Membranas

By

Nicole L'Huillier Chaparro

Bachelor of Architecture, Universidad de Chile (2010)
Master of Sciences in Media Arts and Sciences, Massachusetts Institute of Technology (2017)

Submitted to the Program in Media Arts and Sciences, School of Architecture and Planning, in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
Media Arts and Sciences

at the
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
September 2022

Author

…….

Nicole L'Huillier Chaparro
Program in Media Arts and Sciences
May 30, 2022

Certified by

…….

Tod Machover
Muriel R. Cooper Professor of Music and Media
Thesis Supervisor, Program in Media Arts and Sciences

Accepted by

…….

Tod Machover
Muriel R. Cooper Professor of Music and Media
Academic Head, Program in Media Arts and Sciences

Membranas

By

Nicole L'Huillier Chaparro

Submitted to the Program in Media Arts and Sciences, School of Architecture and Planning, in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
Media Arts and Sciences

Abstract

Organized around an installation called *Membranas*, this dissertation will explore alternative logics and modes of socialization through improvisatory encounters. *Membranas* is an infrastructure that stimulates call and response exchanges between humans, the wind, vibrations in the air, and a machine. It does this by shifting away from conventional notions of sound and music through the creation of several interactive sculptural elements that activate an experience using vibrational and sonic organs contained in the installation, a set of membrane sensors in the form of flags that perceive sounds and vibrational activity, and a vibrational membrane microphone based on a soft accelerometer elastic sensor to be used outdoors. *Membranas* is a performative interface that establishes a continuous testbed for exploring resonance as an inclusive force that stimulates collectivity and the sense of interconnectivity among participants. This work emerges as a way of putting into practice ideas within *La Membrana*, an organizational conceptual apparatus that stimulates vibrational ways of speculating about how to rearrange the social.

Thesis Supervisor:

Tod Machover

Muriel R. Cooper Professor of Music and Media, Academic Head, Program in Media Arts and Sciences, Massachusetts Institute of Technology.

Membranas

By

Nicole L'Huillier Chaparro

This dissertation has been reviewed and approved by the following committee member:

Tod Machover

…….

Muriel R. Cooper Professor of Music and Media,
Program in Media Arts and Sciences, Massachusetts Institute of Technology

Membranas

By

Nicole L'Huillier Chaparro

This dissertation has been reviewed and approved by the following committee member:

Caroline A. Jones

…….

Professor of Art History
History, Theory, and Criticism Section,
Architecture Department, Massachusetts Institute of Technology

Membranas

By

Nicole L'Huillier Chaparro

This dissertation has been reviewed and approved by the following committee member:

Camila Marambio

…….

Curator, Founding Director of Ensayos, a nomadic research program in Tierra del Fuego
Ph.D. Monash University, Curatorial Practice MADA, 2019

Membranas

By

Nicole L'Huillier Chaparro

This dissertation has been reviewed and approved by the following committee member:

Marc Downie

…….

Artist and co-founder of the OpenEnded Group
Ph.D. MIT Media Arts and Sciences, 2005

Acknowledgments

Infinitas gracias to everybody that has been part of this process. It has been a crazy and beautiful adventure with many fortuitous encounters, inconmensurable learnings, and incessant resonances.

Infinitas gracias to my dear advisor Tod Machover for all the support, trust, mentorship, and friendship. Thank you so much for this amazing opportunity. It has been such a fun and enriching ride! I am forever grateful for our time together at the Lab and for the many adventures to come. Thank you for inviting me here, and for always inviting me to operate with passion and joy, even/mostly when things were hard.

Infinitas gracias a mi familia, most importantly Luna Necochea and Juan Necochea for all the love, patience, and joy, for giving me life everyday.
Infinitas gracias a mi mamita Patricia Chaparro *por ayudarme en el lab ordenando y regaloneandome tanto* a mí y a la Lunita.
Infinitas gracias Tatá a.k.a. Sandra Barbosa *por cuidarnos tanto.*
Infinitas gracias a mi viejito Gastón L'Huillier y Lely Wilson for always being there.
Infinitas gracias to my brothers Gastón, Tomás and Juan Pablo. I am who I am because I had the luck of growing up with you. *Gracias por la música.*
Infinitas gracias Andrea L'Huillier y Max Campino *por siempre estar cerquita.*

Infinitas gracias to my dear committee members: Caroline Jones, Camila Marambio, and Marc Downie. I am forever grateful to have crossed paths with you, I feel extremely lucky and honored. Thank you so much for your time, support, mind-blowing conversations, for challenging me in the best way, and most importantly, for your generosity, it means everything to me.

Infinitas gracias Devin Murphy and Jessie Mindell for your great help. *Gracias* for being there for me, for all the fun, stimulating conversations, and the endless days solving technical challenges. I am grateful for having encountered both of your amazing minds, but most importantly for having encountered you as kind and caring friends.

Infinitas gracias to my MIT and Opera of the Future *amigues* for always being there for me.
Infinitas gracias to my Boston family that not only was there to cheer me up, but also for helping me to make things, to lift structures, to drip resin, to test speakers, to clean, to care for Luna, to cry and to laugh even at a distance.
Infinitas gracias to my dear human and more-than-human friends, collaborators, and conspirators who have inspired me and been near me these past years.

Table Of Contents

List of Figures

Figure 1 *Membranas (Membranes), 2022. Text: Nicole L'Huillier. Photo: Detail from picture by Jimmy Day, MIT Media Lab.*

Intro

Figure 2 *QR code for audio Intro, An Invitation To Fuzz. 0'58". I recommend listening with headphones. The file can also be accessed from this link: http://nicolelhuillier.com/intro/ (Accessed: 04-13-2022*)

a. An Invitation To Fuzz

I would like to begin by making an invitation. I believe that every meaningful relationship starts with some kind of invitation. However subtle or unintended, an invitation is always made with the hope of being acknowledged, felt, opening up, engaging, being called, responding. The invitation I am making here is one to engage in a practice of fuzzing[1]: fuzzing boundaries, bodies, knowledges, languages, temporalities, signals, and straight lines, among other things that can—and must—be fuzzed. I invite you to think about fuzzing as a way of refusing, decentering, rearticulating, and possibly unlearning some of the static and rigid things we have been taught. I could extend this invitation using many different methods, but in this case, I would like us to use my favorite: I invite you to fuzz by resonance.

When we resonate, we engage with a series of vibrations that activate membranes in our spaces, bodies, and minds. Part of these vibrations are perceived as sounds when we listen. While we are resonating—as

[1] Fuzzing refers to the action of making something unclear or indistinct. It is a synonym for blurring, although fuzzing references an act of blurring that does not limit itself to the single sense of sight. It is an action that values the unclear in a plausible intentional strategy. It does not imply to be a state that precedes stability or clarity of vision, nor does it imply an inferiority or diminishing of value. Seemingly contradictory in traditional thought, it treasures the action as an empathic and permissive extension to existing closed definitions. It allows for the sonic phenomena to be more than acoustic: to rescue its unstable, undervalued and unpredictable vibrational characteristics on equal footing within the scope of *Membranas*. The term *fuzz* was selected intentionally as an alternative to *blur* in order to incorporate a language that is more in tune with the resonant vibrational epistemology proposed in this work, and to take another step in an ongoing and unsettled quest to find the vocabulary to shake things up and *difuminar*.

well as listening—we become many, we receive, and by doing so, we also give back. Limits and borders are diffused and things reorganized in an agglutinant relationality. The things we think we see so clearly are fuzzed and reconfigured on the go. We tend to forget that we can engage with the world through resonant strategies, such as listening, because we have consistently been told to rely only on what we can clearly see or already know.

My invitation to engage in a practice of fuzzing begins by asking you to reorient your senses away from ocularcentrism in order to unveil unknown types of relations and experiences. I believe that by doing so, we can awaken more intimate and intricate possibilities, and activate networks of affection and care within ourselves and other bodies—both human and nonhuman. A practice of fuzzing is a practice of learning from the possibilities of resonance and interference so that we can rearticulate our relational ways and the narratives that define us. Today, rearticulation and reorientation seem to be more urgent than ever. Our planet has been driven to crises caused by living too long under a violent regime of extreme individuality and intolerance promoted by hegemonic borders and rigid lines in service of extraction, consumerism, and control—all things that have been drastically accentuated by the Covid pandemic.

As a response, during the past few years, social and cultural transformations have powerfully emerged to show resonant examples of how to activate change. These transformations have shown us how to contest and resist division, fear, and hate in order to establish other relational modes, and to propose other systems that come from respect, balance, and care. In a planet that is being drained by extraction, consumerism, and control, it is urgent to develop counter-strategies that yield polyphonic togetherness, rituals for collective resonance and attunement, as well as spaces to listen to each other. I will make the case that these strategies' success demands that we question the very meaning of togetherness within otherness, by acknowledging that this conversation can no longer be an only-human one. I will make the argument that resonant strategies are conductive and aligned with the needed active change that departs from extreme individualism towards an understanding of inescapable resonant weavings. This thesis aims to explore our interdependent and performative world through shared vibrations and sounds. Its objective is to guide us to engage in a practice of fuzzing the *rigidities* that keep us from reorganizing our intuitions and senses so that we can learn how to resonate with our vibrational reality.

b. La Membrana: An Apparatus For Tuning In

Membranas[2] is an essay on sonic emergence and practices of fuzzing. This thesis explores the vibratory—particularly the sonic through its aural and tactile manifestations—as intrinsically collective media that can activate more intimate and intricate ways of relating to each other and the world we are part of. This is a resonant investigation that proposes a body of work derived from the possibilities within the concept of *La Membrana*[3], an organizational apparatus for tuning into our vibrational reality. The practical that accompanies this document is an installation that is meant to be a continuous experiment and test-bed for exploring resonance and improvisation as ways of stimulating more-than-human[4] arrangements for collective emergence. The installation mediates the interaction between a machine, humans, the wind, and voices that travel within the wind—not only human voices, but a variety of sonic events propagated in the air. The installation constitutes an open system that provides a space to diffuse sounds and vibrations from agents in distant places, as well as for participants to listen to those sounds and to listen to each other. Shifting from Western notions of music, this dissertation explores *Surlogical*[5]

---

[2] *Membranas* is the Spanish word for *Membranes*. It is the name of the installation that I did as a thesis project. It is the material manifestation of the ideas behind my research.

[3] *La Membrana* translates to *The Membrane*. It is the concept that encapsulates different theories and ideas behind my work and research. It is based on the configuration and characteristics of vibrational membranes as organizing structures that in essence are elastic places of transfers and dynamic definitions. A membrane can produce and receive vibrations, it is a porous boundary that can both separate and connect, it is a threshold that is activated by vibrations. I am devoted to exploring *La Membrana* as a physical and theoretical place for onto-epistemological reconfigurings.

[4] More-than-human is a term proposed by American ecologist and philosopher David Abrams as a way to find terms that can extend the vocabulary that we use to refer to ecological systems and phenomena. In Abrams' quest to bridge the divide between the notions of *human nature* and *nonhuman nature,* the term *more-than-human* proposes something that contains the human but is not limited to it. The term encompasses all cosmic and planetary entities, which include, but are not limited to, geological, vegetal, animal, and atmospherical entities. Please refer to David Abrams, *The Spell of the Sensuous: Perception and Language in a More-than-Human World*. (New York: Pantheon Books, 1996).

