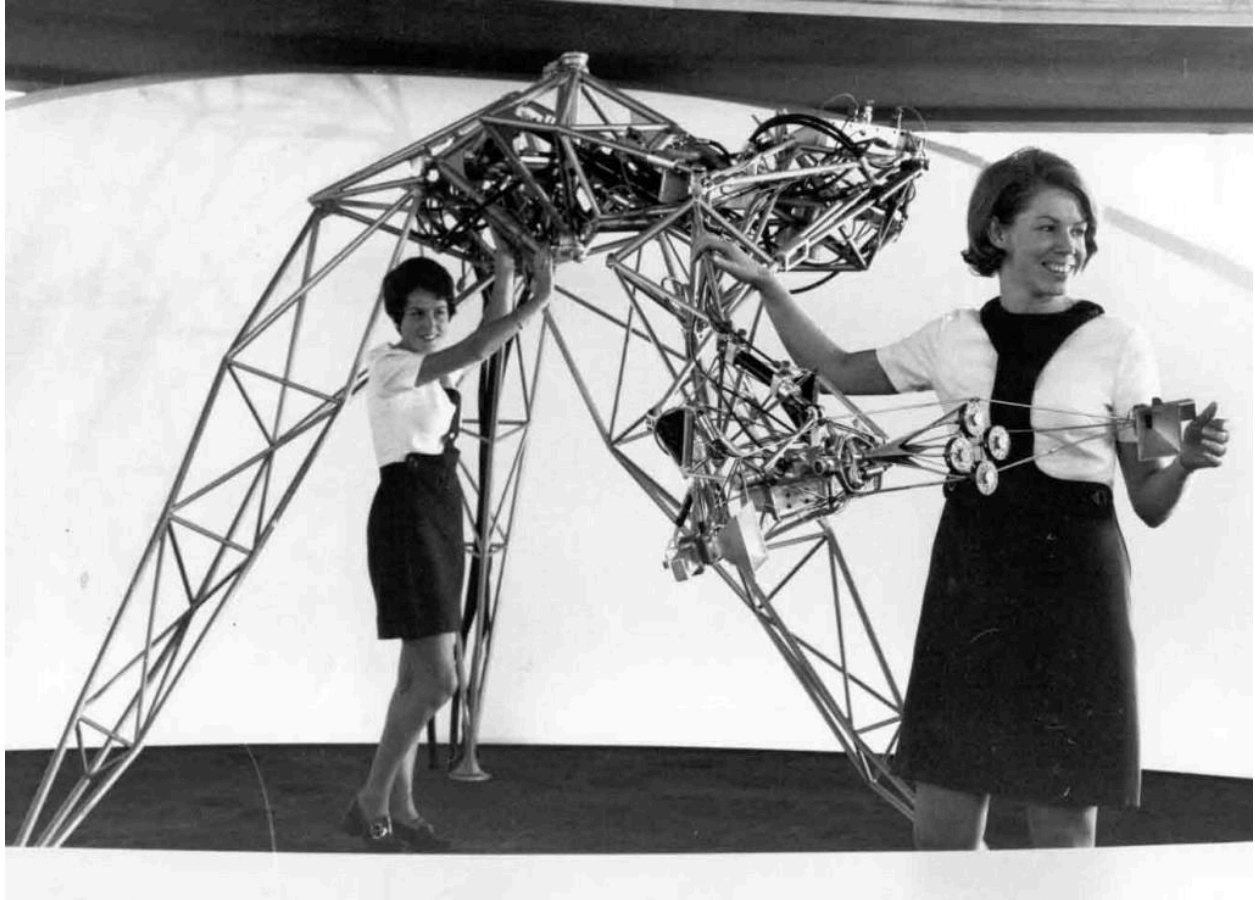


Figure 18 - The Senster, 1970

In the 1980s, the Australian artist Stelarc embarked on ongoing research and technological development exploring the relationship between the human body and machines. As a transhumanist artist, he has delved into various forms of human-machine interactions. Some of his works involve technological prostheses, extending human capabilities beyond what the biological body can naturally achieve. Other explorations focus on human-machine performances, where a robot reacts to his movements, creating a dialogue between his body and the machine.

In Stelarc's own words, his intention regarding human-machine interaction is rooted in both existential and ontological realms: "The body has become a contemporary chimera of meat, metal, and code, performing beyond the boundaries of its skin and beyond the local space it inhabits. Our machines amplify our bodily power and propel the body at great speeds. Our sensors and instruments extend and enhance the body's sensory perception. This generates unexpected paradigms of the world we inhabit. We now navigate from deep time to physical nanoscales to virtual non-places".¹⁹

In 2022, Stelarc and Dr. Paul Loh, David Leggett, Psyche Hou, Qiushi Zhou, Gabriele Marini, Dr. Eric Schoof, Melbourne School of Design, School of Computing and Information Systems, LLDS Architects, Pelican Studios and Festo, created the project called "Anthropomorphic Machine."

The Anthropomorphic Machine is an interactive and performative robotic installation engineered with pneumatically actuated rubber muscles, steel tendons, a deformable tensegrity skeletal structure, a circulatory system of compressed air, and a vision and computational system. It embodies a synthetic organization that allows for the emergence of form through an open system of collective behaviors, including local and remote human presence and actions.

¹⁹ Stelarc, "What it means to be human is perhaps not to remain human at all," 2023, <https://iotainstitute.com/wp-content/uploads/2020/09/02-Stelarc-interview-Final.pdf>.

Under the tensegrity canopy, the vision system detects the density, distribution, and dynamics of people beneath it, prompting the Anthropomorphic Machine to respond with undulating, swaying, pulsing, or glitchy behaviors, creating a vocabulary of machine aliveness.



Figure 19 - Anthropomorphic Machine, 2022

Moreover, the Anthropomorphic Machine is not merely a visual structure but also a sound machine. The choreography generated by its interaction composes compressed air sounds and solenoid clicks, immersing the audience in its acoustical landscape.

1.6 AI and Machine Ontology

1.6.1 AI, utopias and speculations

In addition to the interrelationship between machine, sensing, environment, and human and non-human entities, the advent of artificial intelligence has pushed the idea of sentience even further, advancing toward the notion of machine consciousness and, consequently, machine ontology.

Evaluating further the consequences of machines in terms of human perception, meaning the flow of information: the environment, the human biology, the technology devices, and the human interpretation of the environment, and also understanding that the focus of discussion here is the relationship between the environment and machines, it is appropriate to ask what is the role of the machines and technology in that information flow: Is technology only a bridge between the world and humans? That question implies that machines or technology are only tools to achieve some purpose. However, observing how technology has changed everything around us and how it has evolved and is involving in all parts of human life, it is possible to understand technology beyond its usefulness. In this sense, technology could be understood as a complex language, a culture that has its own codes, procedures, and meanings that converge with the environment. Therefore, it is possible to state that technology is a complex interaction system with the social system that generates new symbologies, objects, and communication codes. Consequently, the relationship between humans and machines is not just morphological, it could also be ontological. In this sense, the philosopher Guattari, in his book *Chaomose*, reformulates the idea

of machines, extending it further to the field of technology, going beyond the signifier of the machines and the limits that represent technological devices:

Through these positions, we will attempt to discern various levels of ontological intensity and envisage machinism in its totality, in its technological, social, semiotic, and axiological avatars. This will involve a reconstruction of the concept of a machine that goes far beyond the technical machine. For each type of machine, we will pose a question, not about its vital autonomy - it's not an animal - but about its singular power of enunciation.²⁰

In this sense, in the information flow mentioned above, a bifurcation can appear: in one sense, the human interpretation mediated by technology, and in the other, an interpretation model mediated by the machine's own language, thus advancing to the hybridization: human/machine, and also toward an ontology of machines.

In this context, artist Kimberly Lyle has embarked on an intriguing artistic exploration of language, sound, and machines. Her work "After Words" (2019) consists of an apparatus that, activated by the user's exhaled breath, generates random combinations of consonants and vowels. This creates pseudo-speaking structures reminiscent of human language but imbued with a surreal quality that elicits a sense of confusion regarding their meaning. This piece delves into the concept of language as a self-generating system, using sound elements to expand language understanding.

²⁰ Félix Guattari, *Chaosmosis: An Ethico-Aesthetic Paradigm* (Indianapolis: Indiana University Press, 1992).



Figure 20 - After Words, Kimberly Lyle

As expressed by the artist, "By using these machines to rearrange sounds of language and incorporating my personal experience, I'm questioning the logic behind systems of knowledge that are often invisible and deeply integrated into our everyday lives. It is my hope that by reducing language to its most fundamental parts, their sounds start to make sense by themselves — another kind of sense than words do".²¹ In this manner, the project serves as a thought-provoking example of a technological artwork that delves into realms beyond human language, challenging its communicative purpose and exploring the language of machines. refutation of the boundaries between humans and machines.

²¹ Kymber Lyle, "Afterwords," accessed June 21, 2024, <https://kimberlyle.net/#/after-words/>.

In 1985, Donna Haraway presented the Cyborg Manifesto, stating the cyborg concept as a refutation of the boundaries between humans and machines. This proposes a hybridization as a cybernetic organism that emerges from a given context and social relationships. For Haraway, the concept of cyborg goes further:

“The cyborg age is here, and now, everywhere, there's a car or a phone or a VCR. Being a cyborg isn't about how many bits of silicon you have under your skin or how many prosthetics your body contains. It's about Donna Haraway going to her gym, looking at a shelf of carb-loading bodybuilders' foods, checking out the Nautilus machines, and realizing she's in a place that wouldn't exist without the idea of the body as a high-performance machine. It's about trainers. "Think about the technology of sports footwear," she says. "Before the Civil War, right and left feet weren't even differentiated in shoe manufacture. Now we have a shoe for every activity." ²²

The cyborg concept has generated a culture around the idea of the human machine, expanding the idea of the body by using technology in our lives and using the body as material for experimentation. This transforms the body into something different from its nature, introducing the posthuman culture.

There have been years of ongoing discussion about human hybridization by technologies, cyborgs, posthumans, and transhumanism. Considering this discussion and current artificial intelligence research, it is possible to ask: could the technology go further and create its own

²² Hari Kunzru, "You are a Cyborg," *Wired*, 1997, <https://archive.gyford.com/1997/wired-uk/2.12/features/haraway.html>.

existence beyond human beings? Is it possible to create systems that could give way to the ontology of machines mediated by AI?

It is necessary to say that current AI is an ongoing technology much closer to a utopian philosophy than having real analogies between human intelligence and artificial ones. In this sense, Johana Zylynska states about the current AI generation:

The renewed interest in AI research has been accompanied by a change of tack: from what became known as Artificial General Intelligence, whose goal was to replicate the human's mental functioning as such, to specialized, or 'narrow' AI, focused on performing particular tasks and solving singular problems. The new approach involves developing artificial neural networks, which at a rudimentary level imitate the way neurons in the brain work.²³

This new direction transformed the utopia of thinking machines from speculative analogy with human complexity into powerful computer skills that can resolve specific problems. This allowed for incredible advances in information processing, affording machines the skill of precise decision-making and performing certain specific tasks based on the training of a large set of data. This new perspective is beyond the idea promised and speculated about historically. Nevertheless, AI technology is still a field that provides deep questions about the future of humanity and machines, giving the context to continue speculating on what will come next.

²³ Joanna Zylynska, *AI in Art* (London: Open Humanities Press, 2020).

1.6.2 AI and sound

In the sound field, different technological advances related to AI have happened in the last few years, generating artistic, scientific, and commercial applications. It is especially relevant to mention highly advanced sound recognition systems like speech-to-text and new possibilities in sound recognition of more complex sounds, like everyday and natural sounds, through signal processing and Machine Listening.

Machine Listening is a branch of the AI field that amplifies the results of the advancements in speech recognition research in the last 70 years. Therefore, if it is possible to process the voice and take linguist information, recognize words, gender, and even speech emotion, is it also possible to recognize more complex sounds like music or sounds from complex sound environments. Izotope, for example, is a commercial tool for studio recording that analyzes the audio signal and, through machine learning techniques, suggests custom presets tailored to the sound you're trying to achieve. Andrew Owens of MIT also created an algorithm to insert sounds in silent videos. Through image analysis and the training of thousands of movie scenes and sound effects, a neural network predicts which sound will synchronize with the image. Other advances in Machine Listening have allowed for the recognition and description of sound environments, which will determine if the ambient sound is an airport, stadium, library, park, or coffee shop. There is also an algorithm that allows for the recognition of short sounds, like “sound objects,” and also describes their characteristics.

These examples clearly provide exciting tools to process audio signals and gather valuable information, allowing machines to make decisions. However, this model is still based on the usefulness paradigm rather than on how to extract sense and more profound meaning from the information obtained.

From this perspective, a question emerges: how can a machine listen to sounds and then process them to make an unexpected decision? That process may not be necessarily useful, but it could be challenging, confusing, provocative, or generate results in an *imminent state*.²³ That means, in other words, it seems necessary to ask how this intelligent process can create art, but art pieces that differ from those that humans can create. It is necessary to find reasons to use this high technology in art. Therefore, the artistic challenge is to pass from using AI as a methodology to recreate or even create art using known and human parameters to moving toward a model that can create an artistic language, a potentially non-human language.

The question arises: how can powerful technology serve complex purposes while simultaneously creating systems where machines not only observe and listen to their environment, but also make decisions and develop models that lead down unpredictable paths? This, in essence, is a move towards a non-human aesthetic. We are building devices and models that extend listening beyond human comprehension, fostering "machinic" interpretations through AI systems.

Given the rapid advancement of AI, it's crucial to maintain a critical distance. This allows us to conceptually explore its potential while acknowledging its ongoing development. Such a reflective approach fosters a counterpoint to mainstream narratives about AI's capabilities. This

critical stance naturally leads to questions: How can AI redefine artistic creation? But beyond being a tool, can AI itself develop an artistic language? Could this technology unlock entirely new, non-human aesthetic possibilities?

These questions and reflections regarding the relationship between humans and machines, the interpretation of reality through listening, and the question about how technological devices and AI create new contexts and scenarios, thrust the idea of the possibilities of experimental processes that could make complex interpretation models about the physical environment, that could give way to new symbols, senses, and meanings through sound experiences.

One aspect of this project is using AI to create sound narratives. Based on the reflections from this last chapter, my approach to AI has been situated in a critical position. The approach was mainly an exploration of AI glitching as territory to find holes, cracks, and gaps that create the space to escape from the idea of AI efficiency and literality, opening up experimental and aesthetic paths toward the creation of speculative soundscapes.

Chapter 2 - The process

This second part narrates the process of two projects that precede the final artwork. This chapter is particularly relevant because the final artwork is a straightforward consequence of the research process that was involved in the development of these two works.

"The Ear" (2021) marked the beginning of my interest in Artificial Intelligence, allowing me to gain specific insights into its use in the art field. Then, "Imaginary Machines" (2022) provided the experience of opening the question about AI and the sound field. Simultaneously, it triggered my exploration of designing and fabricating antennas.

Furthermore, because of the questions that both projects provoked, reflections emerged about technological apparatuses and the environment, ultimately leading to this project's main question: the **tension between technology and nature**.

2.1 The Ear

2.1.1 A surveillance system

In early 2020, inspired by the ideas of philosopher Byung Chul-Han regarding how Western and Eastern countries were facing the COVID-19 pandemic, addressing concepts such as surveillance systems and individual freedom, I developed an artistic work called "The Ear."

"The Ear" is a project centered around listening, surveillance, and Artificial Intelligence. It involves a device that collects human voices, transcribes them into text, and uses that information to generate new texts generated by an AI.

Drawing inspiration from the acoustic mirrors constructed by the British army during the First World War, which were capable of reflecting and concentrating sound waves and were used as acoustic radars, I created a parabolic acoustic mirror capable of capturing sounds from long distances.

The initial challenge for this project revolved around distinguishing between ambient noise and human voices. To address this, I utilized real-time Speech-to-Text AI from Google. Initially, my focus was not on transcription, but seeing the results sparked a particular curiosity.

I conducted experiments by installing the parabolic dish in public spaces. Due to the shape of the parabolic dish, which acts as an acoustic filter, and the surrounding ambient noise, the

transcriptions were not entirely accurate. Instead, they generated peculiar texts based on the AI's attempts to predict words from the limited information it could recognize.

Below is an example of the first experiment involved utilizing real-time Speech-to-Text with a parabolic dish installed in a public space.

cuz

cuz I'm

cuz I'm nice

cuz I am the night

a little

a little

play Orlando

play Orlando

play Orlando

play

girl games

girl games

girl games

how many more

how many more days

can I watch

I've been giving you

better

better

better

acoustic blues

acoustic blues

what is

everything yesterday

everything yesterday

These experiments sparked questions regarding the degradation of information by technology and also raised inquiries into the source of the texts generated by AI. It became evident that while some words may have originated from the actual conversations captured during the experimentation, many others were created by the machine itself. This discrepancy led to exploring the creative and aesthetic possibilities inherent in these failures.

The primary question that emerged was, what kinds of creative and aesthetic pathways these technological glitches could open up? By delving into the interplay between human input, machine interpretation, and the resulting output, the experiment prompted reflections on the nature of creativity, authorship, and the role of technology in artistic expression. It encouraged reevaluating traditional notions of text creation and raised possibilities for harnessing technological errors as a source of artistic practice.



Figure 21 - The Ear, 2021

2.1.2 First Iteration

In the initial iteration, I mixed real-time transcriptions with generated texts using Natural Language Processing (NLP). To accomplish this, I employed a dataset comprising the Acts of Surveillance and Intelligence of Foreign Countries, sourced from the United States Congress via WikiLeaks. This dataset was then trained using GPT-2.

The parabolic dish collected voices, swiftly transforming them into text in real-time, and subsequently utilized these texts as prompts. A text-to-speech system was then employed to audibly play the generated texts. The outcome was a peculiar, surreal blend of everyday conversations occurring in the vicinity of the installation and political speech about surveillance sourced from WikiLeaks.

Below are extracts of generated texts from The Ear installation at the Flux Factory: Group Exhibition: Survival Tools for the Age of Ultra Anxiety, November 2020. (The highlighted words are the prompts, which are real-time transcriptions from the exhibition day)

['**Coronavirus** update to address concerns raised by the Director of the FBI concerning the Terrorist Threat Assessment (TTA) and the process through which the Intelligence Community determines that the threat it is attempting to protect does not include a nexus between terrorism and a wide range']

['**tell me a joke**. . . they are the only ones who can tell the jokes of their country. . . they are the only ones who can break the spell of monotony." S. 2845, Section 323.\nJokes. . .']