[5] The *Surlogical* proposes a perspective from the *Sur/South*, in this case paying particular attention to practices from the South Andean region in South America.
As a way to understand how improvisatory practices are regulated by their contextual conventions, American composer and performer George Lewis presents the *Eurological* and *Afrological* discussion. In this discussion he describes the different paradigms of *improvisation* and *indeterminacy* and how they contain their own protocols and ways of enabling emergent musical dialogue. Inspired by Lewis' work, within the context of Membranas, I propose the *Surlogical* as a method to explore alternative logics for improvisational musical togetherness from a mestiza perspective. I propose the *Surlogical* as a mechanism of emergent collective relations, a place full of syncretisms, complexities, and contradictions that provide a dynamic scenario for socializing, even beyond the human. The *Surlogical* implies learning from modes of socialization through improvisatory operations of el *Sur*, the South and its complex identity remixes, stories of embodied multiplicities, and affective incarnations that oscillate between conflict and love. The *Surlogical* provides for me a territory for speculating about multiple collisions from my personal position, so I can navigate intimate fictions and frictions to open other ways of being, thinking, feeling, and knowing. Please refer to George Lewis, "Improvised Music after 1950: Afrological and Eurological Perspectives," in *Audio Culture: Readings in Modern Music*, ed. Christoph Cox and Daniel Warner (New York and London: Continuum, 2005) 272–284.

approaches and decolonial operations to open up modes of socialization through improvisatory call and response encounters.

I can feel the ground shaking in response to the challenging times we are living in. The air is full of ideas and conjurings that are brewing-up from the minds and actions of thinkers, creators, and activists. The people that I am inspired by share an urge to operate from disciplinary fissures with feminist, queer, antiracist, anticolonial, and ecological perspectives to imagine vibrant more-than-human realities. Through beautifully mixed—humus-like—tactics, it is possible to identify ways to reimagine our social architectures with the objective of mending fractured alliances between ourselves and nature as well as to defy a universal and static notion of reality imposed by the West. This is a time for reformulation. We have the opportunity to remap and rewrite our stories accordingly by rearranging our position in the world and re-calibrate our compass to navigate it.

In my work, I consider it important to put ideas into practice and not to rely uniquely on the theory. As an architect, I have an impulse to materialize concepts, to let ideas grow and shape themselves out of the paper. As a drummer and musician, I know the importance of perseverance, practice and repetition. Both of these roles use methods for learning and rewiring our minds through embodied experience and the enriching possibilities of improvisation. I recall experiences throughout my life that exemplify the importance of materialized or actionalized ideas. When I was a child, I first encountered music by *playing-to-play* instruments with my brothers and friends. It crystallized my profound appreciation for the habit of doing-with-others, without a set of fixed rules but instead with a sense of actionable playfulness. I later experienced the same actionable intuition as a DJ. From performing, I learned to naturally operate from a *mixillogical*[6] perspective and to rely on a deeply *sweaty* emergent togetherness and feedback loops to dialogue with my audience. As an artist, I believe in the immeasurable power of poetry and radical imagination as places of action. It is relevant to anchor these experiences within this introduction because they have shaped how I position myself within the larger conversation and in my professional practice, and therefore how I've shaped this thesis.

The installation *Membranas* materializes from the necessity of having a conceptual apparatus to think with, and a vibrational laboratory to put ideas into practice. Throughout the process of creating this work

[6] *Mixillogical* is a term used by theorist and filmmaker Kodwo Eshun. This term refers to the mechanism of radically remixing and colliding sounds, a genuine emergent action embedded in mixing very different things together to give shape to a musical piece that had no underlying preexistence and that wouldn't have been possible otherwise. In his writing, Eshun fluidly rearranges new terms as part of a practice that seems centered in *mixillogics:* the appropriation of terms by their recombination. Please refer to: Kodwo Eshun, *More Brilliant Than The Sun: Adventures In Sonic Fiction*. (London: Quartet Books, 1998).

and conducting my research for the past several years, I encountered in *La Membrana* a stimulating and productive concept that enables a vibrational way of thinking and being in the world. Based on the configuration and characteristics of a vibrational membrane, *La Membrana* is a model structure that, in its physicality, provides an organizing system that both produces and receives vibrations. It behaves as a porous boundary that can both separate and connect. This structure can work as a threshold or portal that is activated by vibrations and provides a fertile territory for non-linear storytelling, vibrational relations, and oscillatory experiencing. It is an exploratory space for *wit(h)nessing.*[7] Throughout this thesis, I will guide you through a series of ideas, challenges, and strategies that I encountered as I followed my call to explore *La Membrana* as a physical and theoretical place for onto-epistemological reconfiguring(s). This is a place that offers a vibrational ground where we can resensitize our perceptions to situate ourselves within the world we live in and the phenomena we are part of.

Through resonance, *La Membrana* is constantly attuning to its surrounding sounds and other vibratory forces. I propose to follow this as a model so we can tune into our vibrational reality. I propose that we behave like a membrane and resonate like a drum. That we embody oscillations and experience in a vibrational relationship with others. This may sound abstract, metaphorical, or difficult, but it is an activity that our bodies are doing constantly. As every material body does, we have the capacity of vibrating and resonating. It is for this reason that my proposal is not an instruction to engage in something new, but a reminder to be more attentive to what is already happening. By being more receptive to these embodied processes, we may manage to rearrange our senses and embrace the possibilities of immediacy and material weavings that sound can offer. In doing so, we might be able to fuzz the predominance of sight and the distance it conveys. We can reorganize our sensoriums out of the Western modality tied to the regime of sight above the other senses. I propose to do so by fuzzing the predominant

[7] *Wit(h)nessing* is a term proposed by feminist theorist, artist, and psychoanalyst Bracha Ettinger. With this term she refers to the idea that everyone exists already engaged in a cohesive relationship that occurs prior to any independent subjectivity of a Freudian "I." Through Etitinger's revision, the concept of "I," in itself, co-exists already with a negation of itself, a "non-I." These ideas are based on the critical foundation constructed by Luce Irigay's accusation of mainstream, male thought-leaders' phallocentrism, heteronormativity, and reductive perspectives, allowing for a broader understanding of co-emergence.
As I interpret it, *wit(h)nessing* is a term that enacts the idea of *witnessing-with*. To witness refers to bearing testimony, to having knowledge of an event, to having seen something occur. By adding an extra "h," the term is expanded into *with-ness*, something that conveys having experienced *with*, not as a passive, distant observer but as an active participant. I understand this as a radically membranal concept. I first encountered the term *wit(h)nessing* in a conversation with art historian and dear professor Caroline Jones during a public event. When she mentioned this concept to me, it resonated profoundly and lingered in my thoughts for years.
Please refer to: Bracha Ettinger, *The Matrixial Borderspace*. (Minneapolis: University of Minnesota Press, 2006). And: Luce Irigaray, *An Ethics of Sexual Difference* (Ithaca NY: Cornell University Press, 1993).

surface-centered-objectivity of the visual so we can allow ourselves to perceive through deep subjective immersion.[8]

Since *Membranas* weaves a narrative that departs from ocularcentrism, in order to strongly develop this artwork, I thought that a pertinent ally had to be an invisible one: the wind. The wind is a teacher of sensing-without-seeing and therefore a suitable fit for this installation. It is an elusive nomadic entity that is the embodiment of motion of the medium we inhabit; and that inhabits us in return when we breathe. Wind is essentially relational. For instance, its very sound is an event that is shared with others. The whistles, whispers, and *cuchicheos*[9] of wind only emerge when it is in contact with other bodies. As a *hyperobject*,[10] the wind also is a planetary, *membrane-like* invisible architecture that intersects different bodies, peoples, and places as it travels. I am fascinated and intrigued by wind and how it carries not only its own sounds, but also the sounds of others. In this thesis, I will present the many reasons I chose to engage with wind for the execution of this work; however, possibly the one that touches me most is its connection to the predominance of wind instruments and sonorities across the Americas or *Abya Yala*,[11] especially in the South-Andean region, the territory I come from. Engaging with the wind is a labor of *conspiring* in a constant circulation of vital energy. I want to clarify that I am using *conspiring* in a way that conveys the idea of plotting something, but also in an extended manner, where the term encapsulates the idea of *breathing together* as well as *inspiring each other*.

[8] I want to be mindful not to continue perpetuating separatist views of the senses by replacing the predominance of sight with hearing. What I want to convey is that by reorganizing our sensorium we can operate in a fuzzed way where categories interfere with one another and borders are diffuse. This is an operation to shake things up and redistribute the senses so we can have more room for touching, smelling, tasting, moving, and positioning ourselves within the world instead of outside of it.

[9] *Cuchicheos* is a colloquial way of saying *whispers* or *murmurs* in Spanish. It refers to whispering in the ear and carries the connotation of gossiping or the plotting of something. This term is widespread, but not used in every Spanish-speaking country.

[10] *Hyperobject* is a concept proposed by philosopher and ecologist Timothy Morton to describe objects that transcend spaciotemporal specificity due to their large scales and massive nonlocal distribution and temporal affectations. Please refer to Timothy Morton, *Hyperobjects: Philosophy and Ecology after the End of the World*. (Minneapolis; London: University of Minnesota Press, 2013).

[11] This term refers to the American continent. The origin of the word Abya Yala comes from the Kuna language of the Kuna Tule territory. It refers to the "land in its full maturity," which is the cycle of the Earth that we are living now. This term was adopted by many Indigenous groups and activists across the territory as an anticolonial emancipatory action that aligns with their movement and fight. The term has transcended these spaces and has permeated into colloquial language, becoming the term of preference for many people to refer to this continent.

c. A Collection Of Songs: Thesis Overview

I will organize this thesis as a collection of strategies to propose a reorientation towards the vibratory.[12] The chapters that compose this thesis are an archive, a journal, and a testimony of the work and questions that have been guiding my research and artistic production for the past years. Each chapter is a song, and as such, each chapter is accompanied by a sound capsule that can be accessed via a QR code at the beginning of the chapter. These capsules function as sonic introductions to each chapter, providing the reader with a moment of attunement.[13]

Song 1: Resonant Layers has the objective of situating the reader and contextualizing the ideas behind this research and project. In the section *Membranal Examples*, I intend to articulate and put into resonance the influential work of different people that I consider embody essential membranal[14] characteristics. In the process of exploring *La Membrana* as a concept and place of action, these examples have been enormously nurturing and of invaluable inspiration as they have dynamized my ideas and critically stimulated my imagination through the past years. These examples contain *relational articulators* that I identify in the work of artist Lygia Pape and Lygia Clark; the political and social spontaneous emergence of *The Collective Body/La Cuerpa Colectiva* through the work of the collective LASTESIS and other collective forms of protest; examples on *Listening as Emergence* in the work of composer Pauline Oliveros; ideas of *Improvising with Machines* in the work of composer George Lewis; different *Cybernetic Arrangements* and systems thinking such as the *Invisible Open Architectures* proposed by the work of artist Juan Downey, and the *Ghostly Cyborgian Links* in the work of composer Maryanne Amacher; *Indeterminate Systems* and fungal distributed structures in the work of composers John Cage and David Tudor; and notions of Never-Static Listening within the work of artists and researchers AM Kanngieser, Zoe Todd, Marie Thompson, and Dylan Robinson. I weaved into these references some personal observations and notes so I can highlight specific aspects that I am resonating with or being activated by. There is also a section on *Personal Layers* which refers to personal experiences, collaborations, and previous work that has led me to the work and research that I am presenting in this dissertation

[12] I wish I could do this just with sounds and that I could share these ideas through a moment of listening together. But I am certain that the future will provide plenty of opportunities to share more sounds and fewer words, so we can construct sense from there. This is the moment to shake our thoughts through words.