['**What song is this all about?**" The answer, of course, is that it is all about the 9/11 Commission recommendation']

2.1.3 Creative Resistance to Anglocentric AI Research

In 2021, I was invited to exhibit this work at the IN-SONORA New Media Art Festival in Madrid. One of the first challenges I encountered was related to language. It seemed incongruous to exhibit in Spain and display texts solely in English. This realization posed both technical difficulties and conceptual challenges.

The initial hurdle involved locating a pre-trained model in Spanish to facilitate the training, fine-tuning, and generation of texts in Spanish. This proved to be a significant obstacle, as the predominant language of technology is English. This issue prompted reflections on the anglocentric nature of technology and raised broader questions about colonialism and the bias inherent in such technologies.

Navigating these challenges required technical adjustments and prompted deeper considerations about the cultural and linguistic biases embedded within technological frameworks. It underscored the importance of addressing linguistic diversity and cultural representation in developing and implementing technological systems.

Ultimately, these questions and reflections resonated with other PhD students and professors at DXARTS at the University of Washington, culminating in the establishment of a research group, Creative Resistance to Anglocentric AI Research, under the direction of Prof. Tivon Race. This group constituted an artistic research project wherein artists engaged with emerging artificial intelligence systems, mainly focusing on languages and contexts beyond English.

The primary objective of this project was to acknowledge and address the inherent bias toward English within Natural Language Processing (NLP) systems. By doing so, the group aimed to develop strategies for working critically and creatively beyond these limitations. Through collaborative exploration and experimentation, the research group sought to challenge the dominant anglocentric paradigm in AI research and foster a more inclusive and culturally diverse approach to the development and application of artificial intelligence technologies.

These reflections and technical challenges surrounding the Spanish model also prompted a reconsideration of the appropriate dataset to use. The question arose: Does WikiLeaks make sense in this context? Ultimately, the underlying issue that emerged revolved around the significance of context, place, and territory: what dataset could enhance, emphasize, and reinforce the notion of "place."

2.1.4 From a Surveillance system to a cultural apparatus

The answer became evident: the dataset should consist of the transcribed texts—the voices interacting with the parabolic microphone through “The Ear.” By focusing on the actual conversations and interactions occurring within the specific context of the installation site, the project could authentically capture the essence of the place and its unique atmosphere. This shift in approach enabled a more direct engagement with the immediate surroundings and facilitated a deeper exploration of the interplay between technology, environment, and human interaction.



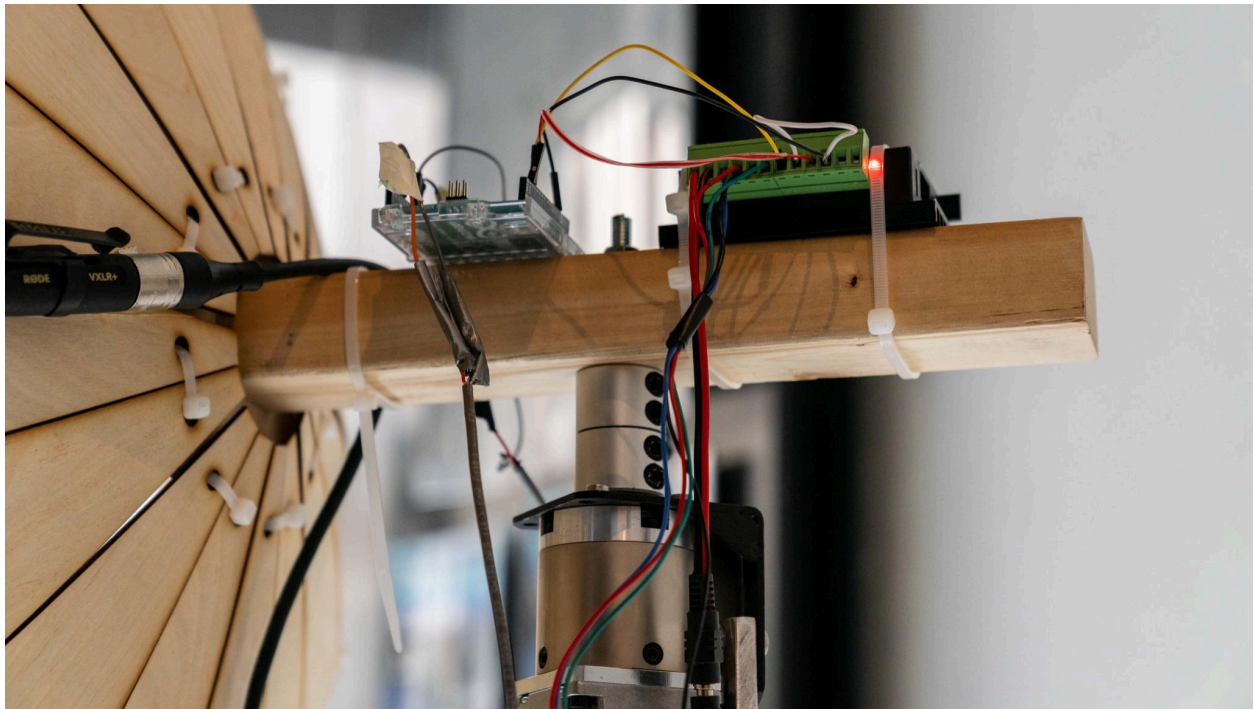


Figure 22 - The Ear, In-Sonora, Madrid

Therefore, this machine utilizes the collected texts as its dataset, progressively accumulating more information from the environment where it is installed daily. The dataset constantly undergoes training, enabling the creation of AI-generated texts tailored to the specific circumstances in which the machine is involved, thereby transforming the piece into a cultural apparatus.

The AI-generated texts are then presented through small parabolic speakers using a computer-generated voice, effectively reintroducing the data into the acoustic realm. The experience with the piece illustrates how the human voice is transformed into a digital object that can be analyzed, recorded, converted, stored, and utilized. This process prompts critical reflections on the concept, significance, and value of information, privacy, locality, and freedom in our contemporary society.

Furthermore, it challenges the relevance of information collected in surveillance systems and raises questions about the ethical and political boundaries associated with such devices. By engaging with *The Ear*, viewers are invited to contemplate the implications of transforming human communication into digital data and to critically examine the broader societal implications of technological surveillance and data collection practices.

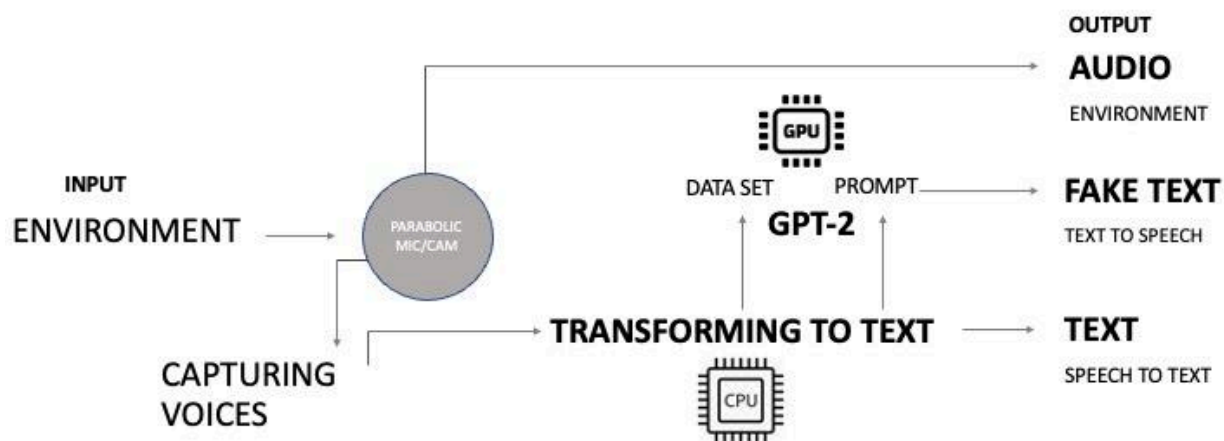


Figure 23 - The Ear System scheme

2.1.5 The Ear a chain of errs

The aesthetic experience of The Ear emerges from the mistakes produced by the machine itself. Real-time Speech-to-Text frequently errs, transforming coherence into degraded text and introducing absurdities and invented words. Moreover, as the dataset is based on collected texts, the AI-generated texts become even more absurd, giving rise to a peculiar form of digital poetry.

This process results in a listening experience centered around an AI experimental narrative created by the machine amidst a series of mistakes. These glitches highlight the imprecision and flaws inherent in such systems, exposing their limitations.

Subsequently, the Text Generation with NLP perpetuates this chain of mistakes, generating even weirder yet experimental and somewhat poetic texts. The continuous cycle of errors becomes an integral part of the artistic process, fostering an aesthetic experience that challenges the notions of AI efficiency and literalness.

Below are two examples of two generated texts after five days of listening to conversations in the public space and trained by an AI model. It took place in Madrid, Spain, at the IN-SONORA New Media Art Festival in 2022.

Alianzas nuestro antídoto contra españoles

haciendo las fronteras somos dolor y baile

convertidos en Resistencia

alianzas

nuestro

antídoto

contra

españoles

haciendo

las

fronteras

somos

dolor

y

baile

convertidos

en

Resistencia

Alliances our antidote against Spaniards

making the borders we are pain and dance

converted into Resistance

alliances

our

antidote

against

Spanish people

doing

*the
borders
are
pain
and*

*dance
converted
in
Endurance*

“Ahí vamos a la licuadora licuadora
licuadora carga la tumba del machismo

“There we go to the blender blender blender

load the tomb of machismo Madrid

Madrid
allá
nosotros vamos
a
el
licuadora
licuadora
licuadora
llevar
el
tumba
de
sexismo
Madrid"

*there
we go
to
he
blender
blender
blender
carry
he
grave
of
sexism
Madrid"*

It was possible to observe how pushing this technology just a little bit out of its ideal technical conditions causes the system to fail and make mistakes. The texts produced by speech-to-text, when attempting to predict what the machine is hearing, often lead to unexpected results. This creates an aesthetic opportunity to reimagine or speculate about our sound environment based on machine inefficiency and glitches.

This research ultimately raises questions about what other sounds AI systems can "understand." Can they recognize complex sounds, such as everyday and natural sounds, through signal processing and Machine Listening?

2.2 Imaginary Machinescapes

On July 31, 2017, The British newspaper The Independent published an article titled: “Facebook's artificial intelligence robots shut down after they start talking to each other in their own language.”²⁴ Facebook had created two chatbots with instructions for negotiating with each other. However, researchers noticed that the way the chatbots communicated appeared understandable to them but not to humans. The article explains that the robots simplified the language, creating shorthand and borrowing only what was necessary from the English language to communicate with each other, effectively creating a pseudo-language.

The initial question that arises from this anecdote is why the company chose to halt the operation of the machines. According to the newspaper, it was because the bots were designed for a human communication experiment, and based on the results, they diverged from the intended direction. This explanation also raises questions about the utility and functionality of the bots. Although researchers have not provided further details about the “incident,” it can be inferred that the chatbots failed to serve their intended purpose, deviating towards an experimental direction and producing inconsistent and unpredictable results.

This anecdote prompts reflections on the rules and context from which these machines derived their pseudo-language. It allows us to ponder whether technology could progress to the point of

²⁴ Griffin, Andrew. "Facebook's Artificial Intelligence Robots Shut Down after They Start Talking to Each Other in Their Own Language." *The Independent*, July 2017. <https://www.independent.co.uk/life-style/facebook-artificial-intelligence-ai-chatbot-new-language-research-openai-google-a7869706.html>.

creating its own existence beyond human comprehension.

2.2.1 The Sound Environment and Machine Listening

In general terms, machine listening is an AI branch dedicated to analyzing audio files or live-streaming sounds. An AI model compares the input with a trained dataset of labeled field recordings. Finally, employing an artificial neural network, it predicts the nature of the sound and assigns it a category.

For the Imaginary Machinescapes project, I utilized Google's AudioSet Ontology model. This model is founded on a vast dataset comprising over 2 million sounds extracted from YouTube videos and is proficient in providing 527 categories.

The initial exploration of this model involved creating a small piece of code. In this code, a microphone captures ambient sounds, generating a continuous audio stream. The program produces an audio file from the microphone's signal every five seconds, which the model then analyzes to determine potential categories.

The initial conclusion drawn from this experiment was that under ideal conditions, the model can precisely recognize various types of sounds. However, for artistic and conceptual purposes, this experimentation raised questions about the significance of a machine's ability to categorize sound. Does this process indeed generate meaning and potential aesthetic experiences?

While the model serves a powerful purpose in classifying and categorizing sounds, particularly in contexts like descriptive movie captions, it is essential to delve deeper when considering the experiments presented in this research as a part of an artistic inquiry.

One potential approach to addressing the question above is through the perspective proposed by the Argentinian philosopher Nestor Garcia Canclini regarding art. He suggests that contemporary artworks exist in a state of Imminence, wherein they evoke an emotional state where things are in suspense and something is on the verge of happening. In essence, the artistic experience resides at a juncture where it is sufficiently clear to captivate us yet enigmatic enough to allow us to project our own concepts and meanings onto it. This emotional state fosters curiosity, igniting the intention to contemplate and reflect upon elements that are not entirely explicit or implicit.

From my perspective, this viewpoint suggests that art is an experiential realm whose components must possess sufficient substance and significance to allow audiences to contemplate a particular topic addressed in the piece. Moreover, the strategies employed to provide such an opportunity also hinge on striking a balance between the explicit and the implicit, between hints and assertions. Thus, the unexpected and the imminent serve as the guiding principles in uncovering meanings.

While Sound Recognition assigns categories to environmental sounds, thereby generating semantic fields related to our surroundings, it becomes essential to inquire: what purpose does this word cloud serve? How can Sound Recognition serve as a conduit for delving deeper and producing an aesthetic outcome?

2.2.2 The interdependence of unities.

From the perspective of Vilém Flusser, our society is currently experiencing a systemic era. Humanity is transitioning from a historical mode of thought, wherein phenomena are understood through linear cause-and-effect processes, to an era where everything is interconnected within a complex network of representations and meanings. From this viewpoint, it becomes evident that the mere ability to classify does not inherently imbue meaning. In the case of the Machine Listening process, the system can identify an object within a cloud of concepts, thus generating a field of words. However, the crucial question arises: how can connections be forged with other entities, memories, or concepts to establish a meaningful system?

Taking this inquiry further, Donna Haraway introduces the concept of Sympoiesis. She posits that the interrelationship between entities is on cooperation, emphasizing that living systems cannot self-organize autonomously; they require other entities for sustenance and reproduction. Haraway extends the concept of autopoiesis into a generative framework through Sympoiesis. In this context, the challenges inherent in this artistic research lie in how the relationship between nature and the machine can function as a system. This system should facilitate its components' intersection, interdependence, and symbiosis to engender new meanings, thus creating novel scenarios, symbols, and realities.

2.2.3 Experimenting with sound and connecting with other semantic fields.

To address this artistic challenge, the following experiment aimed to integrate the categorization process into a system capable of providing an additional layer of meaning. The objective was to explore how the categories provided by sound recognition could yield outcomes beyond mere literal categorization.

For this experiment, I utilized the open-source sound repository Freesound (www.freesound.org). Freesound is a free repository where every community member can upload field recordings and sound effects. With a collection of over 500,000 sounds, it offers a vast library encompassing various types of sounds.

This new exercise complemented the previous one. Essentially, it involved Machine Listening recognizing a sound from the environment, and assigning a category. Subsequently, the system would interact with the Freesound API, utilizing the recognized category as a label to search for and download an audio file with a matching label and category, which would then be played.

Below is an example of how the loop operated using the model and Freesound:

1. The Machine Listening model detects a sound from the environment and categorizes it.
2. The system utilizes the recognized category as a label.
3. The system interacts with the Freesound API, searching for audio files that match the detected category.
4. A suitable audio file is found and downloaded from Freesound.

5. The downloaded audio file is played, adding another layer of meaning to the original sound.

This loop demonstrates how integrating the Machine Listening model, and Freesound allows for exploring additional layers of significance in sound categorization and playback.

In loop

...

INPUT SIGNAL: Open microphone, inside room, starting without any sound (sample of 5 sec)

CATEGORY RECOGNIZED: "SILENCE"

OPERATION: Download a random sound labeled as "SILENCE" from freesound.org

OUTPUT: Play on speakers the sound downloaded

OUTPUT = INPUT

...

A notable aspect of Freesound is that many audio files labeled as "SILENCE" do not represent physical silence. In some cases, they comprise quiet soundscapes, natural or rural environments, or even subtle hums or noises. This occurs because members of the Freesound community may upload sounds that, for various reasons, evoke a sense of "silence" for them and tag them accordingly.

This exercise juxtaposes two semantic worlds, AudioSet Ontology and Freesound, each with distinct labeling criteria. The former relies on human labeling based on Wikipedia and human descriptions by the Google Team, while the latter allows each community member to use their own labeling criteria, resulting in a less controlled labeling process.

Thus, while the categorization by the Machine Listening model may be highly accurate, merely connecting it with Freesound can yield unexpected outcomes. A typical scenario in this experiment is the system initially recognizing “SILENCE,” followed by displaying a tranquil rural soundscape with bird sounds. Subsequent categorizations might include “ANIMALS,” leading to the display of any sound labeled as such, and so forth.

Although the results may appear random to some extent, depending on the input signal, they can also guide the system towards specific types or families of sounds, providing a degree of control. In other words, the accuracy of the system in recognizing the input sound determines the level of control over the output and the predictability of the results, establishing a potent interdependence between the environmental signal captured, the categorization by the AI system, and the fictional soundscape created based on the sound files from Freesound.

The critical question is: how far can the system deviate from the input signal to produce unpredictable sounds? How does the system avoid a literal interpretation and direct connection between input and output?

2.2.4 The input: Technonature signals

To transcend the literalness of sound recognition, pushing the AI to fail, it became imperative to introduce an input signal with some degree of complexity, thereby pushing the AI model to its comprehension limits. In this regard, I opted to utilize sounds from electromagnetic fields, employing an Antenna Loop capable of capturing electromagnetic fields radiated from electronic devices, electricity networks, and various technological and natural phenomena.

From my perspective, there are three compelling reasons to explore electromagnetic signals as inputs: Firstly, these waves represent complex sounds that are challenging even for humans to describe. Initially perceived as mere noise, humans attempt to articulate them as distinct entities with specific characteristics upon closer listening. Despite our limited understanding, we instinctively associate them with familiar concepts. This capacity for connection imbues these signals with meaning and narrative potential. However, in the case of AI, what transpires when the input signal lies outside the established dataset? What manner of understanding, interpretation, and subsequent connections become feasible in the face of such a challenge?

Secondly, these signals originate from various natural phenomena, human activities, and technological signals. Simultaneously establishing a direct correlation between the physical source of the signal and the resultant sound proves challenging. This disconnection between source and sound engenders a fertile field of study characterized by conceptual ambiguity, opening avenues for speculative understanding. For instance, if we consider solar storms propagating through the Very Low Frequencies of the radio spectrum, the resulting sound may

deviate significantly from our preconceived notions of how solar storms manifest. Similarly, the sounds produced by satellites, phone signals, and other non-natural activities may defy our expectations. These imperceptible phenomena become audible through technological devices, wherein the electrical signals traversing the radio spectrum are transduced into audio signals. Consequently, these phenomena, which lie beyond our direct auditory experience, introduce an intriguing conflict regarding categorizations, descriptions, interpretations, and, ultimately, potential meanings and narratives.

Thirdly, the radio spectrum, through which electromagnetic waves travel, constitutes a vast domain. With the appropriate devices and technology, capturing a considerable array of signals associated with diverse phenomena becomes feasible. These signals present unpredictable and abundant varieties of sounds. Furthermore, these signals can be categorized as non-human sounds or as a form of technological nature. They constitute another layer of the environment, blending elements of technological and human activities with natural phenomena. However, they remain outside our audible, visible, and experiential realm. In a sense, electromagnetic signals represent a distinct categorization of our environment, which can be termed "technonature."

The concept of technonature, as explored by Professor Damian F. White of the Rhode Island School of Design, aids in understanding and conceptualizing the intricate relationship between nature and technology. It prompts questions about the cities, ecosystems, and ecologies we inhabit in the contemporary era. In his book "Technonatures: Environments, Technologies, Spaces, and Places in the Twenty-first Century," Professor White articulates this concept: "Technonatures highlights a growing range of voices considering the claim that we are not only

inhabiting diverse social natures but that within such natures our knowledge of our worlds is ever more technologically mediated, produced, enacted, and contested." ²⁵

In this context, electromagnetic signals can be considered waves traversing through the air. They exist within our environment and nature yet are necessarily mediated by technology through antennas and other technological apparatus. This relationship between technology and nature engenders a symbiosis that integrates technological and natural ecosystems.

2.2.5 The Antenna: A diamond antenna loop

Essentially, an antenna is a device capable of capturing electrical signals traveling through the air. This technological apparatus intercepts a portion of electromagnetic waves and transforms it. Conceptually, an antenna is a physical object capable of extracting invisible and inaudible information from the environment, transforming it into something that can potentially be experienced.

I constructed an antenna loop based on a diamond geometry for my initial approach.

²⁵ F. Damian White, *Technonatures: Environments, Technologies, Spaces, and Places in the Twenty-first Century* (Waterloo, ON: Wilfrid Laurier University Press, 2010).



Figure 24 - Loop Antenna

The initial experimentation with this antenna involved connecting it to an amplifier. Essentially, the antenna captured a significant portion of radio wave frequencies, amplified by an operational amplifier circuit utilizing the LM386 chip.

In essence, this system could capture electromagnetic waves emanating from the electrical network and electronic devices in the vicinity of the antenna.

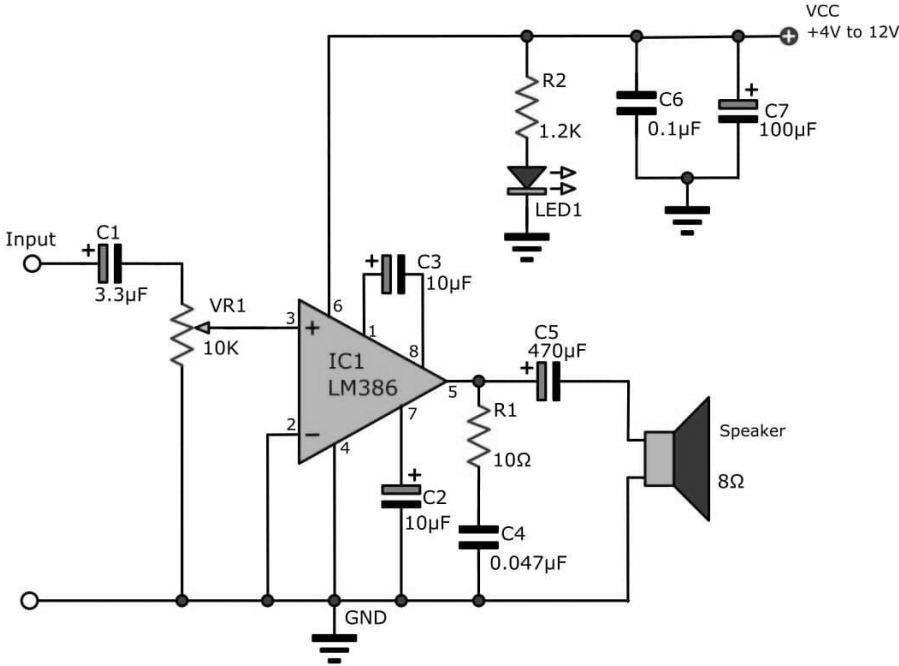


Figure 25 - LM386 amplifier circuit

2.2.6 Antenna, EMF signal, Machine Listening and Freesound

The sound signal obtained was generally stable, although it exhibited occasional minor variations, likely due to human activity in the vicinity. However, these variations consistently displayed similar characteristics throughout the experiment.

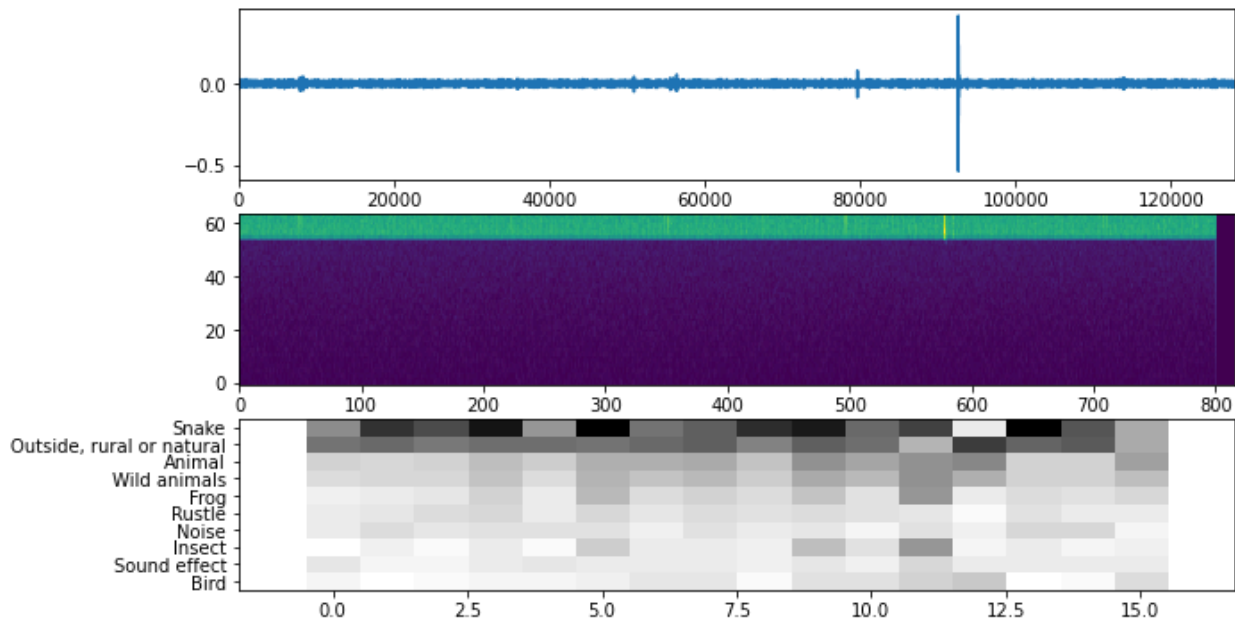


Figure 26 - Sample of the sound captured by the antenna and analyzed by the model.

The sound obtained from the antenna closely resembles the noise associated with electrical hum, with a frequency of around 60 Hz, corresponding to US electrical current.

However, as shown in Fig 26, the signal analyzed by the Machine Listening model primarily was recognized as a "SNAKE" sound. This observation highlights the intriguing aspect of how the system falters when pushed beyond its familiar territory.

The possible conclusion drawn from this experiment is that despite their extensive capabilities, such systems have limitations. They operate based on biases stemming from the notion of objectivity and standardization. The model simplifies the complexity of our environment into a restricted set of words.

However, limitations are inherent in the machines' logic in general. One of the significant conceptual breakthroughs that led to a shift in perspective regarding Artificial Intelligence systems was the realization that these systems ultimately serve specific tasks within a confined domain of operation. Each machine fulfills a distinct function, and this characteristic could be considered an ontological quality.

Despite the machine's limitations and the biases inherent in the model, these glitches represent a potential pathway toward uncovering even more unexpected results. They allow for the generation of speculative soundscapes based on natural signals interpreted and recreated by a machine, which explore new territories based on the interplay and tension between nature and technology.

This experimental procedure prompts questions about the local and global conflict, the unity and interrelationship of systems, and the juxtaposition of territories against hybrid landscapes created by machines.

Despite the potential for this process to evoke aesthetic experiences, questions also arise regarding the antenna itself. The antenna serves a functional role within the system but also holds

symbolic significance. As a component of the system, it must fulfill its intended function effectively, but it also has the potential to assume a sculptural or aesthetic role. How can the object embody a unique identity? What representations can the object contribute within this system?

2.2.7 The Antenna: A Living Architecture

Due to the dependence of the geometry on the frequency response of antennas, a rich experimental field emerges in terms of shape. Specific shapes have been extensively studied, enabling the calculation of frequency response concerning material, geometry, and size. This project is both experimental and aesthetic. Thus, the primary intention is not necessarily to attain specific frequencies and signals but rather to create an object capable of capturing uncalculated information, leading to the discovery of unexpected results. This approach allows, in my view, for a more comprehensive exploration, where each shape and geometry possesses its own characteristics and frequency response.

This notion enables us to transcend mere "antenna efficiency" and delve into experimental terrain, where the possibilities offered by different geometries, structures, and shapes extend beyond technical considerations.

Therefore, it prompts questions such as: How can the antenna also serve as a symbolic object? How can the antenna possess its own uniqueness and distinctive features? Furthermore, how can the object transition into something more sculptural?

Under these questions, and in striving to maintain consistency with specific conceptual ideas that have already surfaced—essentially, the non-human, the interdependence and tension between nature and technology, the concept of technonature, and the speculative and imaginary territories created by machines—I drew inspiration from the architect Buckminster Fuller.

One of his main conceptual ideas that captured my attention is creating architectural principles that originate from something other than human cognition and elaboration. Tensegrity is one of his most renowned concepts, rooted in biological origins, such as cells, water molecules, and even particular animal creatures. He explains the tensegrity principle as a continuous network of balance and synergy between tension and compression forces, creating a self-supporting structure based on geometrical patterns: "a system that stabilizes itself mechanically because of the way in which tensional and compressive forces are distributed and balanced within the structure."²⁶

Furthermore, concerning the relationship between tensegrity and biology, the article 'Tensegrity, cellular biophysics, and the mechanics of living systems,' by Donald E. Ingber, Ning Wang, and Dimitrije Stamenović, demonstrates that at the molecular level, the structure of cells is based on the tensegrity principle. Going further, the tensegrity principle has also enabled cells to detect and respond to external signals because the balanced network can be entirely modified structurally if just one of its elements is perturbed.

²⁶ R. Buckminster Fuller, "Tensegrity," Buckminster Fuller Institute, Santa Barbara, 1961, <http://www.rwgrayprojects.com/rbfnote/fpapers/tensegrity/tenseg01.html>.

This particular feature of Tensegrity transforms this architectural principle into something that extends even further. Conceptually, it embodies a malleable, adaptive structure that responds to its environment. In some ways, it functions as an element within a larger living system:

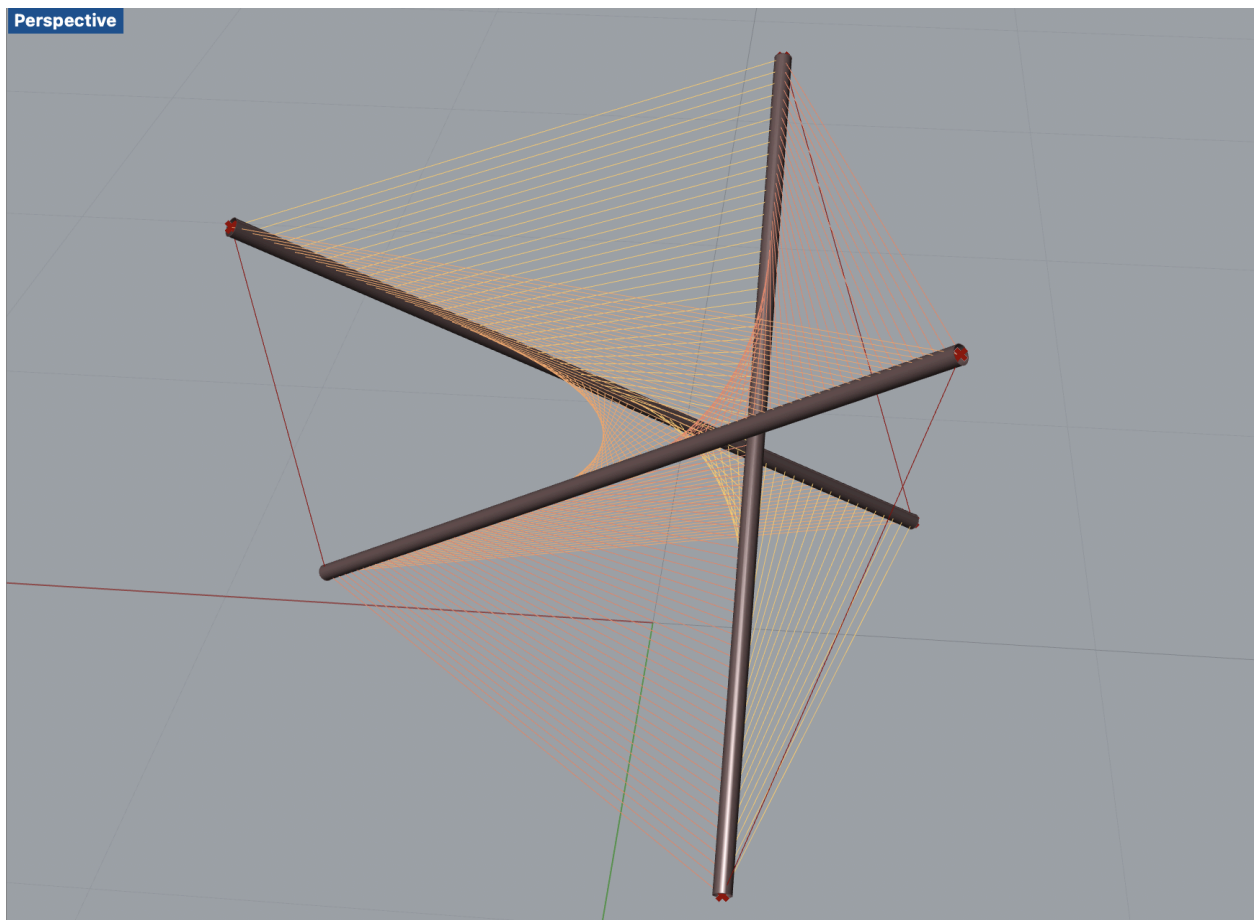
At its core, tensegrity is a system that provides structural stability by imposing a tensile prestress in its compressive and tensile members. But nature has leveraged this fundamental building principle in many ways and at all size scales to create increasingly complex multimodular and hierarchical molecular structures, which has led to the emergence and evolution of living cells and organisms.²⁷

The idea articulated above reinforces two concepts integral to this project. Firstly, the notion that interdependence fosters the development of complex and dynamic systems, and secondly, the idea of living and mechanical entities as components of an integrated system.

In this context, I drew inspiration from the structural experiments conducted by Kenneth Snelson, a student of Fuller and a sculptor. His self-supporting structures, where rigid elements are suspended in a continuous network of cables, create a balanced tension without direct contact between the rigid elements. This structural principle enables the formation of distinctive geometries, embodying a dichotomy between patterns and irregularities, unity and multiplicity, fragility and strength, and the biological and mechanical realms.

²⁷ Donald E. Ingber, Ning Wang, and Dimitrije Stamenović, "Tensegrity, Cellular Biophysics, and the Mechanics of Living Systems," IOP Publishing Ltd, accessed April 2014, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4112545/>.

I created the first prototype of the Tensegrity Antenna using Kenneth Snelson's models' basic structure, which consists of three rigid elements balanced by a continuous network of copper wire turns.