[13] After the completion of this PhD, each of these capsules will be expanded into sonic essays/fictions that contain sounds and key narrated elements to diffuse this work into other types of experiences that are not limited to the traditional academic thesis document.

[14] Membranal means something that relates or pertains to a membrane. Some membranal characteristics that I would like to highlight in this thesis are a series of stimulating and productive features that allow transductive and vibrational ways of thinking and being. The membranal is in constant relationship with others, it means to be performative and in constant flux.

Song 2: La Membrana, An Apparatus for Tuning In provides the foundations for the practice of *fuzzing by resonance* as I unfold the many threads of the concept that is *La Membrana*. There are many theoretical layers that construct the performative concept of *La Membrana* but in its centers it contains notions of more-than-human performativity, agency, and the non-stationary cosmos proposed by physicist and feminist theorist Karen Barad.[15] This section presents an examination of the construction of subjectivity outside of the Western norm and its categorical divides, such as the Cannibal Metaphysics[16] proposed by anthropologist Eduardo Viveiros de Castro; anthropologist Marisol de la Cadena's ideas around Andean fractal entities and identities[17]; anthropologist Philipe Descola's[18] work advocating for animism as a new order to rearrange the social, supported by philosopher of science Isabelle Stengers's quest to re-enchant reality[19]; ecofeminist author Donna Haraway's notion of "naturecultures"[20]; and anthropologist Eduardo Kohn proposal to tune into other systems of intelligence that are not exclusively human.[21] This section also presents questions of difference and finitude in the work of artist and philosopher Denise Ferreira da Silva[22] and other thinkers that critically explore the notion of definition and construct theories of fuzzy otherness. Within this context, I frame *La Membrana* as a place to fuzz sight and rearticulate the sensorium out of the predominant surface-centered-objectivity of ocularcentrism so we can allow ourselves to perceive through deep subjective immersion. The theory of *La Membrana* is an energetic and generative vibrational apparatus that enables transductive[23] territories, rubbery identities, and porous

[15] Please refer to: Karen Barad, "Posthuman Performativity, Toward an Understanding of How Matter Comes to Matter," in *Signs*, Vol. 28, No. 3. (Chicago: University of Chicago Press, 2003); as well as Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. (Durham; London: Duke University Press, 2007 (2nd edition)).

[16] Eduardo Viveiros de Castro, *Cannibal Metaphysics: For a Post Structural Anthropology*. (Minneapolis: Univocal Publishing, 2014).

[17] Marisol de la Cadena, *Earth beings: ecologies of practice across Andean worlds*. (Durham: Duke University Press, 2015).

[18] Philippe Descola, *Beyond nature and culture,* trans. Janet Lloyd (University of Chicago Press, 2013).

[19] Isabelle Stengers, "Reclaiming Animism," in *eflux Journal #36* (2012). (Accessed: 10-9-2018) https://www.eflux.com/journal/36/61245/reclaiminganimism/

[20] As described by Nicholas Malone and Kathryn Ovenden, "*Natureculture* is a synthesis of nature and culture that recognizes their inseparability in ecological relationships that are both biophysically and socially formed." This term was introduced by Donna Haraway (2003) and it emerges as a way of questioning the drastic binaries embedded in Western thought that sustain the dissociation between humans and nature. Please refer to: Nicholas Malone and Kathryn Ovenden, "Natureculture," in *The International Encyclopedia of Primatology*, ed. Agustín Fuentes. (Chichester: John Wiley & Sons, Inc., 2017). p. 848. And to: Donna Haraway, *The Companion Species Manifesto: Dogs, People, and Significant Otherness*. (Chicago: Prickly Paradigm Press, 2003).

[21] Eduardo Kohn, *How Forests Think, Toward an Anthropology beyond the Human*. (Berkeley, CA; Los Angeles, CA: University of California Press, 2013).

[22] Denise Ferreira da Silva, "On Difference without Separability," in *Incerteza Viva: 32a Bienal de São Paulo, exhibition catalogue*, eds. Jochen Volz and Julia Rebouças. (São Paulo: Fundação Bienal de São Paulo, 2016). p. 65. Also: Denise Ferreira da Silva, Tangible Possibility lecture, ICA Miami, 2021. (Accessed: 04-10-2022). https://www.youtube.com/watch?v=79UWUHtCW6g

[23] Transduction is a process through which one form of energy is converted into another. For example, in audition, transduction takes place when sound waves are converted into electric impulses that are interpreted in the brain as

relational possibilities. I ground these ideas in vibratory systems that resonate deeply from inner dimensions at a material and immaterial level to the expanse of the cosmos. By focusing on the sonic and its aural and tactile manifestations, I unravel ideas of how vibrations can operate as multidimensional construction materials and as dynamic portals between worlds. With these mechanisms I intend to open up questions that can stimulate other ways of rearranging reality as well as speculating about and the enormous possibilities of tuning into membranal territories.

Song 3: Membranas, A Platform to Practice presents the practical component of this thesis, the installation called *Membranas*. This art work proposes an experimental platform to put into practice the ideas presented in the previous chapter. *Membranas* aims to be a synthesis of ideas that are displayed in a nonlinear way, based on embodied experiments on resonant togetherness. In order to do this, *Membranas* is set up as an infrastructure for activating improvisational modes of socialization, based on call-and-response dynamics between human and nonhuman participants. The installation presents an indoor tensegrity[24] structure with different sonic and vibratory organs that mediate the interaction. This structure receives sounds from *La Orejona,*[25] a vibrational membrane microphone that is meant to be placed outdoors. In this chapter, I provide a description of what the experience is like in its installation mode and its performance mode. As I describe the experience and intentions of the installation, I dive into the idea of the *Surlogical,* that emerges in contrast to the Northern Western *Eurological*, as a way of exploring and speculating on alternative logics for musical togetherness from a *mestiza*[26] perspective. I propose the *Surlogical* as a membranal place, full of syncretisms and complexities, that I believe provides a dynamic scenario to socialize beyond the human through resonant emergent arrangements. This conduces to numerous ways of concatenating with the wind, resulting in a mechanism to *co-inspire*. I elaborate a list of interpretative definitions of what it means for me *to co-inspire* in order to construct a poetic and subjective meaning that gives shape to my proposed scope. I also deal with ideas around the

sounds. As a form of energy, sounds are constantly being transformed and transferred to exist in multiple media, forms, and dimensions.

[24] A tensegrity is a structure that maintains its integrity by the concatenative tension of its parts. This is a collective body of individual parts that is compressed into a net of continuous tension. Tensegrity structures are the structural basis of many biological, vegetal, and other networked structures such as cellular and cosmic systems. During their Black Mountain College days, Kenneth Snelson and Buckminster Fuller started exploring these structures in more depth and engineering structural systems that accommodate the logic of these natural scaffoldings.

[25] *La Orejona* translates to *the big-eared one*.

[26] *Mestiza/o/e*, in the context of the American continent, refers to a person who is of both European and Indigenous heritage. Originally, this term carries a negative connotation that comes from its association with the violence of colonialism in Abya Yala. Over time it has become identified as a cultural term alluding to the combination of both cultures, as well as others. The *mestize* person is a mixed figure full of syncretism and contradictions. They carry a complex vertiginous psychological identity, because of their denied *European prestige* and a culturally imposed contempt for their *Indigenous roots*. In order to contest the historical, dismissive connotation of the term, decolonial thinkers have appropriated this identity as a place of empowerment and emancipation, where instead of not belonging anywhere, the *mestize* can inhabit many worlds at the same time.

politics of listening, as I expose an ethical framework that negotiates with technologies for listening and surveillance, the orientation of modern microphony, and the risks of immaterial extraction. By critically facing these topics and situating my work within this context, I propose a practice centered in the poetics of unintelligibility as a way of disrupting—or fuzzing—apparatuses that perpetuate extreme individuality and control.

Song 4: Sistemas introduces the different parts that are put into dialogue by the installation *Membranas*. Its objective is to unpack in detail the components of *Membranas* and the fractal weavings of the system. As this chapter presents each of the elements that compose the installation and experience, it also tackles the technical challenges and decisions involved in the development of the piece. Many of these decisions emerged through an experimental, hands-on methodology, where the process informed the concepts of the installation and vice versa. This methodology denotes an approach of working by following intuitions and being open to the fruitful possibilities of errors, mistakes, and iterations. I also present the implementation of a series of mechanisms that have the intention of giving up control and being open to fortuitous results and chaotic resonances. I frame my argument under the idea of the agency of the machine, a central component of the installation.

This dissertation finishes with the *Outro*, a discussion of the overall experience of *Membranas* throughout its process in order to be able to narrow down some key observations and results. I reflect on the impact and contributions of this work, in addition to reflecting on future work and further resonances as I continue navigating the vibrational universe of *La Membrana*.

Song 1: Resonant Layers

Figure 3 *QR code for audio Song 1, Resonant Layers. 0'30". I recommend listening with headphones. The file can also be accessed at this link: http://nicolelhuillier.com/song-1/ (Accessed: 04-13-2022*)

a. Membranal Examples

Throughout the exploration of *La Membrana* as a concept and place of action, I have been encountering multiple embodiments of these ideas within the body of work of various artists as well as in resonant social events. In this section, I intend to articulate examples of membranal manifestations that have informed and energized my personal experiments and ideas. These artists and their work have paved the road with provocative, ground-shaking membranal practices that keep resonating today. These have been for me enormously stimulating and nurturing, as they have inspired and taught me valuable lessons. As I present these influential references, I will try to humbly weave in some examples of personal work that have guided me to the questions and drives that initiate the installation that I am presenting in this thesis. It is important to mention that the concept of *La Membrana* being so elastic made it difficult to narrow down this list, as many things can be considered *membranal* or embody some aspect of membranal-ways-of-thinking. The examples I will refer to in this section compose a concise but relevant group.

Membranes are organizing structures that in essence present an agglutinant apparatus that embody promiscuous exchanges, and which are performative as they perpetually redefine and rearticulate themselves. Membranes are also places of constant transfers and emergent encounters. When thinking about these membranal qualities, it is natural to think about certain key events and movements in the history of artistic expressions, such as the Neo-Concrete and Antropofagia movements that spawned in

the ‘60s in Brazil; the emergence of feminist collectives during the social uprisings in the past few years in Chile and the world; the rise of cybernetics, systems thinking, and networked art since the second half of the 20th century; and the experimental and emancipatory intentions within the postwar chance operations in music, avant-garde’s emergent improvisations, and sound art.

Relational Articulators

The Neo-Concrete movement in Brazil emerged as a reaction to the limitations of understanding art as a dislocated antisocial object and the serial operations in abstraction and the extreme rationalism that abounded in the North in those days. Neo-concrete artists were interested in the political relations that an artwork could embody as a sensuous articulator. These involved the audience in the artwork as they activated each other in a reciprocal relationship. This movement resisted the idea of art as a superficial distant object that had to be admired from afar. The artists were interested in the affective potentials of the work, as it was strongly relational and about stimulating exchange. A key representative of this movement, Lygia Pape (Brazil, 1927–2004), embodied these ideas through vivid explorations in performance, sculpture, film, and participatory work, perhaps most notably in her living sculpture *Divisor* (*Divider*) (1968). This piece is one of the clearest representations of Pape’s desire to break down the space between the art and the viewer. It completely changes the way the audience and the artwork are understood, as the audience stops being a *viewer* and becomes a *participant*. *Divisor* is a very tangible membranal example that consists of a shared performance where 60 participants poke their heads through holes in a large blank canvas and experience a series of collective exercises. Pape proposes a collectively populated membrane as a model to experience and act in multiplicity. A large arrangement of bodies composes a system of collective experience and movement, in which the participants and the membrane are one collective body. The name of the piece is particularly interesting to me, as it unveils another key characteristic of a membrane—the duality it presents as it is simultaneously a place of both connection and separation.

Figure 4 *Lygia Pape. Divisor (Divider), 1968. Performance at Museu de Arte Moderna, Rio de Janeiro, 1990. Photo: Paula Pape. © Projeto Lygia Pape.*

Another example within the Neo-Concretists' is the work of Lygia Clark (Brazil, 1920-1988). She departed from a visual-centric practice to one centered on bodily actions and movements and membranal relationships between objects and participants. She was interested in creating encounters through her work on *relational objects*. These artworks proposed ambiguous tensions and dialogues between binaries, such as inside and outside as well as subject and object. Similarly to Pape's work, these dualities are not embodied as binaries but as multiplicities within the pieces. One example is *Diálogo de Mãos* (*Hand Dialogue*) (1966), an object consisting of an elastic Möbius strip that had the function of hinging the hands of two participants. By doing so, this artwork assembles the participants' bodies, the space they inhabit, and the elastic strip into a moving sculpture. It is an articulator of scales and relations. I also feel it is key to highlight that the material itself is an elastic, porous membrane. Clark's interests in those days focused on participation, architecture, and the inner spaces of relations, the intimacy of folding and hinging bodies/spaces, as well as collective experience and emergent processes between participants, artwork, and artists. The artwork was never the objects she made, but the encounters they propitiated. This is precisely how I conceive my works. These ideas are embodied in Clark's *Bichos* (*Critters*) (1960), a series of playful, manipulable sculptures. These marked the beginning of the viewer's active participation in Clark's work. The *Bichos* are always in a transitional mode, they are never in a final state.

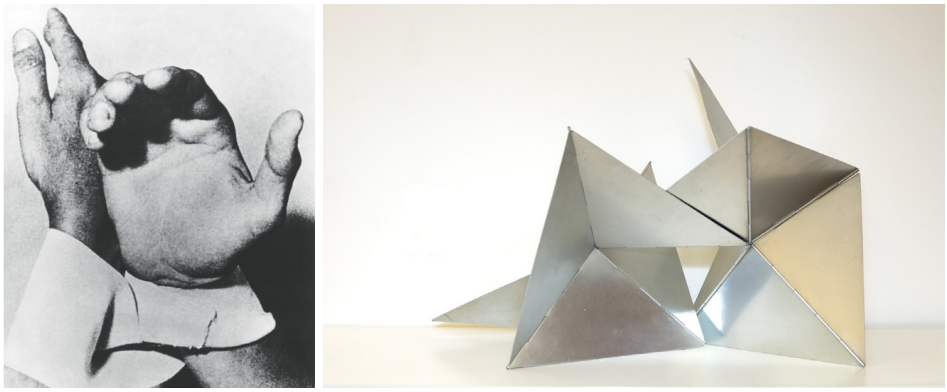

Figure 5 *(Lef) Lygia Clark. Diálogo de Mãos (Hand Dialogue), 1966. Both Clark's and Hélio Oiticica's hands are pictured inside the elastic Möbius strip. Photo: CDOC/Museum of Modern Art, Rio de Janeiro. (Right) Lygia Clark. Bicho linear (Linear Critter), 1960. Photo: Associação Cultural "O Mundo de Lygia Clark".*

Viscous Layered Remixes

Another key membranal movement is Antropófagia.[27] This is an artistic movement and postcolonial tool that gained force in Brazil during the '60s as a revival of the *Manifesto Antropofágo* (1928) by poet Oswaldo de Andrade[28] (Brazil, 1890–1954) earlier in the century. This movement was a way of refusing to be culturally dominated by European ideas by proposing cultural cannibalism of the colonizer. This was an operation that opened up the possibility of appropriating contradictory and complementary elements of different cultures in order to make remixes that enable hybrid forms of empowerment. As an artistic concept, Antropófagia gained strength in the '60s under the umbrella of Tropicália, a movement rooted in Brazilian culture and politics that also incorporated influences from the North. Antropófagia presents a territory of hybrid *South-North* encounters, assuming all the complexities, problems, contradictions, and possibilities that this brings to the table.

This movement is inspired by Indigenous practices that the state and the international community used as a way of exoticizing and commodifying Brazilian culture. Since the outsiders were already *cannibalizing* Brazilian culture and imposing imaginaries based on reductionist racist categories, the countercultural movements took over by reverting the operation and *cannibalizing* them back. The movement is based on the idea that by cannibalizing the enemy one gains their strength and appropriates their qualities, which I understand in a paradoxical way, both an act of defiance and one of respect and desire. However, it is not a desire for everything—this process, as any metabolic process, consists of a selective digestion. By

[27] *Antropo* refers to *people* and *fagia* to *eating. Antropofagia* translates to *eating people,* or cannibalism.
[28] Oswald de Andrade, "Manifesto Antropófago," in *Revista de Antropofagia* 1(1928): 3-7.

digesting, one absorbs what the body needs, and what is not assimilated is excreted. This digestive process is full of permeable and porous membranes[29] that determine what is absorbed and what is not.

Antropófagia was understood as a multiculturalist movement up until the '90s. Recently, newer generations have continued to update the ideas behind this movement to negotiate the problems within Antropófagia. The contributions and provocations coming from contemporary thinkers[30] have pointed out the importance of shifting Antropófagic action from a *multiculturalist* perspective to a *multinaturalist* one. In this way, Antropófagia can be understood as an act of crossing boundaries and ontological frontiers that fuzz categories. This allows one to inhabit an indeterminate and elusive identity that has to do not only with eating the culture of the other, but about eating their nature, their position. The critique still lies in how this emancipatory action can resonate in a respectful way with Indigenous communities and how care needs to be taken to not perpetuate other forms of colonialism. The most notable problem is that the movement is based on Indigenous philosophies and symbolisms but, at the same time, it is disconnected from the political struggles of Indigenous peoples. We must never forget that *decolonization is not a metaphor.*[31]

The Collective Body/La Cuerpa Colectiva

The previous examples center on porous articulations of political relations and multitudes before the turn of the century. I would like to deviate now into recent years, where these ideas are echoed and embodied in demonstrations for social and environmental justice around the world. I will center on two examples from the social uprisings in Chile since October 18, 2019. Within this context, social movements have powerfully emerged after many years of demonstrations to demand a more just society on many fronts, such as social security, education, and women's and Indigenous peoples' rights, as well as environmental justice. After a turbulent period of social unrest and the Covid-19 public health crisis, these collective movements have had historical concrete outcomes, such as the initiation of the process to write a new Constitution.

[29] The epithelial layer, the adventia or serosa, and the mucous membrane, composed by the lamina propia, the epithelial layer, and the submucosa, to name just a few.

[30] Such as artist and writer Pedro Neves Marques and architect Paulo Tavares, among many others who elaborate from anthropologist Eduardo Viveiros de Castro's ideas around becoming other and cannibalizing alterity. Please refer to: Pedro Neves Marques, *The Forest & The School / Where to Sit at the Dinner Table?* (Berlin: Archive Books, 2015). And: Eduardo Viveiros de Castro, *Cannibal Metaphysics: For a Post Structural Anthropology*. (Minneapolis: Univocal Publishing, 2014).

[31] Eve Tuck and K. Wayne Yang, "Decolonization is not a metaphor," in *Decolonization: Indigeneity, Education & Society Vol. 1, No. 1*, (Open Journal Systems, 2012) p. 1-40.

Figure 6 *(Top) Carla Motto. Photo taken at the demonstrations between October 2019–April 2021, Santiago, Chile. Photo: Carla Motto. (Bottom) Colectivo LASTESIS. Intervención "Un Violador en Tu Camino". First intervention done in Santiago, Chile, during the International Day for the Elimination of Violence against Women, November 25, 2019. Photo: Film still of video documentation by Carla Motto.*

When I see Lygia Pape's *Divisor*, I can't help but think about the vivid collective moments of the social demonstrations in the streets of Chile. Here, the work of feminist collectives was central and lit a collective inner fire that resonated at an international level. Within this context, the interdisciplinary feminist collective LASTESIS (Chile, 2018) has created participatory protest performances to denounce violence against women, the LGBTQI+ communities, and other marginalized bodies. From an intersectional feminist perspective, they put their bodies and voices in the forefront as a form of resistance and *lucha*[32] against the patriarchal hegemonic power. Their work *Un violador en tu camino* (*A rapist in your way*) (2019) is a participatory protest performance that consists of a protest song and bodily movement that spread across the world denoting the urgency and strength of repetitive collective action as a way to contest violence. The collective body—like a collective membrane—became enormously more

[32] *Lucha* translates to *struggle* or *fight*.

powerful than the individual one, since the social body occupies a larger space, sounds exponentially louder, and in its expanse, becomes elusive and slippery.

Figure 7 *Carla Motto. Cacerolazos. Photos taken at the demonstrations between October 2019–April 2021, Santiago, Chile. Photo: Carla Motto.*

Another prevalent example of a social membrane that was weaved with sounds during the marches is the *cacerolazo*.[33] This is a strong form of protest that is done by collectively banging pots and pans in the marches. October 18, 2019 is known as the day that *Chile woke up*,[34] referring to the idea that we all spent decades in a lethargic state after the nightmare that was the dictatorship after the coup in 1973. The day that Chile *despertó*[35] is also known as the *Estallido Social*.[36] And like any explosion, this one carried a significant sound that stirred up the air and agglomerated all types of bodies as a large vibrant mass. During the demonstrations that started in those days, the sound of the casseroles was a fundamental section of the vibrations occupying the air and resonating among every type of body and membrane that was present. The casseroles became vibrating bodies of metal that manifested the heartbeat of the marches and kept the pace, with the *heart* of their sound oscillating between 2 kHz and 6.6 kHz. Along with the whistles, chants, and sirens, they agglutinated everything into a giant, invisible, vibrating social membrane. The Earth, the people, the nonhuman animals, the casseroles, the rocks, the concrete, the trees, the buildings, and every single bone resonated, vibrated, and sounded together, again and again. They

[33] This word is a colloquial way of referring to the action of *banging pots and pans* as a form of emergent participatory protest.
[34] El día que *Chile despertó*.
[35] This translates to *woke up*.
[36] This translates to *social outburst.*

echoed and transduced[37] each other. They were a collective body that was being rearticulated on the go. By manifesting oneself, one appears and becomes present. An act of manifesting oneself could be, for example, taking part of the cacerolazo. This sound—as any sound—is mechanical energy, vibrations that propagate through a medium (air), touching other bodies and merging with other sounds that are being manifested. By manifesting oneself, one becomes part of something. Sound weaves into an emergent collectivity.