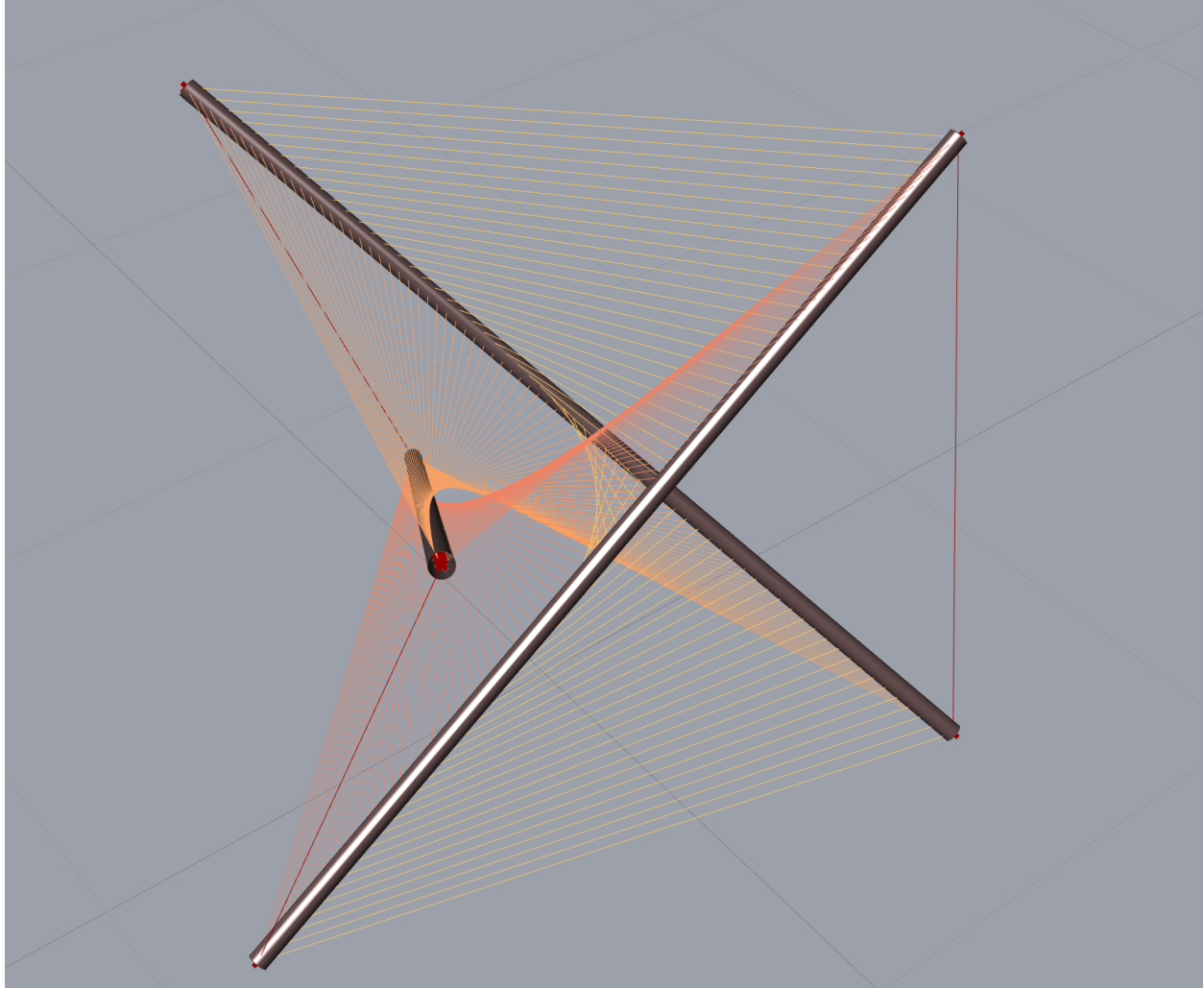


Figure 27 - Tensegrity Antenna Model (Parametric tensegrity model designed with Rhino and Grasshopper)

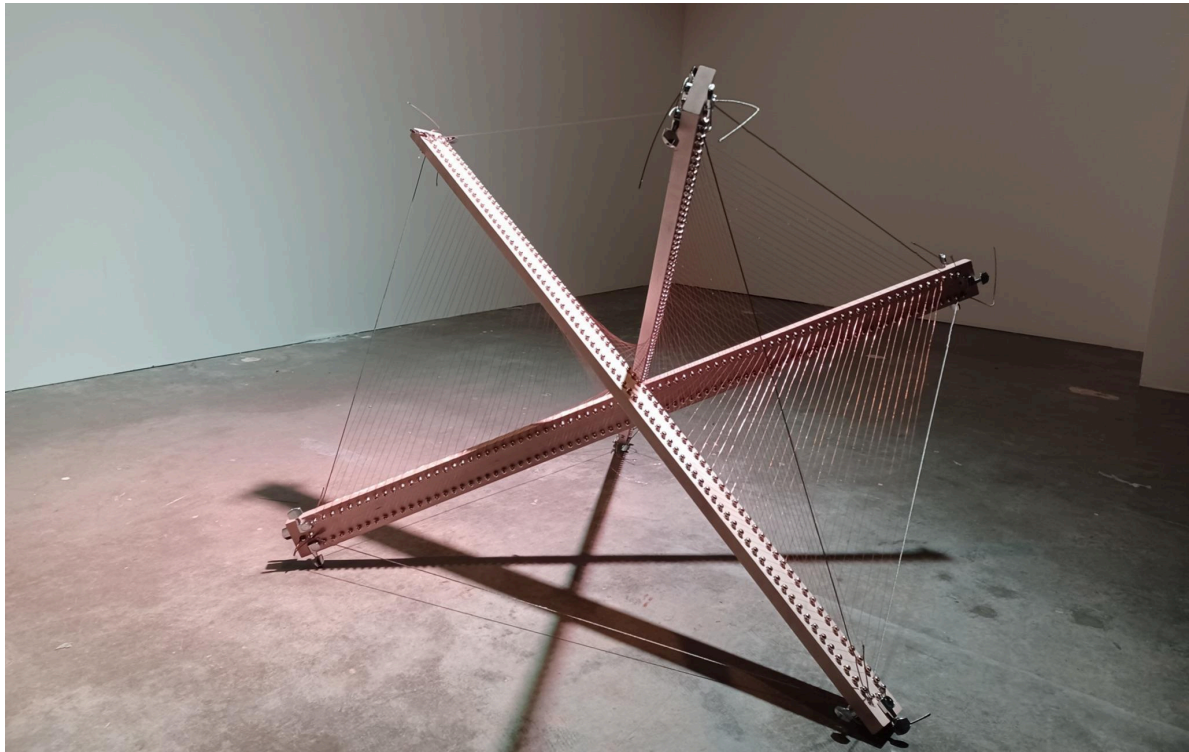
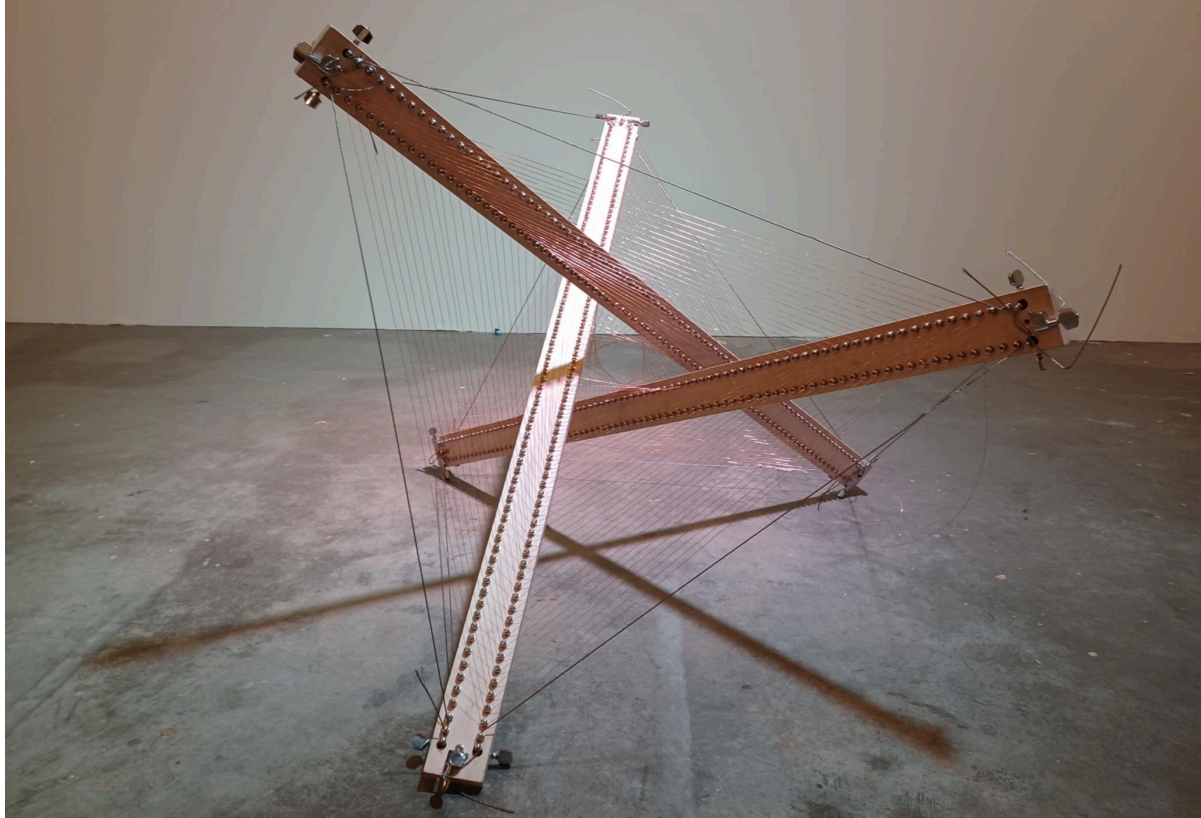


Figure 28 - Tensegrity Antenna Model

2.2.8 Software Defined Radio

One technical issue that leads to aesthetic concerns is how to process the signal captured by the antenna. Working with analog receivers poses the problem of fixed signals at one frequency, resulting in a constant and similar sound. Consequently, this setup offers a minimal number of possible categories by AI interpretations, allowing only for generating recursive and monothematic soundscapes.

To overcome this challenge, the antenna was connected to Software Defined Radio (SDR). Essentially, SDR technology replaces analog devices with software functions, reducing the need for multiple analog devices (modulators, receivers, amplifiers) within a single device connected to the computer. This setup enables the scanning of radio signals across a wide range of frequencies.

For this experiment, I utilized an RSPdx device, a single-tuner wideband, full-featured 14-bit SDR covering the entire RF spectrum from 1kHz to 2GHz, providing up to 10MHz spectrum visibility. This device facilitated the scanning of various radio frequencies, resulting in multiple signals with diverse behaviors. Consequently, it generated a wide range of sounds and, thus, a diverse array of possible categories that the AI system can recognize and process.

2.2.9 The system: Imaginary Machinescapes

Finally, the first iteration of this research involved a handmade loop antenna capable of sensing signals from the radio spectrum. Employing a system based on Software-Defined Radio, the algorithm searches and explores various signals in real time, spanning from VLF to VHF frequencies. It selects types of sounds unfamiliar to humans, resembling noise, that abound in the electromagnetic field's spectrum. These include sounds ranging from those of nature to WiFi, phone, satellite, and other unrecognizable signals.

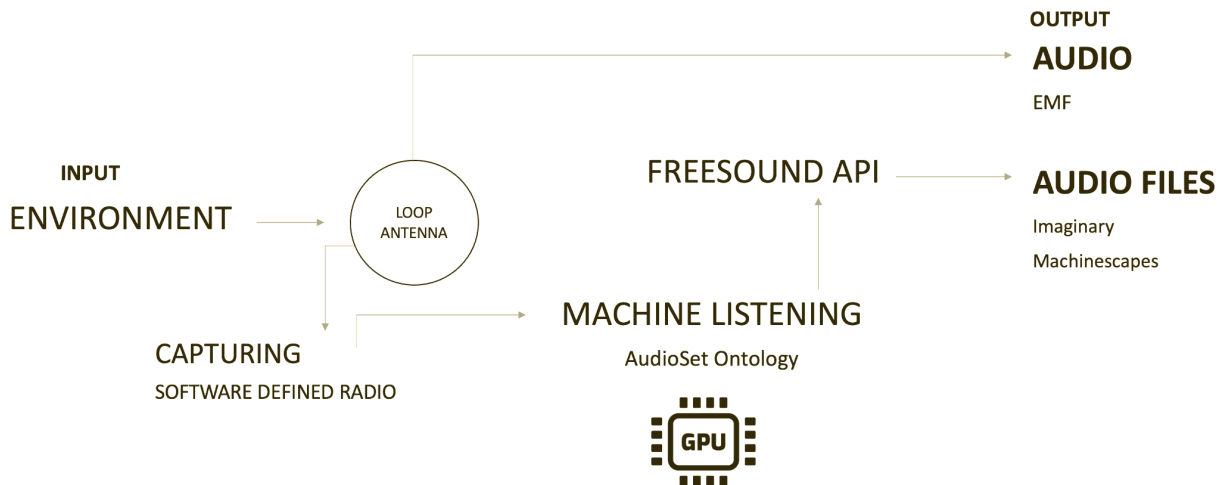


Figure 29 - Flow data of the system

The antenna is a unique entity, part functional and part aesthetic—a tensegrity sculpture covered in copper wire. A Machine Listening model processes the sounds it captures to identify their nature. However, due to the complexity of electromagnetic field sounds, the AI system often fails to categorize them accurately, leading to new and unexpected paths influenced by machine biases, failures, and errors.

Using the categories the AI recognizes as tags, the system continuously downloads sounds in real-time from the collaborative repository freesound.org. These sounds, labeled with "erroneous tags," are then played through a set of speakers installed and suspended from the ceiling around the antenna. This creates a new soundscape, an imaginary and unexpected sound environment based on what the machine hears and interprets from its surroundings.

This process generates a juxtaposed reality between the radio signals, the AI's recognition, and the labels from freesound. Consequently, the system produces a new semantic field expressed through experimental sound narratives, prompting reflection on the expansion of listening toward non-human interpretations.

This initial iteration took place in October 2022 as part of the International Image Festival in Manizales, Colombia. The aesthetic experience could be characterized as an invitation to engage in a listening attitude, observing a new soundscape created through the speculation of a machine. The sound installation offers an experience where the audience can wander and discover sounds, imagining their origins.

In this context, the system—comprising computers, cables, speakers, and the antenna—continuously scans, processes, and relocates sounds from various sources, including radio signals, domestic technological radiation, non-human signals, and even natural sounds from distant locations. This process results in a multichannel soundscape that combines noise, radio transmissions, electromagnetic fields, and snippets of speech. Thus, a semantic field created by the machine is projected as a fictional and imaginary soundscape.



Figure 30 - "Imaginary Machinescapes," Image Festival, Manizales, Colombia, 2022.

Furthermore, this work had a broadcasting version called “Imaginary Radio,” which was part of the series of experimental radio shows “Transmission Ecologies”, Stegi Radio Athens, commissioned by the artist and professor at the University of Washington, Afrodití Psarra.

(available at: <https://stegi.radio/artist/esteban-agosin>)

“Imaginary Radio” is a compilation of several improvisations using an antenna loop, software-defined radio, and Machine listening (AI). It is a machinic ecosystem produced by the dialog between the situational soundscape and the intelligent machine interpretation of the environment. Through Artificial Intelligence, specifically sound recognition, this system creates newly imagined soundscapes based on what this machine hears and interprets from the environment, generating new territorialities based on a specific location and its sounds. The system relocates and recategorizes the information of the real-time environment and plays sounds from other territories and ontologies, creating a speculative and imagined landscape.

The exploration, experimentation, and artistic research of the Imaginary Machinescapes project can be divided into two potential insights.

Firstly, the AI problem through Machine Listening and Sound Recognition systems raises a fundamental question: from what perspective can a machine understand and interpret the world that surrounds us? Thus far, AI attempts to simulate and imitate the human way of thinking to some extent. Sound Recognition serves as a prime example of this approach. It essentially involves processing a large quantity of information to classify the objects and phenomena in our surroundings. Though rudimentary, this method reflects a human-centric approach to

understanding reality. Recognizing that AI is integral to mainstream technology elucidates why it is designed this way. In essence, AI aims to replace human tasks and even perform them more effectively. This pursuit is not novel; machines have sought optimization and profitability since the Industrial Revolution.

However, trying to go further, thinking that machines are somehow part of our ecosystem, therefore speculating on how machines establish their own way of thinking, questions arise about how this technology can advance towards non-human languages. Those ideas provoke deeper experimental research on data formation, dataset construction, and connection to other possible semantic fields, questioning from which perspectives machines can learn, what are the possible learning parameters, and what kind of rules can govern those systems.

Imaginary Machinescapes presents an interesting clue: machine glitching opens a crack that allows us to escape literality, therefore, to escape the purpose of functionality. This crack generates paths to speculate on where we can move the reflection around machines and their relationship with the human, natural, and also non-human world.

Further exploring the unexpected as a terrain for the construction of meanings from an uncontrolled space, “the failure,” “the error,” opens the way to interpretations and meanings that are possibly specific to machines, therefore towards the idea of machine ontology.

Secondly, the antenna is more than a passive object; it possesses a sense of vitality. Drawing from the ideas expressed in this document regarding the relationship between antennas and

biological structures, questions arise about how the antenna can further evolve regarding its materiality, geometry, functionality, and sculpturality.

The relationship between the tensegrity concept and biological structures suggests possible developments of more tensegrity antennas/sculptures and sparks speculation about exploring the idea of bio-antennas. This research could potentially involve an intersection of biomaterials, bacteria, chemical reactions, detection, and transduction—objects that could somehow grow or self-generate, thus reshaping their structure, functionality, and sculpturality.

An example of this is the project of the artist Martin Howse, "Radio Mycelium," which explores the possibilities of fungi as transmitters through its underground connections. The most interesting aspect of this project is its approach to using natural resources. It is not only about the features of fungi as a material to make antennas; it is about understanding the mycelium's behavior in its sense of communication network.



Figure 31 - "Radio Mycelium," Martin Howse

In this context, questions arise about learning from nature's intelligence as an alternative model of communication and even as an alternative model of technological development. These possible explorations, which speculate on the idea of an antenna as a living being interacting with the conceptual development of the ontology of machines, allow us to examine the concept of machinic ecosystems. They also encourage us to focus on the role of technology in ecosystems and on the possible political and aesthetic relationships between nature, biological species and machines.

Chapter 3. M(ol)AR, Hybrid Landscape

3.1 Nature Intelligence, Hybrid Systems

On January 22nd, 2018, the prestigious magazine WIRED highlighted an incredible story: “Slime Mold Grows Network Just Like Tokyo Rail System.” A group of Japanese scientists designed an experiment using oat flakes to simulate the big cities in Japan. Over several days, they observed how slime mold started to create networks and tunnels, forming very sophisticated patterns. This allowed them to prove that the network created by the mold was the same as the Tokyo train rail network. The Tokyo train network is the most efficient in the world and took a lot of time from the best engineers in Japan. Perhaps by simply asking for slime mold, they could have saved time and costs

This fascinating story prompts profound reflections and questions: what kind of human, social, and technological development is possible through understanding and learning from nature's intelligence? Is it possible to imagine a world based on interspecies collaboration? Additionally, these reflections raise questions about possible paradigm shifts, where humans, nature, and technology redefine their positions, hierarchies, and connections. This leads to questioning the role of technology in the idea and concept of an ecosystem.