[37] Transduction is a process through which one form of energy is converted into another. For example, in audition, transduction takes place when sound waves are converted into electric impulses that are interpreted in the brain as sounds. As a form of energy, sounds are constantly being transformed and transferred to exist in multiple media, forms, and dimensions.

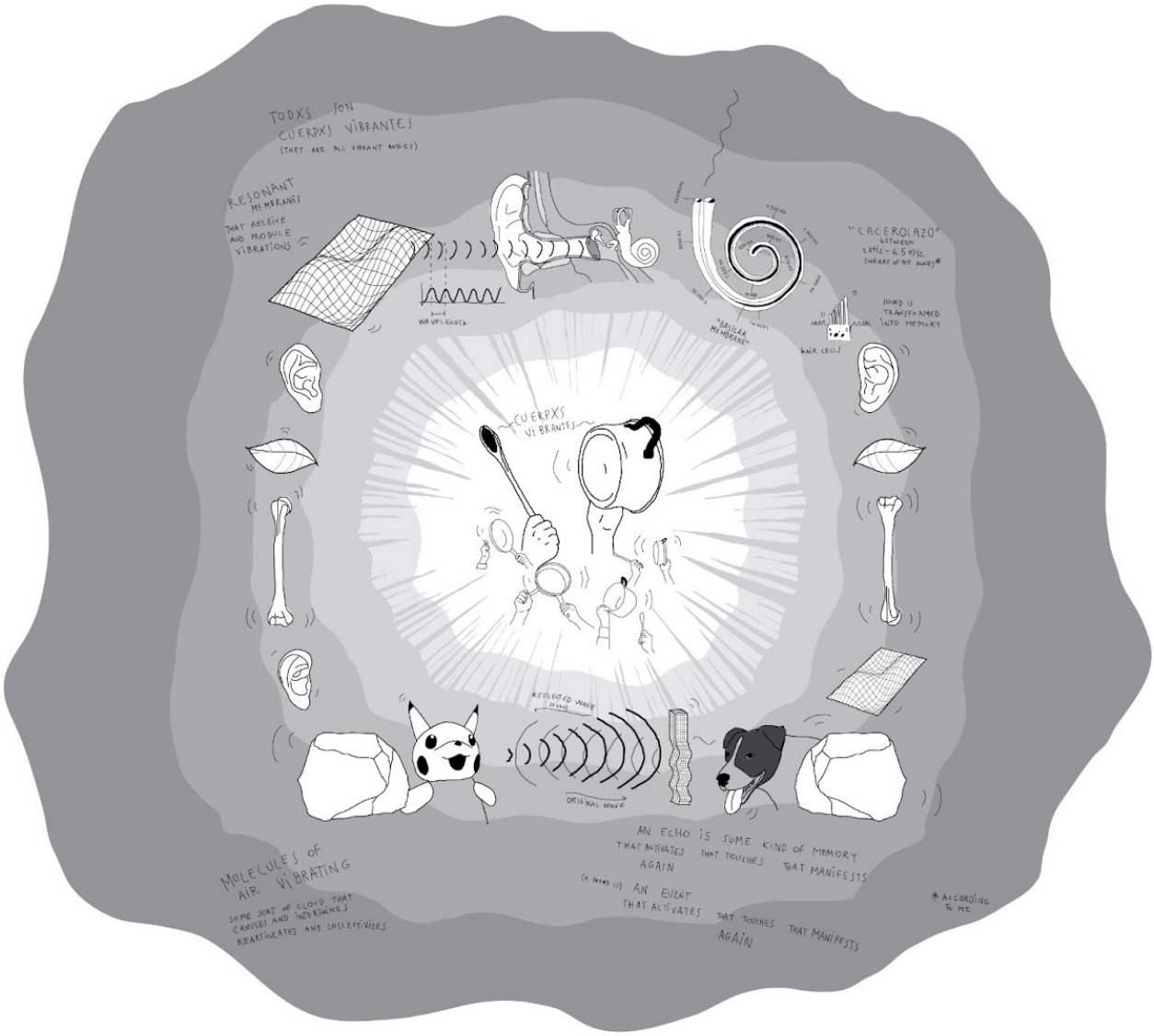

Figure 8 *Manifiesto, Nicole L'Huillier, 2022.*

Listening as Emergence

The *cacerolazo* could be thought of as a moment of collective and emergent improvisation. This would differ from traditional forms of music improvisation that require previous coordination, expertise, or training, as the *cacerolazo* is spontaneous and inviting. Anybody can join (and leave) at any moment, since the rules are extremely simple and intuitive. Following similar principles, composer and deep listener Pauline Oliveros (United States, 1932–2016) developed a set of text scores called *Sonic Meditations* (1971). These propose a series of exercises to enter into listening and sounding emergent encounters. These encounters focus on listening to each other in order to attune in collective arrangements of sonic expanded consciousness. By developing these scores, she dove into experiences that invite multiple individuals into spontaneous collective action. The instructions are very clear and simple, making it easy for a collective to emerge without previous practice or the need for extensive musical knowledge. Her work is a great reference to think about how to create a set of simple and clear instructions that can guide a group into an emergent collectivity. Oliveros was particularly interested in unveiling the universe of sound through individual and collective sensibilities as well as trying to expand registers and dimensions of listening.

–XVIII–

ReCognition

Listen to a sound until you no longer recognize it.[38]

Pauline Oliveros

Through her practice, Oliveros engaged in emancipatory experiments that meshed the in-betweens. She cared deeply about perspectives, difference, and positionality, which led her to develop a practice centered on listening as attuning and recalibrating our sensorium. The way she worked and navigated life led her to become a prominent feminist figure and queer activist who confronted normative spaces and misogyny in the music world, which has been characterized by being predominantly white and male. Her work overflows in generous ways of listening, as well as examples of resonant care. Oliveros's work is a

[38] This is one of Pauline Oliveros's sonic meditations. I find it particularly interesting since it centers the way that, by listening, one can recognize or acknowledge something, and how *re*-cognizing implies that this acknowledging or knowing is done in repetition and can evolve into acknowledging and knowing again and again. Dismantling staticity and permanence within the action of listening. Source: Pauline Oliveros, *Sonic Meditations* (Baltimore: Smith Publications, 1971). p.26.

reminder that listening is about others as much as it is about oneself. It is about silence and space as one continuously negotiates energies and shifts hierarchies to balance space for receiving and transmitting in a loop of generous emergence. Deep Listening is about understanding oneself as part of the spacetime continuum. Oliveros was interested in the agency of the performers as a dynamic system that emerged in an impossible-to-predict group intelligence of collective listening. This is not an intellectual process, but an intuitive and intimate exercise of togetherness.

Improvising with Machines

As a curious and explorative listener, Oliveros stumbled into Quantum Listening as a way of Deep Listening. According to her, "Quantum listening is listening to more than one reality simultaneously."[39] This way of listening implies the possibility of listening in fractal ways and not only expands scales of attention, but also opens up the possibility of engaging simultaneously in differential registers of listening, as well as suggesting a place to inhabit nonlinear temporalities. She writes, "Quantum Listening is listening in as many ways as possible simultaneously—changing and being changed by the listening."[40] The quantum brings to the conversation the potential of listening as an apparatus that contains and embodies simultaneous differential states, just like the vibrational modes of a drumhead circular membrane. In Quantum Listening there is a direct openness to altereity, which is clear later in Oliveros's work around *Quantum Improvisation*,[41] a practice that enables improvisatory emergence with nonhuman machinic agents. This improvisatory practice is one that simultaneously engages different types of intelligences to come into sonic collectivity.

When diving into the space of cyborg[42] improvisation, a key figure is composer, performer, and researcher George Lewis (United States, 1952). Lewis has devoted many years to theorizing and putting into practice relations between people and interactive systems to explore these relations, "as a microcosm of the

[39] Pauline Oliveros, "Quantum Listening: From Practice to Theory (To Practice Practice)," in *Music Works #75* (Fall 2000). p.1.
[40] *Ibid*., p. 2.
[41] Pauline Oliveros, "Quantum Improvisation: The Cybernetic Presence," a keynote address presented at the conference *Improvisation Across Borders* at UCSD April 11, 1999. This paper appears in *Sounding The Margins: Collected Writings 1992-2009*, Pauline Oliveros, Deep Listening Publications 2010. It is also included in *Sound Unbound: Sampling Digital Music and Culture*, edited by Paul D. Miller aka DJ Spooky that Subliminal Kid, MIT Press 2008. Reprint permission by Pauline Oliveros. Available online. (Accessed: 04-10-2022) https://www.hz-journal.org/n16/oliveros.html
[42] Cyborg or cybernetic organism is a term coined by Manfred Clynes and Nathan S. Kline in the '60s. For a comprehensive discussion about the sociopolitical and ethical affectations of the cyborg, see: Donna Haraway, "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century," in *Simians, Cyborgs and Women: The Reinvention of Nature* (New York: Routledge. 1991) p. 149-181.

social,"[43] as improvisation is not limited to musical exchange but asserts a way of being in the world. What I find most interesting about his work on machine improvisation is that he starts by posing the question: "Why do we want our computers to improvise?"[44] The answer is not simple or straightforward, but what I want to highlight about this question is not the answer but the consideration of the question itself as a guidance for putting critical intention behind this action. Lewis talks about the immense power of a *hybrid cyborg sociality* as a way to challenge traditional forms of human sociality. This can bring to the conversation expanded notions of subjectivity that break with the constraints of the rigid divide of subjects and objects. His perspective takes into account the dangers of these divides as he points out the injustices and atrocities that the Western construct of subjecthood imposes on other groups that are (and have been) categorized as nonhuman so they can be objectified, commodified, and owned. By questioning the limits of subjecthood and objecthood it is possible to encounter other paradigms and social structures that can enable relations centered in justice, care, and respect. So improvisation as a way of socializing and problematizing rigid categorizations becomes a way of resistance, and by doing so, improvisation becomes a mark of agency and an assertion of an indeterminate subjectivity.

Figure 9 *George Lewis. 1999. Photo: Ian Cummings.*

For Lewis, there is no such thing as a "virtual improviser," even in the case of a computer system, as its virtuality is not of importance for its improvisational capacities. A virtual improviser is simply an improviser. This is rooted in the idea that the musical experience delivered to the world is not a simulation

[43] George Lewis, "Why Do We Want Our Computers to Improvise?" Presentation, part of *Media Lab Perspectives Series* hosted by Professor Tod Machover, April 29, 2021 (Accessed: 03-26-2022) https://www.media.mit.edu/videos/ml-perspectives-2021-04-29/?autoplay=true
[44] *Ibid*.

of a musical experience but *music,* with real and palpable outcomes in the world. Improvisation is a way of collaborative world-making; its essence is in the encounter, not in the internal processes and logics, whether these are cognitive operations, algorithmic processes, mechanical reactions, embodied memories, or other mechanisms. What matters is the encounter of different improvisers who are activated by input sonic signals to engage in a collaborative conversational space. As Lewis writes, in this case the computer is "a form of artificial life that produces nonartificial liveness."[45] When we improvise, we encounter alternative perspectives and we construct collective meaning through sound as we learn from the other's identity, positionality, and relative autonomy. By improvising with machines, we can look inside them and learn from that interaction. In the end, we are part of relational systems and construct other forms of common sense on the go. Lewis writes, "Negotiating this complex matrix is part of why many of us want our computers to improvise and why we want to improvise with them. What we learn is not about machines, but about ourselves, and our environment"[46].

Cybernetic Arrangements

Membranas is largely informed by the emergence of systems thinking in art and music, which arose from the advancements in communication technologies in the first half of the 20th century and was dynamized by the cybernetics revolution in the second half of the century. Some examples of early interactive system artworks and processes can be found in the work of László Moholy-Nagy (Hungary, 1895–1946), Nam June Paik (South Korea, 1932–2006), Gordon Pask (United Kingdom 1928–1996), and Juan Downey (Chile, 1940–1993), to name a few. Later, in response to the rise of the internet and the intensification of global connectedness, it is possible to see artists fluidly navigating and connecting virtual and physical worlds as they appropriate the protocols and critically use this medium to their benefit. Today, it is hard to *not* operate in networked ways, as we have been subliminally trained to think like this for decades. I believe that because of this networked paradigm, plus the need for meaningful connections, the urge of epistemic emancipation, and in view of the palpable consequences of our actions in the environment, we find today waves of artistic production that continue what spawned in the cybernetic techno-utopian days, but are now infused with strong ecological, feminist, decolonial, and posthumanist approaches. These movements bring to the forefront systems of interdependence over a fantasy of hyperconnection.

Systems thinking has also been central to artistic production in sound art and electronic music, where the work embodies intricate relationships that network ideas and agents in vibrant sonic and resonant

[45] George Lewis, "Why Do We Want Our Computers to Improvise?" in *The Oxford Handbook of Algorithmic Music,* ed. Roger T. Dean and Alex McLean (Oxford: Oxford University Press, 2018). p. 129.
[46] *Ibid*., p. 129.

arrangement. Relevant historical references can be found in the work of John Cage (United States, 1912–1992), David Tudor (United States, 1926–1996), Alvin Lucier (United States, 1931–2021), Pauline Oliveros (United States, 1932–2016), Bernhard Leitner (Austria, 1938), Maryanne Amacher (United States, 1938–2009), to name a few. I believe that music and sound art are intrinsically net-weaving and system-building creative endeavors, which I think is the reason for ideas around these topics to be widely found across musicians and sonic practitioners. Musicians and sound artists are essentially membranal agents; even if cybernetics and system thinking bring knowledge, reactions, tools, and possibilities to the conversation, this inherent characteristic comes from relational practices and languages that we have embodied over thousands of years.[47]

Invisible Open Architectures

Throughout his work, the artist Juan Downey developed a series of influential experiments on cybernetics and systems thinking that put in relation notions of telecommunications and technological advancement, anthropology, politics, energetic transference, notions of reality, and trans-hemispherical exchanges. Downey migrated to the United States in 1965, and from 1973 to 1975, he was a fellow at MIT's Center for Advanced Visual Studies (CAVS), which placed him in close proximity to cybernetics and new media arts. It is possible to identify in his work some aspects from the New Tendencies movement that intersected artistic practice with the information revolution and cyber-utopian perspectives, as well as the influence of the United States' counterculture, which was oriented towards ecological and communal thinking. In a context of fluid exchanges between art and technology, Downey focused on setting up experiments that enmeshed cybernetic and biological systems to interrogate structures of power through transformative social encounters. In order to do this, he worked with electronic devices and sensor technologies in relationship with natural forces and elements, as well as through intersubjective and multinatural relations. He was interested in exploring intertwined multiple perspectives, emergent cyborg intelligence, paradigm shifts, and spatial configuration as places for speculative rearticulations of socio-political arrangements. I believe that it is possible to recognize in Downey's work a series of *cybernetic hechizos*.[48]

---

[47] Gary Tomlinson, *A Million Years of Music, The Emergence of Human Modernity*. (New York : Zone Books, 2018).

[48] *Hechizos* translates to spells. In Chile, *hechizo* is also a colloquial way of saying something that was made by hand in a rough way, something *almost done*, something *made-ish*. Chilean curator and researcher Valentina Montero proposes this concept as a way of framing an epistemic disobedience embedded in the DIY and hacking mechanisms of media arts. Montero situates this concept within the media arts context in Chile and Latin America, which is set within a precarious situation that demands for the artists to be ingenious and resourceful so they can create with what they have at hand, which usually ends up being hybrids charged with uniqueness and a weird richness. For more about *hechizos*, please refer to: Valentina Montero, "Entre Frankenstein y el hada de la Cenicienta. Arte y tecnología desde América Latina," in *Tecnología, política y algoritmos en América Latina*, ed. Andrés Maximiliano Tello (Viña del Mar: CENALTES ediciones, 2020). p. 97-110.

Downey's concept of *Invisible Architecture*[49] is essential to his practice and alludes to how the material world and socio-political dynamics can be transformed and contained by intangible energies such as sound waves or electromagnetic signals. The energies that Downey uses as invisible materials for his architectures range from physical, social, political, psychic, cultural, and natural. Through exchanges between energies, devices, peoples, and natural elements, he created playful and dynamic indeterminate feedback loops. His electronic sculptures and audiovisual works signal a structure based in an open system that is aligned with second-order cybernetics. His work embraces the idea that the observer is not a passive outsider but is included as part of the system, as the observer affects and modulates the system as well. A synthesis of his ideas can be found in his series *Life Cycles* (1970–1973), a collection of architectural projects and environmental proposals towards circuits of communicational and relational utopias that encompass cybernetics, architecture, ecology, and feedback.

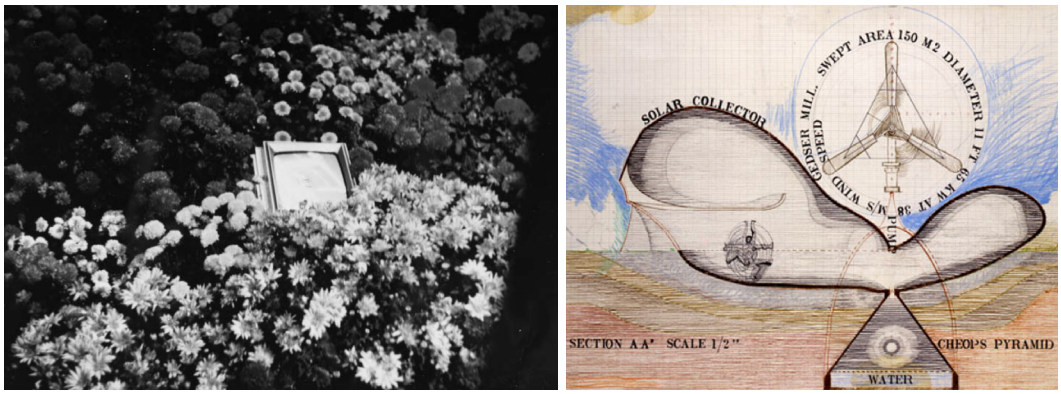

Figure 10 *(Left) Juan Downey. Life Cycle: Soil + Water + Air + Light = Flowers + Bees = Honey, 1971. CCTV environment, detail. Installation view, Electric Gallery, Toronto, 1971. Photo: Juan Downey. Courtesy of the Juan Downey State and Marilys Belt de Downey. (Right) Juan Downey. Mi casa en la playa 1, 1975. Colored pencil, graphite on paper. Courtesy of the Juan Downey State and Marilys Belt de Downey.*

Ghostly Cyborgian Links

Composer and artist Maryanne Amacher was obsessed with listening. In order to rigorously study and learn in detail about it, she created collapsed *sound-systems* that assembled distributed cybernetic ensembles. By doing so, she activated ways to become a distributed cyborg energized by distant sounds as

[49] Valerie Smith, *Juan Downey: The Invisible Architect* (New York/Cambridge: Bronx Museum of the Arts/MIT List Visual Arts Center, 2011).

well as inner ghostly tones. As a devoted spatial practitioner concerned with hearing spaces, she was deeply interested in the mediations and shapeshifting articulations between sonic folds of spatial distances that oscillated between the most-inner and most-outer dimensions. This expanse was circuited by acoustic information in the air, telephonic networks, and inner processes of psychoacoustics. American art historian Walker Downey refers to Amacher's concept of the *Third Ear* as "an exemplary cybernetic organ—a cyborg in miniature—bringing us, in a pursuit of wider connectivity, back to the body: the crucial hinge and hurdle in her practice."[50] The *Third Ear* phenomenon consists of otoacoustic emissions created by outer tones diffused in space that trigger inner tones that only exist inside of the listener. This enables the receiver to dwell in new emergent and improvisatory inner sonic spaces.

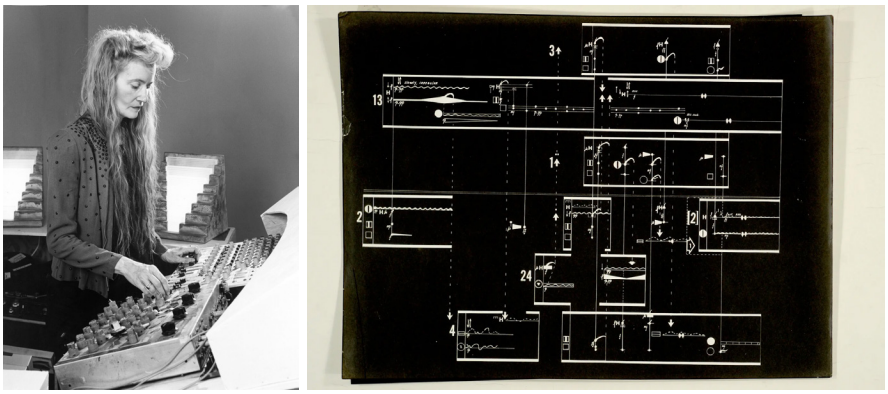

Figure 11 *(Left) Maryanne Amacher at work on her 1985 "Mini Sound Series," Sound House, during her residency at the Capp Street Project in San Francisco. (Right) Maryanne Amacher. Adjacencies, 1965. Score Excerpt. Photo: Blank Forms and Estate of Maryanne Amacher.*

Amacher's work was one of linking different scales and types of hearing spaces and thus creating multidimensional systems. She was interested in listening to the environment but not with a romantic or representational intention of discovering different signals that shape the narratives of a place. She was not interested in soundscapes or clearly identifiable sounds. Her intention was set on identifying key features of the place through sonic signatures constructed by its tones. Between the years 1972 and 1976, she was a fellow at CAVS, where one of her main projects was *City-Links* (1974). It started by installing eight microphones in the Boston Harbor and transmitting them to her studio at MIT via telephone lines. At the studio, she continuously listened to the distant sounds of the Harbor and offered listening sessions for

[50] Walker Downey, *Crossing Canals: Maryanne Amacher's Cybernetic Impulse.* (Unpublished manuscript, 2017).

many hours. Over the years, she continued microphoning distant places to remix them and create interferences with other links to other cities, which she played as instruments. These explorations in tones and textures of places and spaces are what later led her to dive into the inner possibilities of the *Third Ear*. These experiments in turn led her to develop a body of work and research around what she called *Perceptual Geography*, a concept to name the process between a series of inner formations and membranes that conduce to specific transductive operations, which created an inward subjective reconstruction of the outer resonant sounding spaces. This reveals an impossible to predict and indeterminate geography of listening.