I took these reflections as a starting point, drawing from previous experiences from “The Ear” and “Imaginary Machinescapes” project. I asked myself, how can we further explore the tension between nature and technology? How can these antennas, called "living entities," incorporate

live organisms into their function? It is not only about using natural resources; in fact, copper, an essential element for antenna fabrication, is a natural resource. However, this is not about an extractivist perspective. It is about understanding and learning from our environment: understanding species behavior, their methods of communication, and the balanced use of resources that nature itself employs.

3.1.1 The Ocean, an Electrical Territory

We are surrounded by electrical signals generated by humans and natural phenomena. From activity in the ionosphere to Bluetooth and WiFi signals manifesting in our surroundings, these signals occur within our terrestrial territory, where the air is a medium for propagating electromagnetic waves.

Almost ten years ago, I had the opportunity to develop a radio project in the South of Chile, specifically in the archipelago of Chiloe. The project aimed to explore sound phenomena from social, cultural, and natural perspectives, focusing on underwater sound. During this project, we observed a particular phenomenon: the entire machinic underwater soundscape was influenced by salmon factories, raising questions about the impact of electrical signals on marine life. However, our surprise was even more significant when we realized that the ocean is, in a sense, an electrical territory.

The ocean can be considered an electrical territory due to its various electrical phenomena. For instance, seawater acts as a conductor of electricity due to the presence of dissolved salts and

minerals, enabling the conduction of electrical currents and the propagation of electrical signals generated by marine life or geological processes.

Additionally, the ocean is subject to electromagnetic fields from sources such as the Earth's magnetic field, electrical storms, and human-made electromagnetic radiation. These fields can influence marine organisms and processes.

Furthermore, research has shown that certain marine organisms, such as electric eels and some fish species, generate and sense electrical signals for communication, navigation, and hunting. These electrical interactions further contribute to the ocean's status as an electrical territory.

Overall, while the ocean is not exclusively an electrical territory, it does exhibit significant electrical activity and interactions, making it an essential aspect of the oceanic environment.

3.1.2 Sea water Antennae, technical aspects

Considering the ocean's characteristics—seawater serving as a container of electrical signals and electrolytes being a central element that allows for electrical conductivity—the idea of researching antennas based on seawater emerged.

The literature available about seawater antennas provides two main designs:

1. Monopole seawater antenna, designed by Daniel W. S. Tam and patented by the U.S. Navy.

The principle of this antenna involves the embodiment of an electrolytic fluid antenna comprising a current probe, a pump, and a transceiver. The pump is configured to pump electrolytic fluid out through a nozzle via an aperture in a current probe. The transceiver is operatively coupled to the current probe. Pumping the electrolytic fluid out through the nozzle and aperture creates a continuous stream that functions as the antenna element, thereby effectively creating an antenna capable of receiving and/or transmitting electromagnetic signals. The electrical length of the electrolytic fluid antenna may be varied continuously by adjusting the flow of electrolytic fluid to achieve any desired wavelength.

U.S. Patent Feb. 5, 2013 Sheet 12 of 15 US 8,368,605 B1

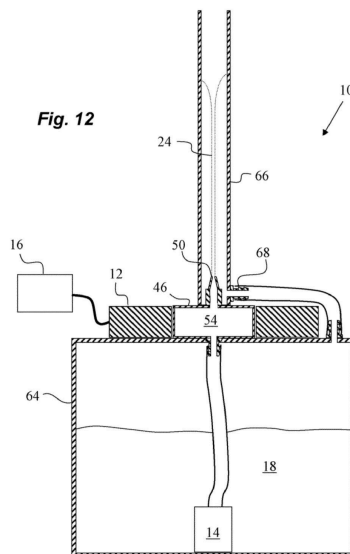


Figure 32 - Seawater Antenna, US NAVY patent

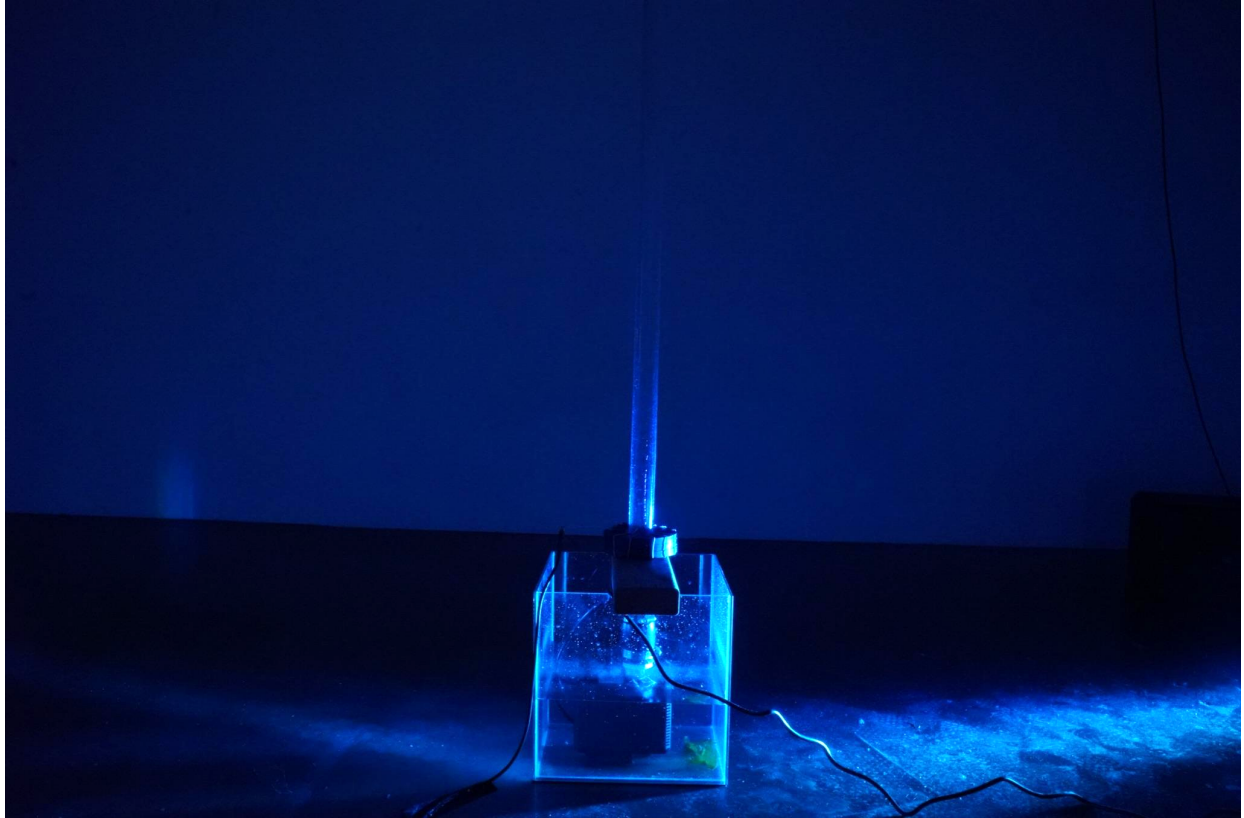


Figure 33 - Iteration 1, Seawater Antenna

This prototype did not yield efficient results. I assessed its efficiency and performance using a NanoVNA V2, a vector network analyzer (VNA) capable of measuring antennas, filters, duplexers, and amplifiers. The leading indicator was the Standing Wave Ratio (SWR), which gauges how effectively the transmit power signal emitted from a transceiver (radio) travels through the antenna system into the atmosphere.

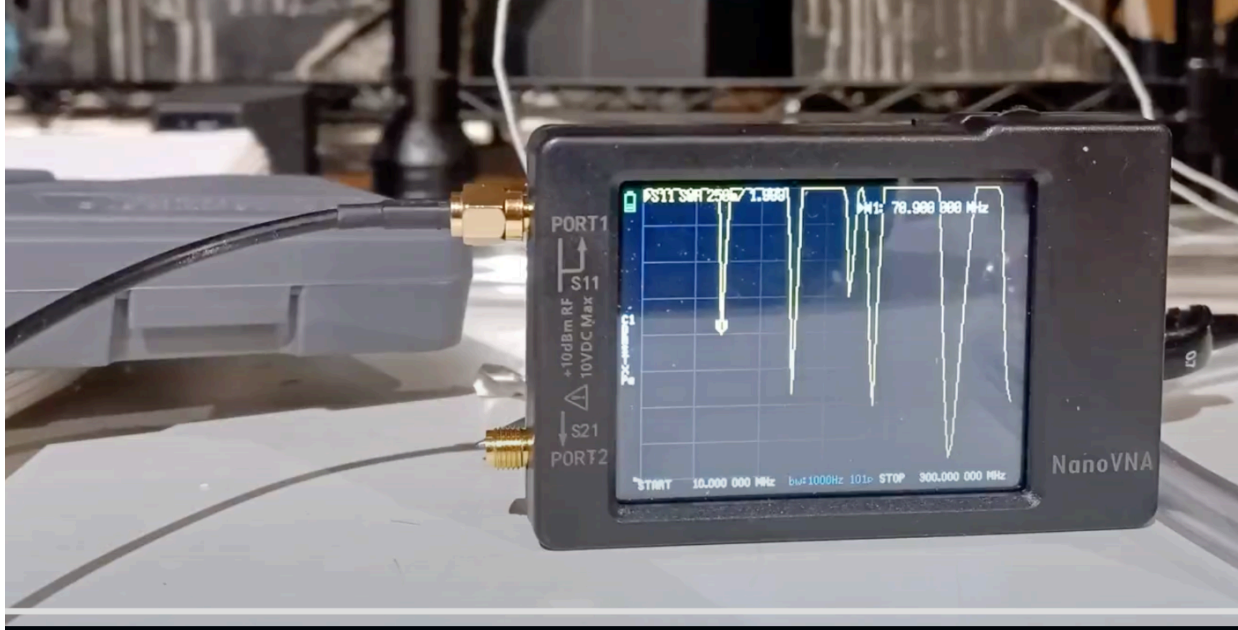


Figure 34 - Nano Vna, measuring antenna signal

The results were highly unstable. Despite numerous attempts, this design never provided consistent data that would allow for the determination of its functionality. Simultaneously, empirical tests using software-defined radio never revealed significant differences related to the length of the water stream and its relationship with various resonances and tuning frequencies.

2. A Monopole Water Antenna, designed by Lei Xing, Yi Huang, Saqer S. Alja'afreh, Steve J. Boyes, Department of Electrical Engineering and Electronics, University of Liverpool, Liverpool, United Kingdom

A water monopole antenna is designed with a layer of foam to isolate the water from the ground plane and has the following parameters: the height of the water antenna is 50 mm, a PVC tube is

used to contain the water with a height of 100 mm and a diameter of 25 mm, and the thickness of the conducting ground plane is 1 mm. A foam base is applied to maximize its bandwidth.

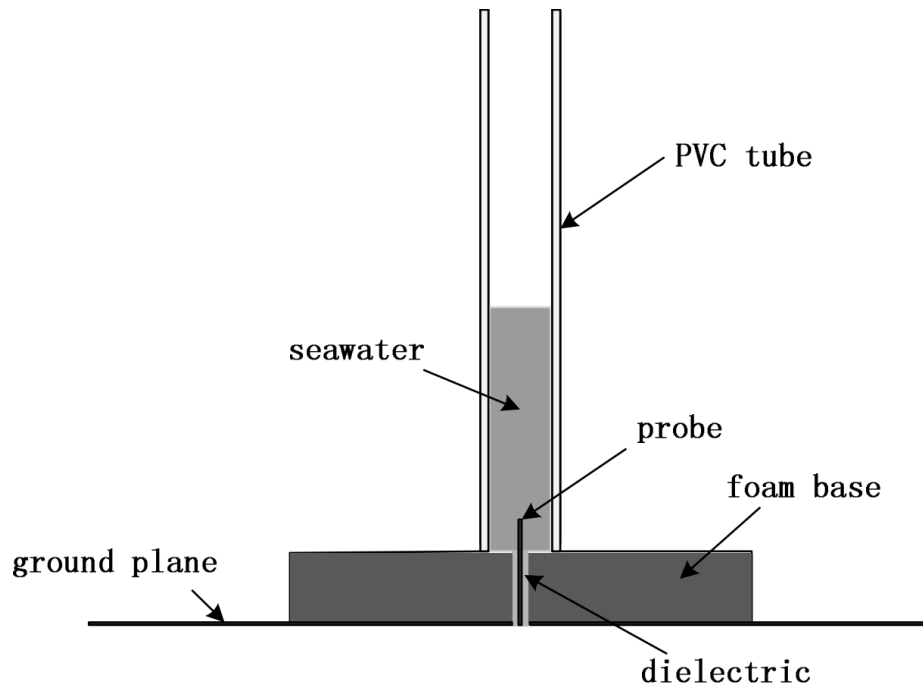


Figure 35 - Monopole Water Antenna

With the guidance of Dr. Alejandro Garcia, a physics professor at the University of Washington, and using this design as a model, I created my own version with a few modifications. It's worth noting that according to this design, seawater simply replaces the copper wire with a stream of seawater. In a sense, it follows the traditional design of a monopole antenna. Still, it utilizes seawater instead of using a rigid conductive material like copper or any other electrical conductor metal rod.

3.1.3 First functional prototype

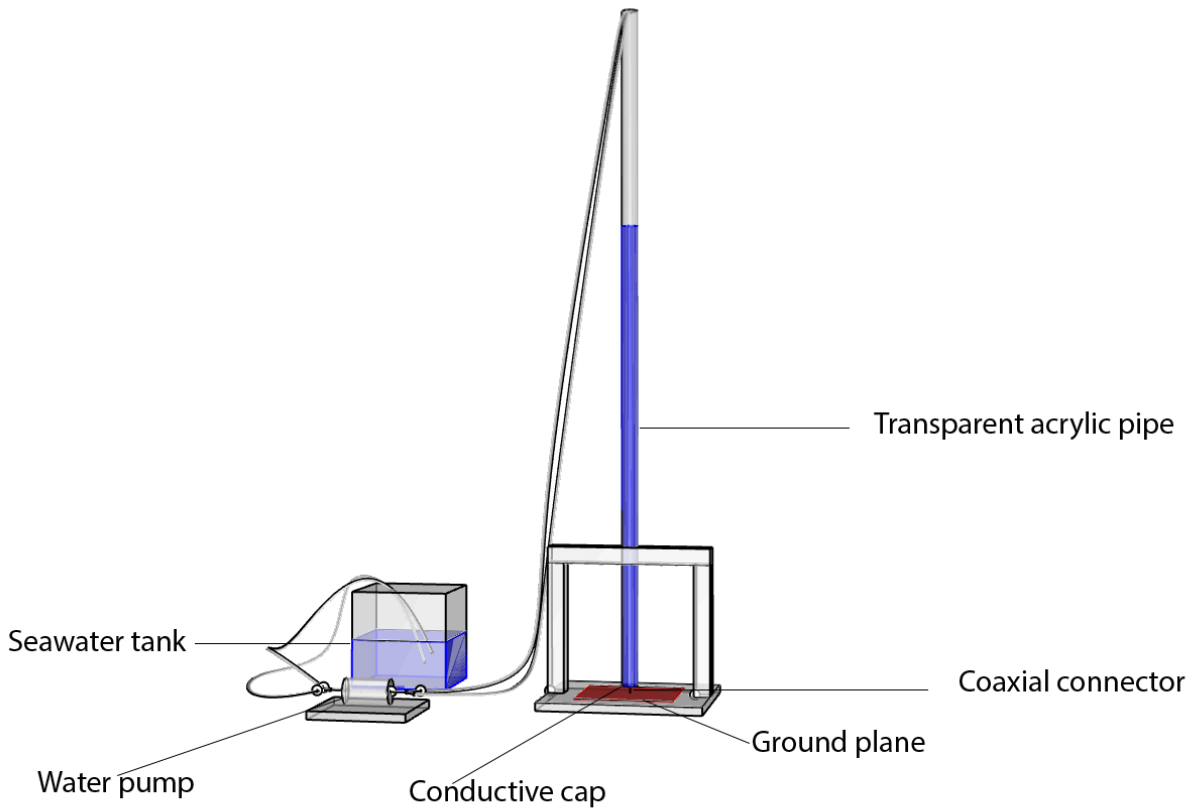


Figure 36 - Seawater Antenna, Iteration 2 (model)

This prototype features a 6-foot transparent acrylic pipe fed with seawater through a water pump controlled by an Arduino microcontroller, which operates with electro-valves and relays. This setup allows for the adjustment of the water column length, enabling the tuning of the antenna to different resonant frequencies, from VHF to LF.

The ground plane comprises a 12 x 12-inch copper sheet fitted with a coaxial connector. At the bottom of the pipe, a copper pipe acts as a conductor between the water and the coaxial connector.