For Amacher, there are two ways of being in the world and relating to others, either by being a receiver or by being a transmitter. Even if her work at a first glance seems to be all about transmitting, she paid detailed attention to the idea of receiving and the role of the listener. This is because the way you are receiving something changes everything depending on what is there to listen to. This created a strong specificity in the work and how it related to the spaces it is being transmitted in/to. She makes a radical move and centers the work towards its reception, towards ways of listening instead and the encounters of sounds instead of the source, the musician, or the composer. In a way, her cybernetic *tele-music* sets into play a correspondence between disembodied acousmatic entities where their individual characteristics are not what matters, but the mesh between their spectral bodies as they dissolve in relation to multiple other spectral energies. So in the end, most of her work is about the inharmonic membrane weaved by sounds when in a particular space and, most importantly, when inside each one of the receivers. This shift from transmitter to receiver appears in her work under the name of *Negative Notation*. This directly refers to the score operating in the opposite way that a score usually does. The Negative Notation scores do not signal instructions on how to *sound* or *play*; instead, they convey instructions on how to *listen* to *be able* to play. This is particularly present in her work *Adjacencies* (1965), which consists of a graphic score for two percussionists and spatialized electronics. As the percussionists listen in specific ways to the sounds that are happening, they can understand how to join the performance. In this specific piece, the transmitter and receiver are prompted to think of these sounds not as individual and distinct timbres of a particular instrument, but as frequencies in dialogue that are dynamically entangled, frequencies that can be continuous and can be spatially modulated by the listener's position. The name *Adjacencies* refers to the intention behind this piece that centers on it being activated by the phenomena of sounds neighboring frequency areas and becoming something different, something enmeshed.

"LISTEN BEYOND THE CHARACTERISTIC IDENTIFYING TIMBRES OF THE INSTRUMENTS. Forget source timbre and explore."[51]

Maryanne Amacher

Indeterminate Systems

Composer John Cage introduced the notion of *chance operations* in music as a way of integrating chance and randomness as part of the compositional process and/or the performance of the piece. This composition strategy was originally inspired by the *I Ching*, which was Cage's guide for composing as well as many other aspects of his life. By bringing these ideas to the musical composition process, indeterminacy materialized as a central element and a characteristic feature of both Cage's creative practice and persona. Cage was also known for being a devoted mycologist, probably because foraging presented him with another opportunity for chance operations. His love for fungi was present in his work, as mushroom-inspired compositions such as *Mushroom et Variationes* (1983) and mycelial ways of thinking were very present in his networks of unexpected relations. His work had an immense impact in electronic and experimental music, and his radical ideas and mechanisms precipitated a huge shift in the understanding of music in the Western modern context. Through his prolific and extensive body of work, John Cage was positioned as one the most prominent figures in the postwar avant-garde.

Cage creates systems that unfold in unexpected ways. He does this through different mechanisms but primordially by either creating a fixed score through processes of chance operations, or by composing scores with *mobile* or open structures that can be rearranged throughout the performance, or by creating indeterminate scores embodied by graphical scores or text notations that prompt the musical piece. The only consistent, determinate thing in Cage's work is that in some way, there will be variations. It is important to highlight that the indeterminacy of chance operations may appear to come from a radically free mechanism, but it actually emerges from the opposite. Indeterminacy came out of a very rigorous process that required following a strict set of rules. What Cage proposes is that freedom comes through these rules as they have the power of removing choice from the artist, whether composer or performer. By doing this, the work will unfold as what it is meant to be, allowing the piece to become something that exists outside of the spontaneous desires, subjective intentions, aesthetic intuitions, and other biases of the artist. This algorithmic way of composing proposed a networked system of possibilities where things

[51] Maryanne Amacher, "Adjacencies," in *Maryanne Amacher: Selected Writing and Interviews*, ed. Amy Cimini and Bill Dietz (Brooklyn, NY: Blank Forms Editions, 2021) p. 39.

were highly controlled but sufficiently open for random and unexpected things to happen. It was a controlled way of giving in to chaos. The abstraction of the subjectivity of the composer aims to bring the artwork to the forefront and by doing so, challenge conventional hierarchies and structures in Western music, all while yielding groundbreaking experiments and theories around music, sound, and silence.

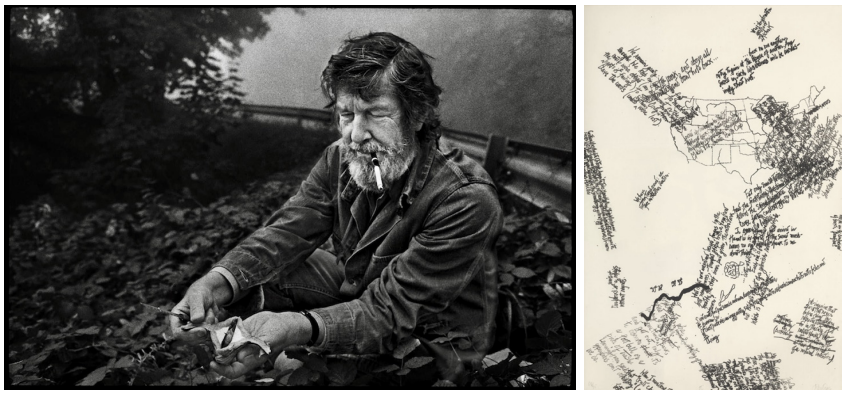

Figure 12 *(Left) Cage Foraging in Grenoble, France 1971. Photo: James Klosty. (Right) A page from Mushroom Book, 1972. Scan of 63/75, Plate I, with artwork by John Cage. Courtesy of the John Cage Trust.*

John Cage was a close friend of Maryanne Amacher, which comes as no surprise since their work resonates and shares many aspects. One could see in Amacher similar composition strategies that are open and evolve from chance, as well as the understanding of enmeshing elements, subjectivities, and places through sound and listening. Another of Cage's friends and close collaborators, pianist and composer David Tudor, was interested in compositional strategies based on indeterminate operations as a way of dislocating the musical outcome from the composer's solely creative control. Tudor's arrangements incorporated elements of ungovernable characteristics as he placed the intention of the work on the spontaneous resonances of the material elements of the system. In a way, he centered the sonic outputs by letting the material bodies *speak* for themselves, or better said, are sonically activated through their own resonant capacities. These ideas are central to *Rainforest V (variations 1)* (1973/2015), by Tudor and Composers Inside Electronics. This is a sound installation that consists of a spatially distributed sound system composed of 20 everyday found objects. These objects have sonic transducers embedded so they can diffuse sounds throughout their bodies as they resonate with a sound piece. They are suspended so they can enact their full resonant potential. The installation is a floating resonant environment that is activated by sound.

Rainforest (1968) was created as a musical composition and performance for choreographer Merce Cunningham (United States, 1919–2009). Later, in 1973, Tudor revisited the work during a workshop with young artists—who would later become Composers Inside Electronics—and materialized it as a performative installation called *Rainforest IV*. This iteration consisted of incorporating found objects as the embodiment and transmitters of the piece. They continued making iterations throughout the years; the latest one was presented in 2019–2020 under the name *Rainforest V (variation 1)* at MoMA, New York. This work centers on the agency of each of the objects as a body that is activated by sound and thus resonates in a particular way. The specificity of each body is central, as each of them modulates and filters the composition in a particular way. The resonance of the object changes the outcomes of the piece and the way that it is received. Through this operation, the objects are placed as part of the composition but also as extended composers themselves. This distributed way of composing ends up not only proposing an unpredictable sound piece, but a completely unpredictable sonic environment that invites the audience to move and explore the piece, and by doing so, again changing it in return as the sounds resonate within them. This extends Cage's explorations, as there is an intentional shift towards the agency of the nonhuman participants of the performance. The object is not an instrument that is controlled by human subjects but unfolds as a performer itself through its particular relationship to sounds.

Figure 13 *David Tudor and Composer Inside Electronics Inc. Rainforest V (variation 1), 1973/2015. Installation view, October 21, 2019–January 5, 2020, The Museum of Modern Art, New York. Photo: Jeenah Moon for The New York Times.*

Eurological, Afrological, *Surlogical*

The indeterminate possibilities explored by Cage, Tudor, and other artists of the avant-garde are extremely enriching in terms of the artistic output and of how these catalyzed important changes in the Western music scene. However, it is important not to confuse the disciplined use of chance operations with improvisation. They may share similarities but the radical difference lies in the agency of the subject. On one hand, Cagean indeterminacy concretely looks for the erasure of the subject, and improvisational practices are all about the subjectivities behind the emergence of the group. Improvisation is based on predetermined rules or agreements, but these are meant to be interpreted in elastic, subjective ways, so the participants and the piece can arise through dialogue and mutual correspondence. As a sonic relational form, improvisation provides a way for subjects to pay attention to each other and emerge together in a collaborative effort. Humans do this by carefully listening to each other as well as by attuning to each others' subjective intentions and bodily gestures. There is an important recognition of the other as a means of energy transfer; improvisation is a form of relational transduction. Improvisation is present in many forms of relationality, but here I want to focus on this term as a musical concept. In regard to this aspect, it is important to take into account the *Eurological* and *Afrological* discussion proposed by improvisation expert George Lewis.[52] In Western society, music has often been culturally constructed as a highly predetermined and normative space. This characteristic has influenced, or has been imposed on, other cultures that have adopted the Western norm as a consequence of processes of imperialism and colonization.

Lewis's Afrological and Eurological discussion is set in the musical context of New York City in the 1950s. Initially, improvisation was a concept rooted in jazz and other non-Eurological music forms. The Afrological perspective on improvisation conveyed the idea of freedom and agency. Under this perspective, music was seen as a performative rite that carries and unfolds identity, personality, and other characteristics embodied in each musician's subjective narratives coming into collectivity. These narratives were not relevant to Cagean chance operations, so they were not embraced by the "uptown (New York) scene." This was the scene of the Eurological. Contextualized among the elite and the educated, it took place in a theater, where there was a stage, a composer, performers, and an audience. In this context, the experimental music of the avant-garde emerges as a radical, new, and refreshing form that breaks with many preconceived ideas of what music can be. Although the avant-garde's contributions challenged rigid boundaries within music, the uptown scene remained in the Eurological lineage. Lewis presents the work of composer John Cage as an example of the Eurological perspective, where the term

[52] George Lewis, "Improvised Music after 1950: Afrological and Eurological Perspectives," in *Audio Culture: Readings in Modern Music*, ed. Christoph Cox and Daniel Warner (New York and London: Continuum, 2005) 272–284.

indeterminacy was used instead of *improvisation*, as a way to detach it from the downtown scene. At first sight, these two concepts are very similar, but in contrast to the Afrological concept of improvisation, Cage's indeterminacy had a highly regulated and prescriptive way of being performed by abstracting the subject, far from the dynamism and free form subjectivity conveyed by improvisation.