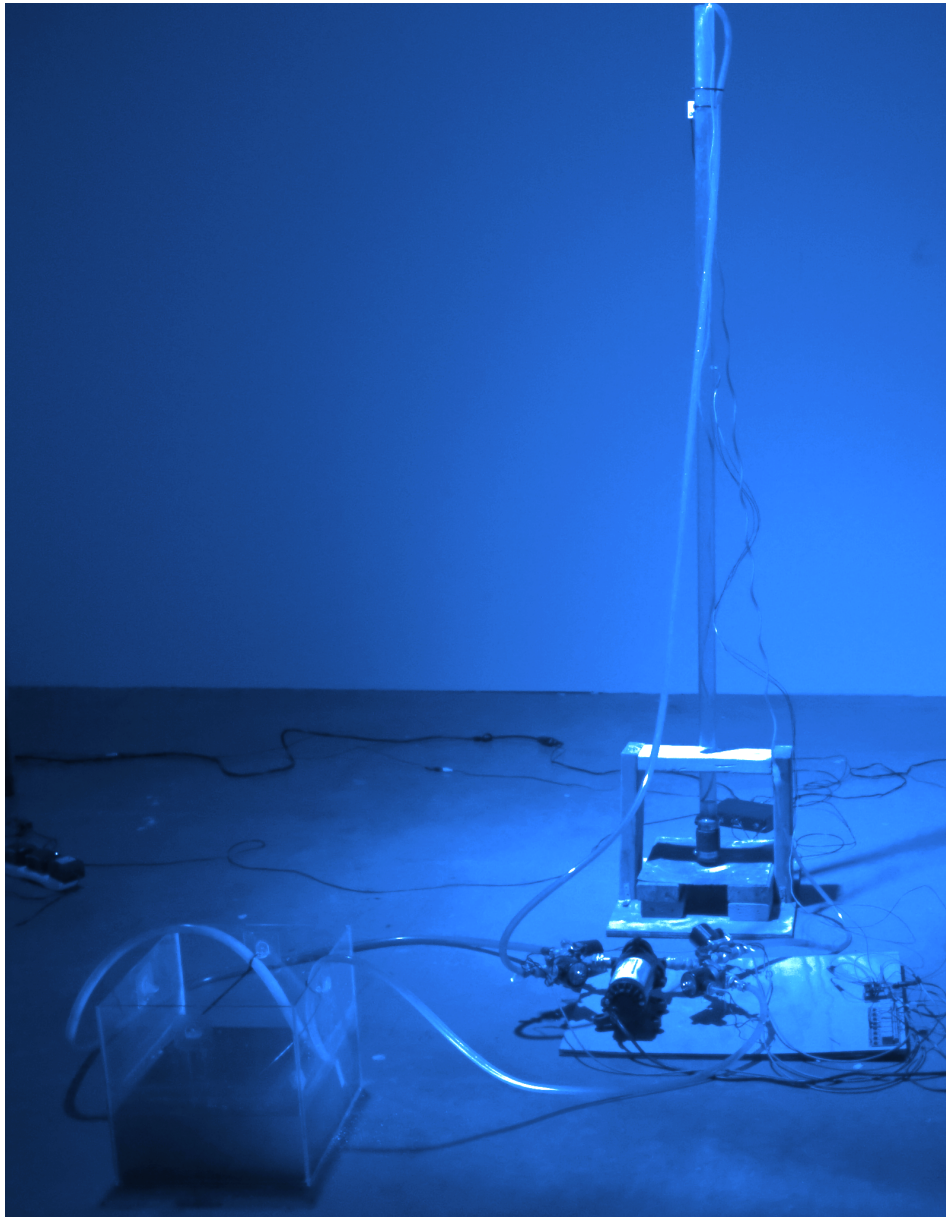




Figure 37 - Seawater Antenna, Iteration 2

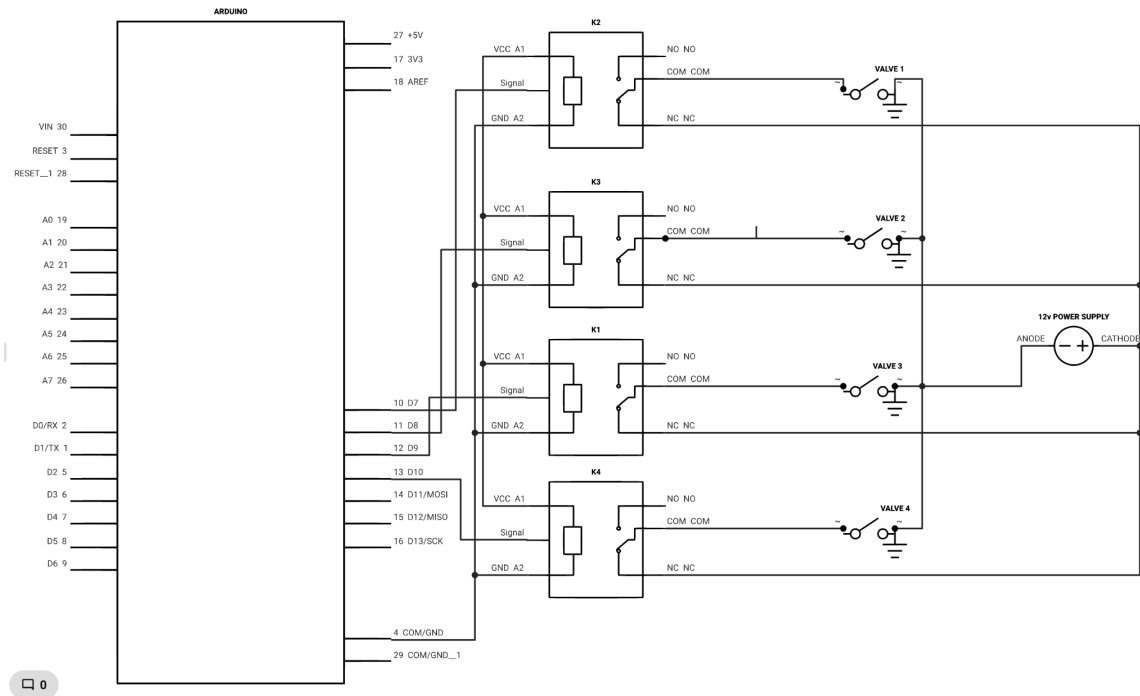


Figure 38 - Arduino schematic

This prototype yielded excellent results. The system tuned the antenna to different resonant frequencies, allowing it to capture various signals.

3.1.4 First experiment: Soundless Nature

Steamplant, George Town, Festival Spam, October 21, 2023.

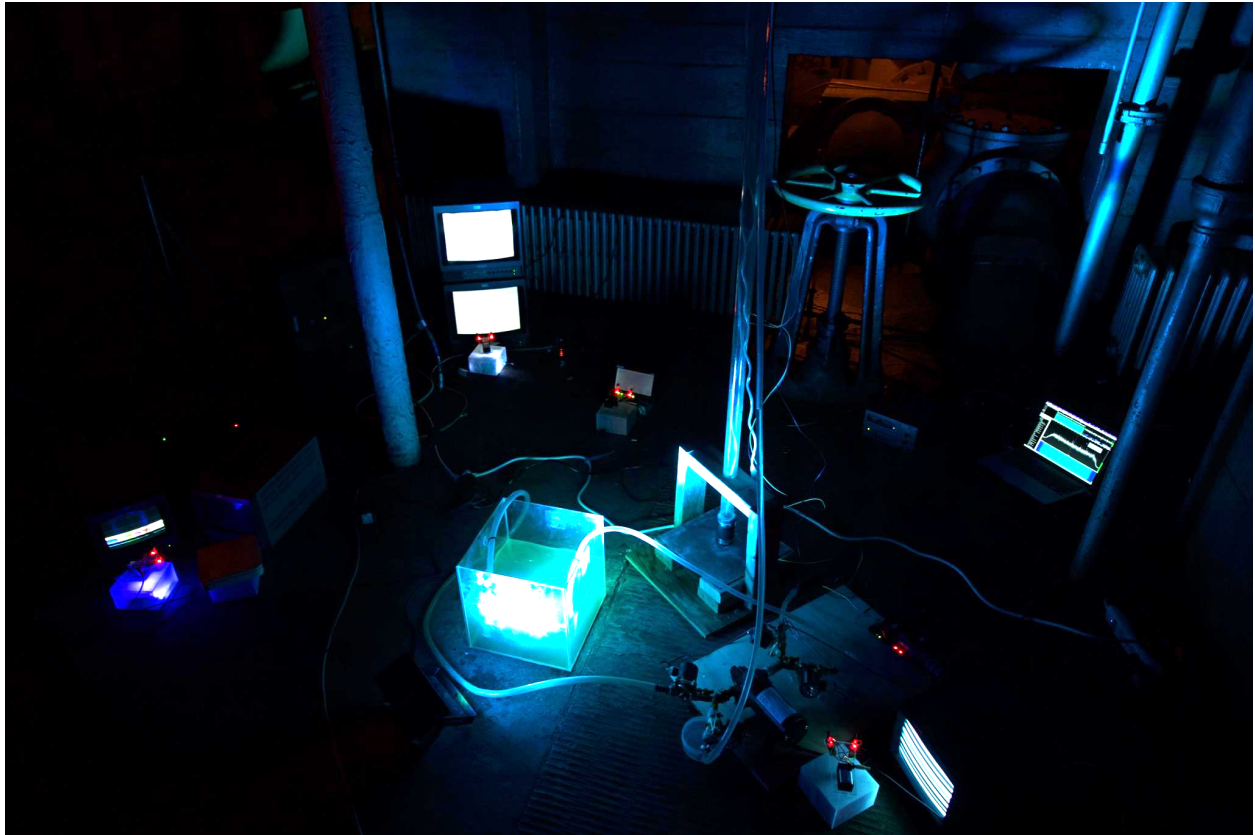


Figure 39 - Soundless Nature, Steam Plant, Seattle 2023

Soundless Nature is a durational installation composed of a collection of everyday found obsolete electronic devices, including old TV monitors, Wi-Fi routers, and handheld radios, among others. At the center of operations is a seawater-based antenna. This antenna distributes all the interconnected signals, generating a complex system in which one device continuously affects the other. Small robotic inductors capture the electromagnetic radiation from these

devices and transform the signals into sound. This piece creates a speculative world where the inaudible nature of electromagnetic fields comes to life, generating a sound and visual ecosystem from otherwise wasted electronic devices.

Technically, the seawater antenna was connected to a digital TV tuner. Depending on the water column length, the antenna was more efficient in the digital TV frequency range between 30MHz and 300MHz. The image on the TV screen became pixelated when the antenna was out of range, generating real-time video glitches.

Then, the output audio was connected to other TV monitors, generating graphics depending on the sound signals picked. The glitched image or even "no signal" constantly interrupted this process, generating moments of silence.



Figure 40 - Soundless Nature, TV signal processing

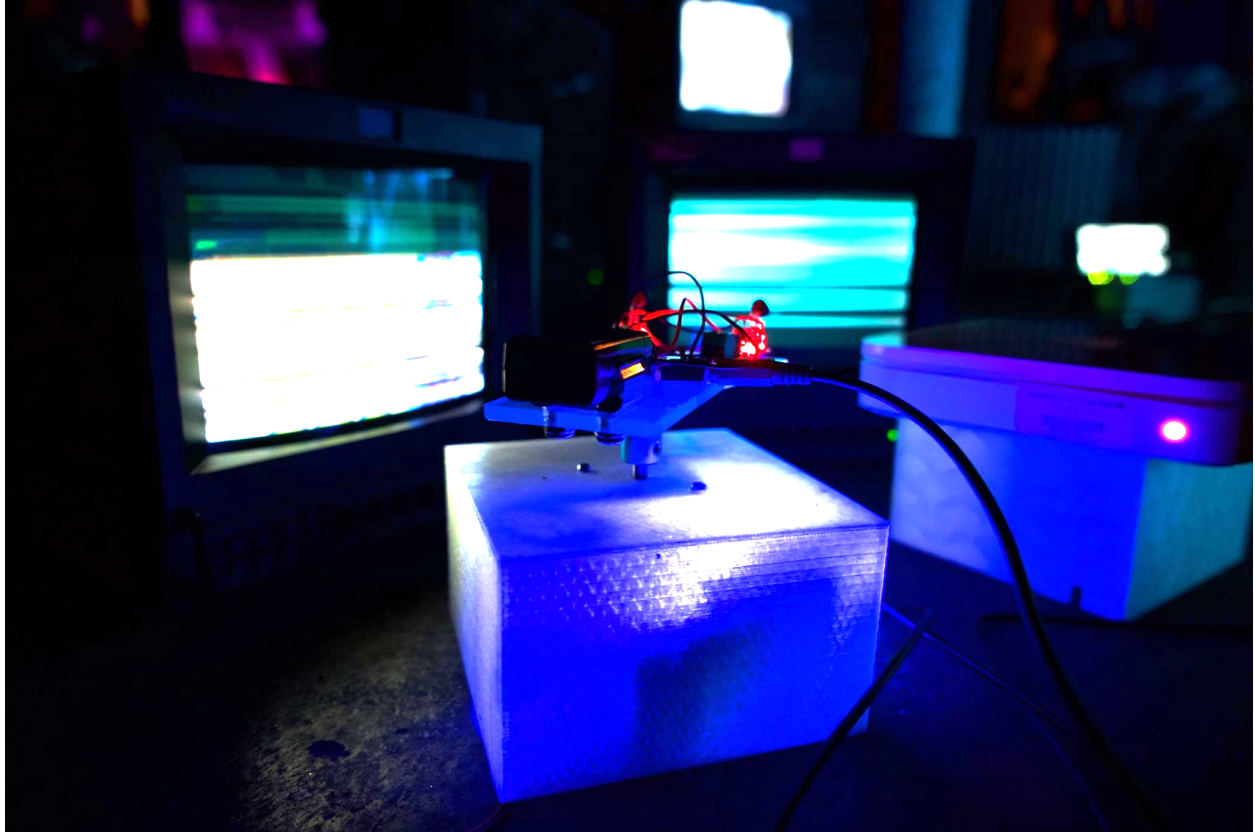


Figure 41 - Soundless Nature, Steam Plant, Seattle 2023

3.1.5 Tree creatures: exploration between nature, technology, and radio

This work explores the relationship between nature and machine as a system in which the intersection and symbiosis of its parts create new possible meanings, symbols, and realities. To investigate this possibility, I am asking how a radio antenna can inhabit natural places—can a tree or forest be a potential antenna? In this work, trees function as antenna architecture, providing a framework for exploring possible geometries. To create these, I experiment with different combinations and methods of connecting trees, stringing copper wire between their

branches. Also, using the trunk itself as an electrical conductor, the tree serves as a monopole antenna.

The piece is a site-specific installation within a small Freeway Park area in Downtown Seattle. A tree supports different antennas, each forming a part of a family of slightly autonomous sound and radio transmission systems. Due to their specific shapes, these modules transmit radio signals that can capture and reflect unique soundscapes from the airwaves. Antenna Creatures is a noisy and subtle sound installation, in which these seemingly alive devices camouflage themselves within the park's foliage. By utilizing the organic structure of the trees to produce their work, they create a kind of ecosystem in which natural and artificial networks coexist.



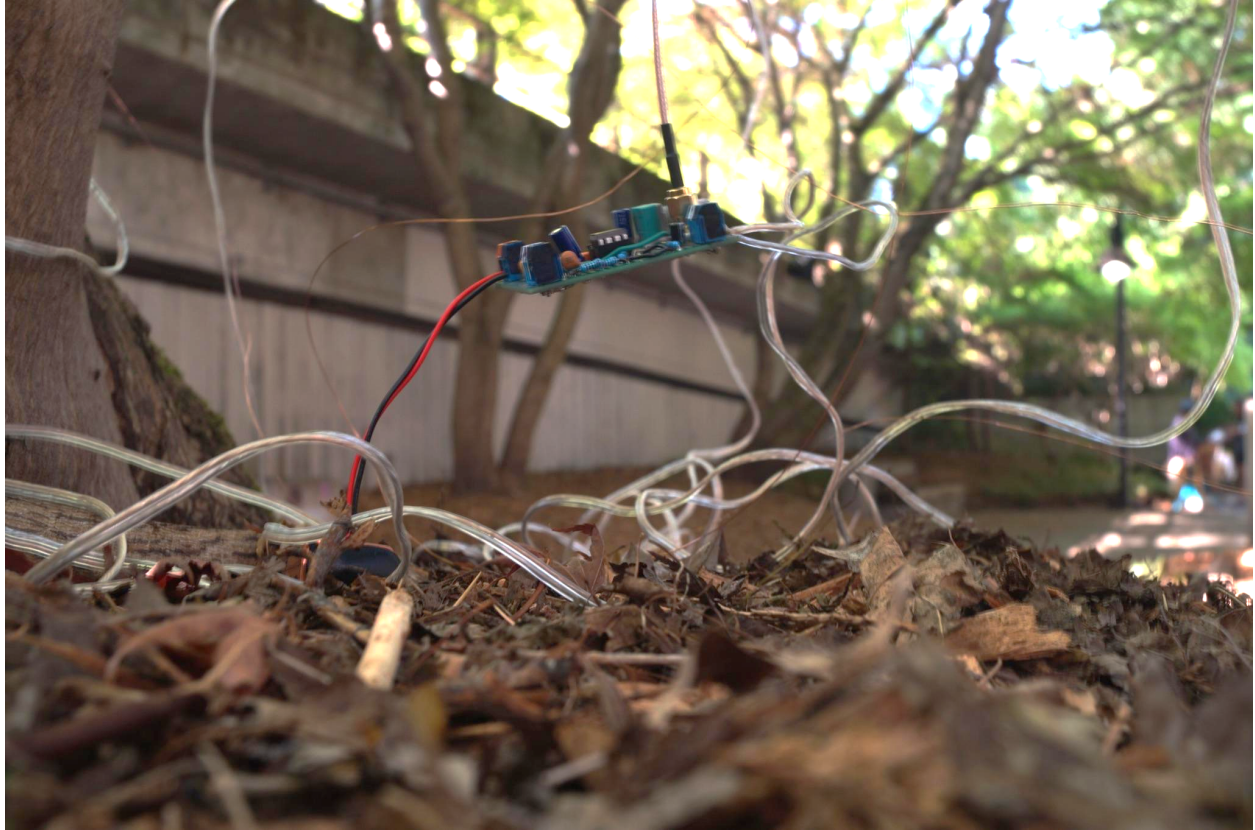


Figure 42 - Tree creatures, Freeway Park, Seattle, 2023

3.1.6 Conclusions from these two explorations

These two experiments brought different powerful reflections and ideas to continue exploring. Some of them were essential for certain aspects of the final artwork.

In this sense, the primary reflections that arise from both experiences concern the space in which the work is displayed. How relevant is the site-specificity for the art piece? How does the space interact with the work? A white box is typically considered a neutral space designed to focus 100% on the art piece. However, spaces with a story, background, and meaning can make the work even more significant.

In both cases, Soundless Nature and Tree Creatures, the context characteristics were considered to design a specific experience. In the case of the Steamplant, the pipes in the space dialogued with the antenna pipe, the water, and the ghostly steam. The sound was industrial, noisy, rhythmic, and sequential, bringing to life the idea of a plant in function. The TV and the rhythm of their graphics illuminated the darkness of the place. In the end, a whole system that was significant mainly depended on the places where this work was displayed.

In the case of Tree Creatures, the strategy was to directly amplify the electromagnetic waves picked up by trunks and copper winding without any computing process. Electronically, all amplifiers were connected, sharing the ground and the signal using the same trunk and branches. This generated interference between each amplifier, resulting in electronic sounds based on the electromagnetic waves and the voltage variation produced by the interconnection. Additionally, the cooking pots hanging on the trees served as acoustic nests or metallic fruits that hung from the branches, inviting people to come under the tree and hear what the system was generating.

Another highlighted aspect of both experiences is the idea of time. Both were durational installations, with an ephemeral existence lasting only 3 hours. This placed the pieces between performance and installation, giving value to the random transit of people who unexpectedly encountered the situation, and also highlighted the unique moment when things occurred.

As a main conclusion, both works put tension on the concepts of nature and technology. On the one hand, it was about bringing natural elements to human ruins; on the other hand, it was about bringing electronic objects and human creations into natural spaces.

3.2 M(ol)AR, Hybrid Landscape, Design

"The Ear," "Imaginary Machinescapes," "Soundless Nature," and "Tree Creature" set the stage for landing on M(ol)AR. Each project poses questions, inquiries, and challenges, driving the evolution of ideas. Ultimately, the interconnected art projects, iterations, prototypes, and theoretical contributions collectively formed the methodology of this research.

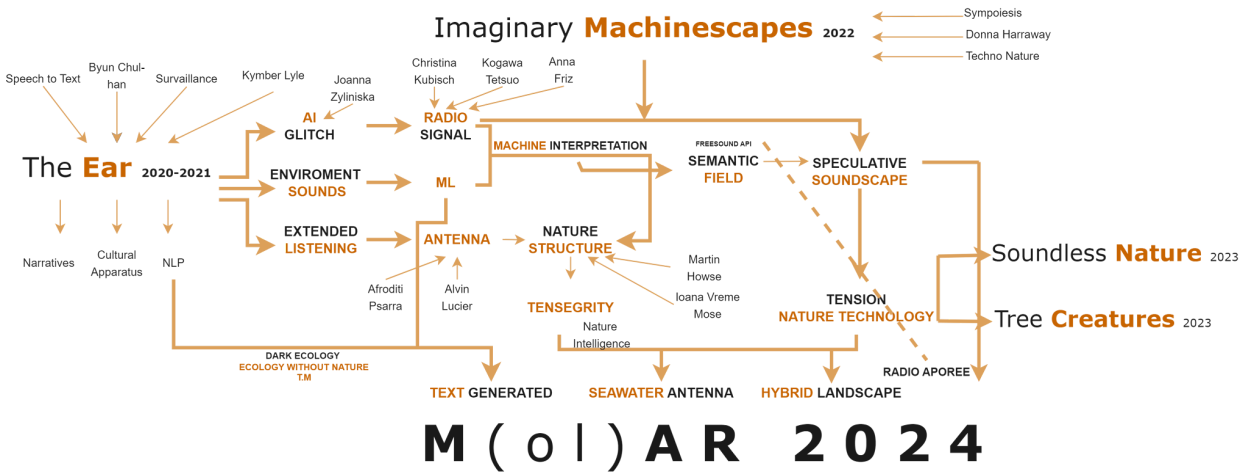


Figure 43 - Methodology diagram

Having overcome the technical issues with the seawater antenna, the final proposal contains the following features:

1. Design and fabrication of a series of sweater antennas.
2. Site-specific placement.
3. Rewrite descriptions and categories of the AudioSet Ontology dataset using NLP.
4. Connect the system to a repository different from Freesound.
5. An ephemeral piece, blurring the lines between installation and performance.

3.2.1 Tensegrity antenna:

This monopole antenna embodied a water container, a transparent acrylic pipe, a ground plate, a pump, and a water level sensor. Technically, this antenna was tuned by adjusting the water column length. In an attempt to simulate the ocean tide cycles, the water pump raised and lowered the water level within the pipe.

To connect with the entire research process and address this project's aesthetic inquiries, I revisited tensegrity structures. This choice was primarily influenced by the multiple dichotomies inherent in these structures. This structure represents the tension between nature and technology, a concept that became increasingly prominent in this project. Tensegrity is a tension between human calculation and biological structures, between strength and fragility, and between patterns and apparent disorder. Tensegrity is a balance between tension and compression forces.

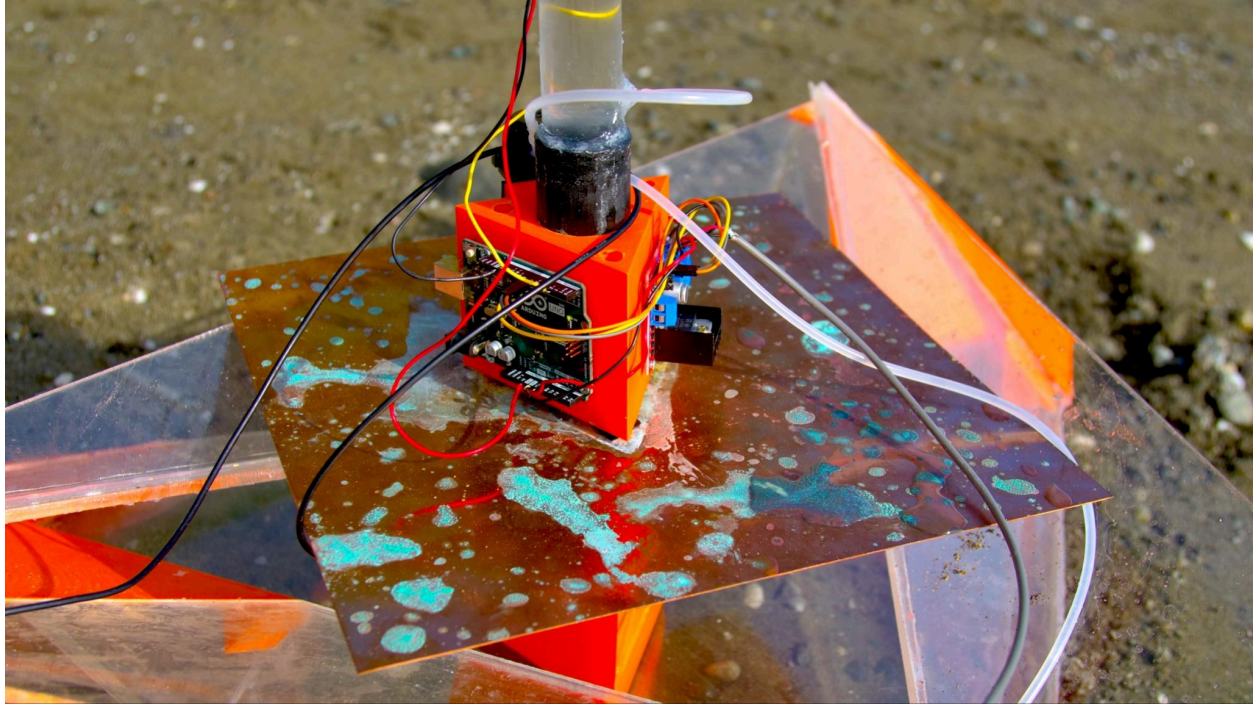


Figure 44 - Tensegrity antenna



Figure 45 - Tensegrity antenna, digital model vs physical model

3.2.2 Salt Antenna

This antenna is based on the idea that a monopole antenna requires a ground plane to function. Understanding that salt is an electrical conductor, a salt ground plane replaced the copper sheet typically used as the ground plane. This salt crystallization was inspired by the work of the Israeli artist Sigalit Landau, who creates salt sculptures in the Dead Sea by immersing objects in its water, which is ten times saltier than regular seawater.



Figure 46 - Sigalit Landau work , Dead Sea

In this sense, I submerged a wooden plate into a fish tank with a very high salt concentration for three months, allowing salt crystallization to form over the plate and the metal tube at the bottom of the pipe.

Salt Crystal cultivation

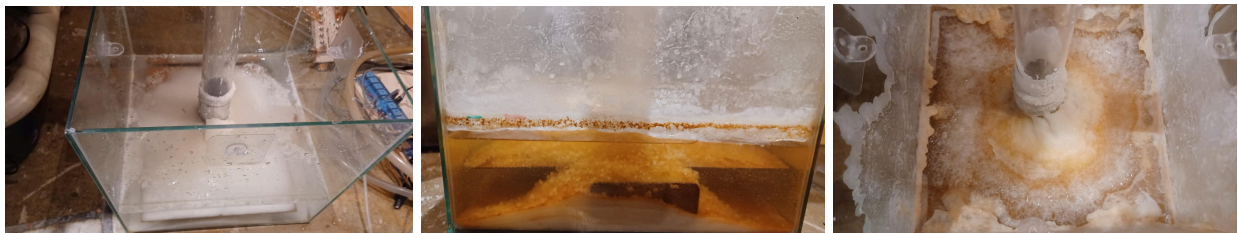


Figure 47 - Salt crystallization process

This antenna was decidedly more experimental than the others, as technically, a ground plane should be flat. However, although this main characteristic was not fully achieved, the antenna could still pick up radio signals, amplified directly with an LM386 amplifier.

This experiment has drawn possible future research directions, exploring the concept of salt sculptures as both solid electrical conductors and even potential electricity generators through salt.





Figure 48 - Sea salt antenna

3.2.3 Satellite Antenna

This is another monopole antenna embodied by a 2-foot acrylic pipe, a triangular ground plane, and a water pump. It was directly amplified by an LM386 amplifier, bringing in noisy radio signals. I've called it a "satellite antenna" because it is smaller within the installation system and orbits around the others like a satellite.

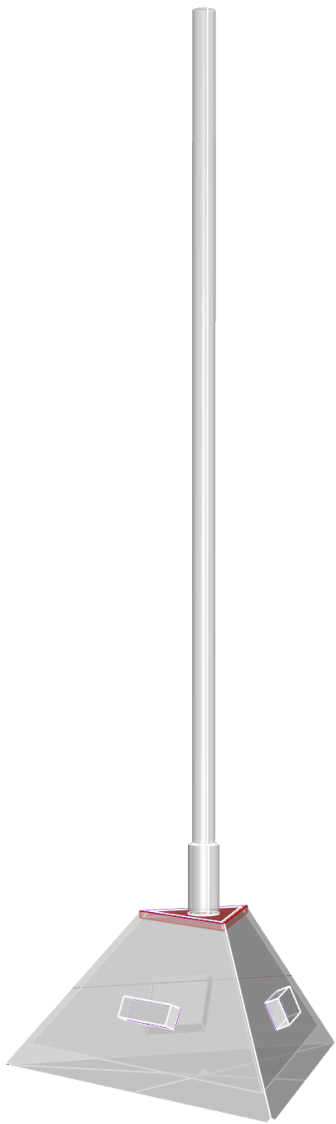


Figure 49 - Satellite antenna, digital model vs physical

3.2.4 Dipole Antenna



Figure 50 - Dipole antenna, digital model vs physical

A dipole antenna consists of two conductive elements, typically metal rods or wires, aligned horizontally or vertically and separated by a gap. These elements are usually connected to a transmission line, such as a coaxial cable, where the shield (ground) is connected to one pole, and the signal is connected to the other. The length of the conductive elements indicates the frequency at which the antenna operates, with each pole typically being $\frac{1}{4}$ wavelength of the desired frequency.

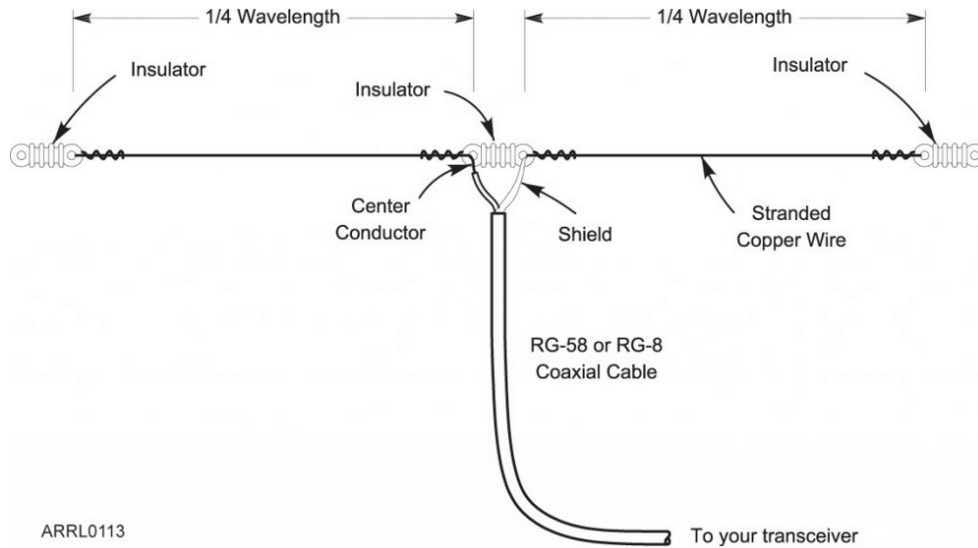


Figure 51 - Traditional dipole antenna model

When an alternating current flows through the dipole antenna, it generates electromagnetic radiation. The radiation pattern produced by a dipole antenna depends on its size and shape. Still, it typically forms a pattern with lobes of radiation oriented perpendicular to the antenna's axis. This makes dipole antennas suitable for omnidirectional and directional communication, depending on their design and placement.

In this case, the water pump constantly adjusts the length of the water column between 5 inches to 30 inches, divided into five steps, providing efficiency between 60MHz and 600MHz.

3.2.5 Space in Dialogue

The decision of where to install this research was not based on technical or functional considerations; instead, it was an aesthetic decision. The central concept behind this decision was exploring hybrid landscapes, extended ecology, and dark ecology.

The traditional viewpoint of nature essentially defines everything that is not human or not created by humans. From Timothy Morton's perspective, this idea reflects an anthropocentric view of the environment aimed at separating humans from non-human entities. This perspective conveniently aligns with capitalism, extractivism, and climate change denial. In this view, humans are given a different value and category compared to other species, organisms, minerals, etc. Timothy Morton goes further to assert that ecology represents a vast mesh of interconnectedness where everything exists in entanglement: "Ecology is about realizing that everything is connected, even things we don't usually think of as being connected. It's about understanding that we are part of a vast mesh of interrelations that includes not just humans and other living beings, but also non-living entities like rocks, rivers, and even the air we breathe".²⁸

This idea prompts questions about the role of technology, human creations, human ruins, and waste such as plastics, concrete, and wires: are they also part of the ecology?

In this sense, this project is aesthetically inspired and influenced by three artworks:

²⁸ Timothy Morton, *Ecology without Nature* (Cambridge, MA: Harvard University Press, 2007).

The Monolith on in 2001: A Space Odyssey, Stanley Kubrick

In the movie "2001: A Space Odyssey," a perfect, large, calculated structure appears—the monolith—which somehow represents an evolutionary shift. In the movie narrative, after encountering the monolith, a tribe learns how to make weapons and tools. Throughout the story, the presence of these structures catalyzes progress, especially regarding technological development.

In a way, this representation amid a vast and wild landscape signifies the presence of humans and their creations inhabiting the planet. In this case, perhaps because of its measured perfection, it attempts to create a separation between the human and non-human world. It represents humanity through a calculated structure, placed in tension with a natural



Figure 52 - The Monolith in 2001: A Space Odyssey, Stanley Kubrick

Arboreal Receptors N2, by Ioana Vreme Moser, 2021

In this work, the Romanian sound artist Ioana Vreme Moser installs a series of antennas that embrace, occupy, and camouflage the forest and trees. They are sculptural sound instruments placed in nature in relation to natural networks connected with trunks and their roots.



Figure 53 - Arboreal Receptors N2, by Ioana Vreme Moser, 2021

In the artist's words: “In the air, multitudes of human-made radio-electromagnetic fields expand inconspicuously as a large net in both urban and natural landscapes. Underground, entangled in roots, a different kind of network coexists with ours, Mycorrhizal, fungal systems, cordially known as the wood wide web”²⁹

²⁹ Ioana Vreme Moser, "Arboreal Receptors N2," 2021, <https://www.ioanavrememoser.com/arborealreceptors>.

The artist displays a hybrid landscape, an intervened environment through technological elements that generate sound signals entangled with the natural soundscape, inquiring about the coexistence of these two worlds and how they can potentially contribute to each other.

Dark Ecology, Sonic Acts research project, 2017

Dark Ecology was a three-year art research project, commissioned by Sonic Acts and Kirkenes-based curator Hilde Methi, in collaboration with Norwegian and Russian partners. Unfolding through research, creating new artworks, and presenting a public program on both sides of the border in 2014, 2015, and 2016, Dark Ecology included lectures, presentations of newly commissioned artworks, guided walks, a discursive program, concert evenings, and workshops.

The project is informed by the idea that ecology is ‘dark’ (as the American theorist Timothy Morton has argued), because it invites—or demands—that we think about our intimate interconnections with, for instance, iron ore, snowflakes, plankton, or radiation. Ecology does not privilege the human, it is not something beautiful, and it has no real use for the old concept of Nature. What we now know about the impact of human beings on the planet has led to the need to rethink the concepts of nature and ecology, and exactly how humans are connected to the world. This rethinking occurs in philosophy as well as in the arts.

Though these issues are relevant worldwide, they are especially pertinent in the Barents Region with its pristine nature, industrial pollution, and open-pit mining. Speculation on global warming fuels local economic growth, as the prospects for exploiting the oil and gas reserves below the

Barents Sea and the trade through the Northern Sea route are rising. Disparate interests and ‘approaches’ from both sides of the border must be negotiated. This interaction informs the Dark Ecology project and is a starting point to invite artists and theorists to develop new approaches and works.



Figure 54 - Dark Ecology, Sonic Acts research project, 2017

These three examples provide different perspectives on the tension between humans, nature, and technology. On the one hand, the presence of humanity and the significant switch, represented by calculated structures (such as the monolith). On the other hand, the idea of hybrid landscapes from a collaborative interconnection perspective (as seen with Arboreal Receptors N2). Lastly, the consideration of human creations, ruins, radiation, electricity, and waste as a part of the

ecology, extending the traditional idea of nature from green and beautiful to something ugly and dark.

My main question was how to display an installation in which both aspects, nature and technology, were in dialogue and coexistence, generating tension between them. This brings to the forefront the two main questions of this project: What is the role of technology in the paradigm of the Anthropocene? Also, what possible future can we speculate about by understanding and learning from nature's intelligence?

Initially, the idea was to bring natural elements to human ruins, specifically by displaying the installation in the Military Batteries ruins in Port Townsend, Washington State. But in the end, it turned into bringing human creations such as plastics, acrylics, cables, speakers, and computers to a natural place. The space design aimed to install and execute a comprehensive system comprising speculative antennas, fictional soundscapes, radio signals, data, sounds, and computers. The place was Discovery Park, a wild beach in the Pacific Northwest in Seattle.

3.2.6 The objects (sounds) in the space



Figure 55 - Discovery Park, Seattle

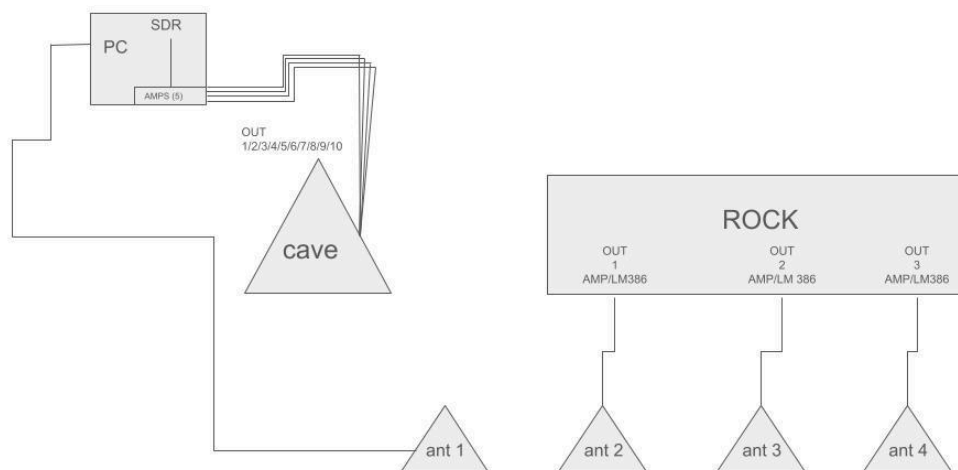


Figure 56 - System scheme

There were defined four areas:

1. Computer and signal processing
2. The Cave
3. The rock
4. The antenna area

Radio signals

The tensegrity antenna was connected to the Software-Defined Radio, allowing me to search for real-time signals. I determined which signals the antenna could pick up, selecting those to be processed and played in the cave through ten speakers. The other three antennas were directly amplified by LM386 amplifiers, picking up radio signals depending on the water length.

Fictional Soundscapes

Similar to the "Imaginary Machinescapes" project, the radio signals were analyzed in real-time using machine listening and employing the AudioSet Ontology dataset. Leveraging AI mislabeling, the system downloaded sounds from the Internet, specifically connecting to Radio Aporee via the Internet Archive API.

Radio Aporee, initiated by artist and sound designer Udo Noll in 2006, is an online platform and community-centered project focused on field recording, sound mapping, and sonic exploration. It encourages global contributors to share their field recordings, capturing sounds from diverse locations and environments.

The Radio Aporee platform is an interactive map that allows users to explore and listen to recordings tagged to specific geographic locations. These recordings span urban environments to remote natural settings, offering a varied auditory experience reflecting our sonic environment's richness and diversity.

Utilizing Radio Aporee as a sound repository yielded results that were different from those of Freesound. Firstly, Udo Noll has not labeled, tagged, or categorized the files, making access solely through titles, resulting in more unexpected outcomes. While titles and categories mostly matched accurately, other types of sounds occasionally appeared, using a title referenced to a category but not necessarily connected to it, leading to a more diverse and less literal result. Additionally, the archive is fed by sound artists, ecologists, and recorders, a community with a particular interest in sound and the environment, making it a curated archive.

The human voice and NLP

The other layer of sound that occasionally emerged featured a computer-generated voice articulating the categories identified by the AI. The Audioset Ontology comprises approximately

500 categories, each accompanied by a description reminiscent of Wikipedia entries—functional and technical in essence.

Using GPT-2, I trained a model with the books "Dark Ecology" and "Ecology without Nature," seeking Timothy Morton's insights into the definitions of the most recurrent categories recognized by the AI in the radio signals. This process aimed to generate a more poetic and philosophical description of the context of the soundscape being created by the system.

The resulting text was then vocalized and displayed in the cave environment.

Text generated

***Birds** are dying, the woods are turning blue, the North Sea is changing its name.*

***Birds** are nowness.*

***Birds** are dying, the woods are turning blue, the North Sea is changing its name to protect our land, and the Sixth Mass Extinction Event is just the so-called 'quiescence' of the world.*

***The Ocean** is a stalemate between the human and non-human realms.*

***The Ocean** is a shard of glass in a disco ball, pointing to the cosmos. It is "from nowhere" within the past, and it is "there" at the same time.*

***The Ocean** is a Palace, the World is a metropolis. A bright magnetic field, an environmental impression of naturalness, a perceptual dimension*

The Machine is the closest thing in modern culture to the sublime

The Machine is the closest thing in modern culture to what he calls veer. We could call it "beautiful Nature."

The Machine is the ideological form of modern life and the ideological form of death.

The Machine is the first mechanistic human ideology. The most sophisticated of all possible future coexist- tense.

The drone is necessarily a metaphor.

Drone is our way of relating to other beings.

Drone is the term for meditation. There is a debate as to when the meditation stopped being an aesthetic practice.

Animals are literally in between oppositional entities—they are our ancestors in the sense that we perceive our surroundings in a conscious, reflexive, and aggressive way.

Animals are part of anthropocentric survival because ecological reality requires such a thing—a science so full of splendid insights that it almost sounds like elementary school.

Animals are not weird at all. They are complex organisms that don't fit our world. We have destroyed their form.

Nature is the specter of the non-human.

Nature is a world of hermeneutical loops.

Sound of nature... is a machine for the time being.

Water is a fuzzy set that contains all kinds of other nonhumans.

Water is like a face drawn in sand, eventually wiped away by the ocean tides.

Water is a drive, not a stop"

Wind is a term from some kind of fall narrative

Wind is the turn. And if you stay still, it turns into a gigantic valley where birds have never trod.

The Sea is a good example of a strange loop. The loop of desire and reality is a compelling environmental model for how ecological awareness should proceed.

The Sea is a right reading of the environment, embodied in the simple phrase "noise"

Rainforest is a miracle of juxtaposed times. The sound of the rainforest is not an echo from some endless, far-future, but a riddle elegantly rendered in high-resolution x-ray diffraction.

The rainforest sound-world, contains many springs, and is the dwelling of the gods in autumnal stillness. There are no humans yet; they are exotic mushrooms, like a member of a species on the edge of extinction.

The birds sound but never rid themselves of the air of the earth, that blows away the charm of the air.

The birds sound but do not hear. The woods are unsynthesized: there is not a picture of nature in the foreground or the background.

The water sound of waves disappears in the night like a distant fairy palace and the wild birds sing Close by.

The water sound is a function of rhythm: a steady sound heard throughout the day and used to be decided beforehand. The "natural" state of ambient poetics was retroactive. We can never know whether it is a circle or a triangles.

Automation or performance?

During the process, I was obsessed with creating an automated system that would require only minimal human supervision, which was entirely feasible. I developed a comprehensive system to search for signals using a combination of Python, Max MSP, and SDR++. Essentially, the Python script reads the antenna's Standing Wave Ratio (SWR) using the NanoVNA as an analyzer. The resulting frequency is then sent to SDR++, and Max MSP, through FFT, analyzes the received sound, distinguishing between noise and signal. If Max MSP determines that the sound is noise only, it communicates with SDR++ via a Python script to move to the subsequent frequency in a scale of 20 Hz.

My concern regarding this approach was the opportunities provided by a durational installation, offering the chance for active participation and curation of the results. Additionally, my analysis of the automated system suggested that its complexity should be further refined to fully capitalize on the potential outcomes. Perhaps in a non-durational installation, where the system can express itself over several days, the automated version would be a coherent choice.

The Screen and sound maps

Perhaps the most subtle aspect of the installation was a small screen in the cave. For me, it represented a gesture of gratitude and recognition toward the community that anonymously collaborated with this project. Additionally, it served as a connection to one of Radio Aporee's main ideas, the creation of sound maps.

Simultaneously, the system downloaded sounds from Radio Aporee, automatically generating a map with the titles of every file. These were localized on the screen using the geolocation metadata, creating a semantic field distributed across the screen. This interconnected the site-specific location with the broader network of territories, places, and manifestations.



Figure 57 - Maps real-time generated

3.2.7 M(ol)AR, HYBRID LANDSCAPE, Overview

M(OL)AR
HYBRIDLANDSCAPES

This project is an experimental installation stemming from my research on antenna design and fabrication, radio exploration, and machine listening. The term "molar" is employed to quantify electrolyte levels in water or any liquid, and that mineral is essential to running this work. In the title, there's also a manipulation and deconstruction of the word MOLAR, emphasizing the letters M A R, which, in Spanish, translates to "sea", the essential territory of this project. In this sense, Molar represents, for me, an exciting concept between the metaphoric and the calculation and measurement, in a way, a tension between the control and the unexpected, the experienced and the speculative.

The work is installed as a hybrid landscape merging technology with natural elements, juxtaposing artificial and organic materials, electricity and water, plastic and salt, copper and sand, sound and objects, the inaudible and the invisible.

"Water is a fuzzy set that contains all kinds of other nonhumans.

Water is like a face drawn in sand, eventually wiped away by the ocean tides.

Water is a drive, not a stop"

Wind is a term from some kind of fall narrative

Wind is the turn. And if you stay still, it turns into a gigantic valley where birds have never trod.

The Sea is a good example of a strange loop.

The loop of desire and reality is a compelling environmental model for how ecological awareness should proceed.

The Sea is a right reading of the environment, embodied in the simple phrase "noise"

Texts generated by AI, based on Timothy Morton, and Donna Haraway texts.

Speculative Antennae

Machine Listening
AI "tries" to understand and categorize radio signals, it cannot do so accurately, leading to misinterpretation and incorrect labeling.

Radio Aporee
The system is connected to Radio Aporee, downloading and playing sound recordings using tags mislabeled by the AI.

NLP
Texts generated by AI, based on Timothy Morton and Donna Haraway texts

Antennae based
on seawater, which use electrolytes as an electrical conductor.

NATURE
Natural Intelligence
ECOSYSTEM
Anthropomorphism
Digital Fabrication
Sensory
Experimental devices
Bioinformatics
Sound
Soundscapes
Soundscapes live performance
Machine Listening
Ecological listening

SOUND
Radio Signals
Experimental devices
Soundscapes
Soundscapes live performance
Machine Listening
Ecological listening

HUMAN
Anthropomorphism
Digital Fabrication
Sensory
Experimental devices
Bioinformatics
Soundscapes
Soundscapes live performance
Machine Listening
Ecological listening

2024

Esteban Agosin Otero

Figure 58 - Poster delivered on the show day

This project is an installation stemming from my research on antenna design and fabrication, radio exploration, and machine listening.

This project revolves around a fundamental question: How can we comprehend the inherent intelligence present in nature and utilize it in technological systems? However, it is crucial to clarify that an extractivist approach does not drive this exploration; instead, it revolves around collaboration.

The term "molar" is employed to quantify electrolyte levels in water or any liquid, and that mineral is essential to running this work. The title also manipulates and deconstructs the word MOLAR, emphasizing the letters M A R, which, in Spanish, translates to "SEA," the essential territory of this project.

The installation features four handmade antennas based on seawater, using the electrolytes in the water as an electrical conductor. An Arduino-controlled automated water pump flows water up and down, adjusting the frequency at which the antenna is more efficient in picking up radio signals. The installation was displayed in a natural and wild setting, specifically South Beach at Discovery Park in Seattle.

Within the installation, fourteen speakers played sounds from radio signals through Software Defined Radio alongside natural audio recordings.

A machine-listening AI analyzes the radio signals in real-time and attempts to interpret them. For this proposal, I am using a model called Audio Set Ontology, which is a large data set of more than 2 million sounds and can recognize 500 categories.

Since those radio signals are not part of the dataset, the AI consistently fails, surprisingly often mislabeling the sounds as natural phenomena such as rain, weather, animals, or snakes.

Leveraging this misinterpretation, the system downloads sounds from Radio Aporee, matching the AI's mislabeling with the audio file descriptions from the repository. This generates fictional

soundscapes and speculative realities, juxtaposing the sounds from the radio signals and those created by the AI.

The fictional and hybrid landscape was a convergence of technological elements within the natural space: objects, sculptures, plastic, wires, speakers, computers, rocks, creatures, fluids, motors, and sensors. A juxtaposition of electricity and water, plastic and salt, copper and sand, sound and objects, the inaudible and the invisible.

This entanglement created a tension between nature and human creations, prompting a discussion about the role of these human creations within the ecosystem: Are plastic, concrete, wires, or technology considered part of the ecology?

In this sense, M(ol)AR represents a relationship between the metaphoric and the calculation and measurement. In a way, it represents a tension between control and the unexpected, an ecosystem that blurs the boundaries between signals originating from the radio spectrum, technological elements, and organic materials, creating a speculative landscape where nature and technology converge symbiotically.





Figure 59 - Pictures M(ol)AR, Discovery Park, Seattle

Conclusion

This dissertation explores the relationship and tension between nature and technology from an artistic perspective. Through an empirical exploration, an experimental research process, and theoretical support, several key elements emerged as an aesthetic approach to this topic.

Firstly, exploring antenna-making through the use of raw natural resources provides deep thought. A seawater antenna technically works; it is capable of picking up signals, but it is not really powerful, which raises questions about the uses of this technology in communication systems, its range of action, and its efficiency, opening up questions about the scale of things.

During the 1970s, the term "Degrowth" emerged as a political concept, critiquing extensive development and proposing an alternative approach to address the environmental crisis. The core concept of the Degrowth movement contends that the singular emphasis of modern capitalism on continual growth, measured by the monetary value of overall goods and services, leads to extensive ecological harm and isn't essential for enhancing human living conditions. Moreover, Degrowth theory asserts that the limitless expansion of the economy fundamentally contradicts the finite nature of Earth's material resources.

In this sense, degrowth also refers to the scale of things, moving from the global to the local, neighborhood, and community. A seawater antenna and other artistic examples prove that the speculation of a different social and technological development, understanding, respecting, and learning from nature require imagining a different scale.

"Fluid Memory," created by the artist Iona Vreme Moser, is an artistic exploration of computation through natural resources. Essentially, it is a computer capable of storing a minimal amount of information using only salt water, water fluids, and simple electronic elements. It is a speculative computer representing a future diverging from the mainstream technological, political, and ideological norms. While the mainstream emphasizes extensive data management, social and technological advancement, and growth in all senses, it simultaneously damages our planet and social environment. This work represents a different pace and non-invasive technology, but its existence also asserts another scale of things.

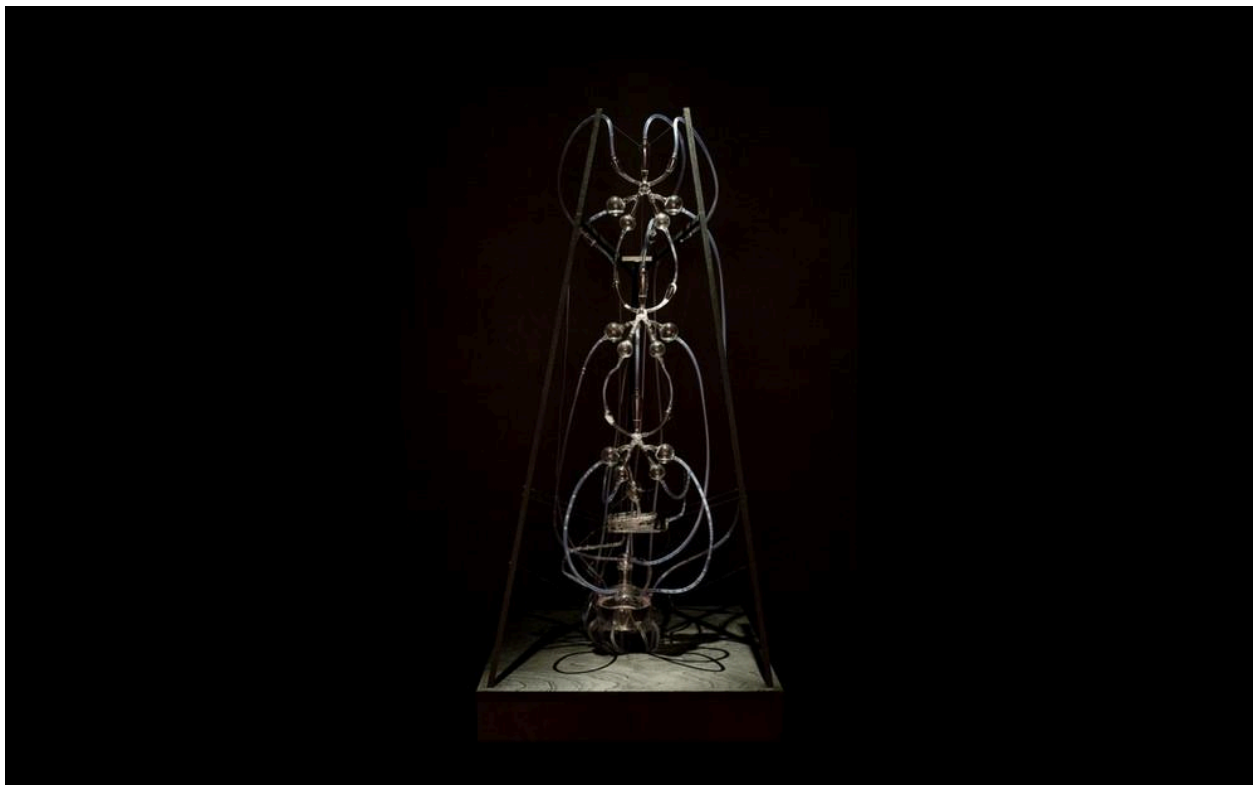


Figure 60 - Fluid Memory, Iona Vreme Moser

Secondly, this project brought aesthetic reflections to my artistic practice.

In these four years at DXARTS at the University of Washington, I have consolidated my research, reaching a place of intersection where my experience has found a specific and consistent point. The whole process, from “The Ear,” “Imaginary Machinescapes,” “Soundless Nature”, and “Antenna Creatures”, provided the path to reach M(ol)AR. Though still experimental, this project is a critical, sensitive, and reflexive position about technology, its uses, and its impact on our environment and social context.

From that perspective, this process provokes in me the embodiment of an idea: Art as a territory to push mainstream technology further, to reimagine, and to redefine the predetermined. Art is a space to envision other possible worlds, intimately connected with reality and the materials that nature and technological systems provide.

I see myself more as a system creator than a composer who controls everything. I am meticulous with every part of the system and how they can be connected, yet I am fascinated with the unexpected results that can emerge from the system. I am convinced that every object, installation, and system that I create can be replaced with something extremely simple, but complexity brings not only complications but also layers of density that make things more significant, bringing up questions, memories, emotions, and conversations. In this sense, art can be useless and dysfunctional, but art can be essential.

This research has given me a deep perspective on the relationship between sound, technology, culture, and ecology. By mixing different knowledge and fields, I developed a project

speculating the symbiotic and tensional relationship between nature and technology based on sound, radio exploration, fabrication, and artificial intelligence.

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