Within this discussion, as a South American person that lives in between territorial, cultural, and disciplinary membranes, I can't help to wonder about the possibility of adding to the discussion what a *Sur*logical perspective would be. As the paradigms of the discussion are described as *Eurological* or *Afrological*, I propose the *Surlogical* as a reference to the global South, particularly paying attention to improvisatory musical togetherness in practices from the South Andean Region. My scope is limited to that region, but I hope for the *Surlogical* to be a concept that can expand from my personal definition and the limited framework provided by my subjective perspective and individual positionality. I take this opportunity to explore alternative logics for musical togetherness from a Mestiza perspective. I propose the *Surlogical* as a place full of syncretisms and complexities that I believe provide a dynamic scenario to socialize beyond the human. I will dive in more depth into the discussion of this perspective in Song 3: Membranas, A Platform To Practice.

Never-Static Listening

One important aspect to consider in the context of the examples I have provided in this section is that it is important to be aware of the dangers of romanticizing listening, since listening can also be a way of surveillance, extraction, capture, and control. Australian scholar and artist AM Kanngieser[53] proposes embracing unknowability as a way to depart from practices of listening that are rooted in separation and move towards listening as attunement. Kanngieser writes, "More than just an aural hearing, listening is a practice of sensing, attunement, and noticing. Attunement means to bring into tune, to find resonances or moments of intersection. It is a laborious, humbling, and self-reflexive process."[54] Their critique highlights the separatist perspectives that are common in sound art and sound studies, where the sounding and listening bodies are detached and abstracted. There is a recurrent abandonment of the individual, an abstraction that takes identity out of the conversation, which in return creates a system that constitutes an objectified *other* that can be captured and used at will. This raises fundamental questions around the

[53] AM Kanngieser, "On not knowing (for that which cannot be imagined)" Keynote with Jack Halberstam, part of *This is not anarchy this is chaos, Transmediale Symposium*, January 29, 2022 (Accessed: 03-26-2022) https://transmediale.de/events/keynote

[54] A. Kanngieser and Zoe Todd, "From environmental case study to environmental Kin study." *History and Theory* 59.3 (2020). 385-393.

politics of listening in relation to consent, presence, and a respectful vibrational intimacy within difference.

In a similar path, xwélméxw (Stó:lō) scholar and artist Dylan Robinson reminds us to listen without hunger.[55] He highlights the need of attuning to how difference guides our listening capacities, habits and biases. Listening with hunger means to set an orientation towards consumption and extractive ways of listening, where sounds are free-floating abstracted things that can be objectified as a commodity. He wants to raise awareness of this practice, which is common in settler epistemologies, to reorient the ways we listen towards an approach that is always situational and changing, towards a practice of attunement. Robinson refers to positionality as a *background hum* that one always carries within. This means that race, gender, cultural background, sexuality, and lived experience guide and filter the way we listen. So this *hum* is not a static *hum*—it changes as we change, thus our listening is never static. We never listen the same.

Both Kanngieser's and Robinson's critiques relate to British author and scholar Marrie Thompson's concept of *white aurality*.[56] This implies the assumption that listening is being enacted from the positionality of a universal and benevolent *white ear*. This assumption sets by default the absence of otherness. This absence can be understood as the abandonment of the individual and the abstraction of identity as a way of erasure of difference and alterity. To conclude her critique of the avant-garde's white ear, Thompson states that the importance of having this conversation and sitting with this trouble stands in tracing lines of action to continue. The current paradigm requires a resituating of the ideas and an update that can reorient us in relation to the current social world as we continue the conversation. To do this, it is central that we—as listeners and as artists that deal with listening—constantly question from where we are listening, so we can *unsettle* listening to understand it outside of the monophonic settler colonial register. Through a series of academic and artistic collaborations, Kanngieser and Métis anthropologist and scholar Zoe Todd have developed extensive work on multinatural listening practices. They both remind us that listening is relational[57] and as any relation, it is not determined unilaterally. It requires proper conditions and protocols. Being aware that listening is an encounter with the inconmensurable teaches us how to listen in a perpetual condition of not-knowing and being-with. Listening as a way of

[55] Dylan Robinson, *Hungry Listening, Resonant Theory for Indigenous Sound Studies* (Minneapolis; London: University of Minnesota Press, 2020).
[56] Marie Thompson, "Whiteness and the Ontological Turn in Sound Studies," in *Parallax: Sounding/Thinking*, 23:3 (United Kingdom: Routledge, 2017) 266-282, DOI: 10.1080/13534645.2017.1339967
[57] AM Kanngieser and Zoe Todd, "Listening as Relation, an Invocation" Lecture-performance, part of *Critical Modes of Listening*, *CTM Festival, Transformation Discourse Series*, along with a presentation by Carla J. Maier and mêLe yamomo, 2021. (Accessed: 03-25-2022) https://www.youtube.com/watch?v=kGe0DYMroEg

noticing and relating encompasses the responsibility of attuning to different sensitivities and registers. By doing so, we might be able to pay attention to the protocols and permissions that are needed in order to listen properly, whether it is to other humans or nonhumans. By paying close attention and recognizing the risks of uncritical[58] listening, it might be possible to work towards a rearticulation of these practices with the political intent, the attention, care, and respect that is so urgently needed today.

[58] Meaning a way of listening that perpetuates power structures through listening by not attending to questions about positionality, difference, and embodiment.

b. Personal Layers

As I have been diving deep into the membranal universe, I have engaged in different experiments and artistic explorations. These oscillate between installations, compositions, performances, technological inventions, musical instruments, sonic vibrational sculptures, (pirate) radio shows, graphical scores, collective improvisations, and listening sessions. I work with sounds, vibrations, resonances, and multiple transductions to explore more-than-human performativity and agency from micro to cosmic scales, and to investigate vibrations and sounds as construction materials for spaces and identity while fostering collectivity and stimulating imagination in non-static and embodied ways. My work is elastic and accommodates diverse types of spaces, covering a wide diversity of scenarios: from the inside of the Earth—in particle accelerators—to the top of the Andes Mountain—at the door of the cosmos; as well as in the air—in radiowaves and microgravity flights—in biennales, research laboratories, museums, music festivals, dive bars, art galleries, outer space conferences, playgrounds, observatories, scientific events, parks, and a range of other places where people and nonhuman actors gather and interact with each other.

I am a Chilena from the city of Santiago, a mestiza whose personal story arises from a very cloudy and diffuse origin of Andean and European lines. Somehow, the history of my family has been very mysterious and obscure, a circumstance I have recently come to understand is due to the hardships of infinite sadness, broken relationships, political trauma, and colonial shame. I grew up in a country with "no memory" and a habit of keeping a deafening silence, which are symptoms that have lingered even decades after the dictatorship that spawned them. I don't know that much about my family's story since it is so mixed and fuzzy, but I grew up hearing about how the women in my family were avid fighters who overcame crazy misadventures. They were creative people who did magic with what little they had at hand. One of them—my great grandmother—was literally a witch,[59] but that is a story for another time. No matter how cloudy, conflictive, sad, or weird, this is the lineage that I embody. Thanks to their model and my parents' upbringing, I learned to never settle and always creatively fight for what I care for, all of which shaped me into a curious, imaginative, and perseverant person. In 2015, I moved away from my hometown to the United States to pursue graduate studies at MIT. I initially came here for a master's degree in media arts and sciences (2015–17) in the Opera of the Future research group at the MIT Media Lab and then stayed for the PhD (2017–22). My main motivation when I first came to MIT was to find a place and the time to work on merging my interests, which I had worked on in a very fractured way before coming here. I was working as an architect *by day*, musician *by night*, artist *on the weekends*, and the only thing I was certain of was that I had to find a way to simultaneously engage with my fragmented

[59] Bruja, curandera.

selves. As I found a place that helped me fuzz the boundaries between the rigid boxes I was distributed in, I discovered a stimulating comfort in the fuzziness of things.

It's a funny thing, but my sight is fuzzy as well. Not many people know this, but I barely see with my left eye. For some reason the condition I have can't be corrected with glasses, so I just navigate the world in a fuzzy way, with a minimum depth of field that makes me very clumsy, and with no 3D vision; depth of field and 3D are things that only exist in my imagination. One would think that my poor vision and love affair with sound must mean that I have great hearing. But the truth is that I have been a very reckless drummer since I was a kid, so my hearing is not necessarily the sharpest. I say this not to garner sympathy or pit seeing against hearing, but to make a point that I don't have a clear predominant sense to rely on in the first place. I have always doubted sight, since I know how imprecise this is for me, how fuzzy reality can be, and this led me to always be attentive to other cues, to whatever sensory blend I could use to navigate the world.

These very personal and fuzzy characteristics that I carry within are extremely relevant to the work and research that I have been conducting over the past several years. In this section, I intend to introduce some examples of my work, as these are linked with *La Membrana* in many ways, whether by preceding, resonating with, or embodying membranal ideas. The pieces I will present are a series of experiments meant to stimulate questions rather than produce answers. These are experiments that I have done as part of my personal quest to explore the ideas that energize and define me as I try to understand myself as someone constantly negotiating and dynamically oscillating between disciplinary, identity, and perceptual membranes.

In order to frame my discourse, I am organizing the next artworks into groups, even though many of these pieces intersect with one another; they are not as organized and linear as they are presented here. All of these works are somehow experiments in mediated listening and sounding. The main thing that they all have in common is that they have guided me into a body of work that questions the very meaning of listening and sounding, and through making many mistakes and assumptions, these pieces have shown me how hard these things can be. To do them properly, they require a lot of effort, attention, and practice. As a sonic investigator and musician, I have come to learn the importance of cultivating a practice of listening to others, which means that many of these works are also collaborations and dialogues with dear friends who I respect and admire enormously. Through these works, I also have come to learn the importance of not romanticizing listening or sounding as these can be used in dangerous and violent ways. I am aware that my work is not perfect and that at moments it can even be messy or contradictory,

but I am not trying to claim otherwise. These are experiments and as such, they are meant to provide space for errors and contradictions, as I think those are the most enriching and stimulating places one could explore in order to unveil further ideas and unusual questions.

Kinetic Spaces and Sonic Agents

During the research I carried out for my master's thesis at the MIT Media Lab (2015–2017), I developed a project called *Spaces that perform themselves* (2017). This project originated from the intersection of music and architecture for enabling a dynamic spatial experience, and consisted of a multisensory kinetic architecture system that augments sonic perception through a crossmodal spatial choreography combining sounds, movements, lights, colors, and vibrations. It was a 3 x 3 m hanging cube with an open bottom that can host one person at a time for experiencing the spatial choreography associated with a musical piece. The cube contains a system of 45 stepper motors and rods distributed to physically activate movement in the five inner fabric walls of the cube. Each wall also contains a high-fidelity speaker and an array of LED lights. In addition, the cube has a vibratory platform that diffuses low-frequency sounds to provide haptic feedback across the body.

The objective of this project was to create a dynamic space that is never static and that continuously responds to the music it embodies. There is a constant reformulation of the cube's inner walls and atmosphere as it continuously dances and performs. This experiment helped me to dynamically explore sound as a dynamic construction material as I realized that no space is ever a static element, but spaces are fundamentally relational and performative entities. The reflections around this project are still extremely relevant and stimulating, as they are the seeds that grew into the foundational ideas behind *Membranas*. *Spaces that perform themselves* was a complex project at a technical level and I learned enormously through its development, which paved the road for many things that came later.

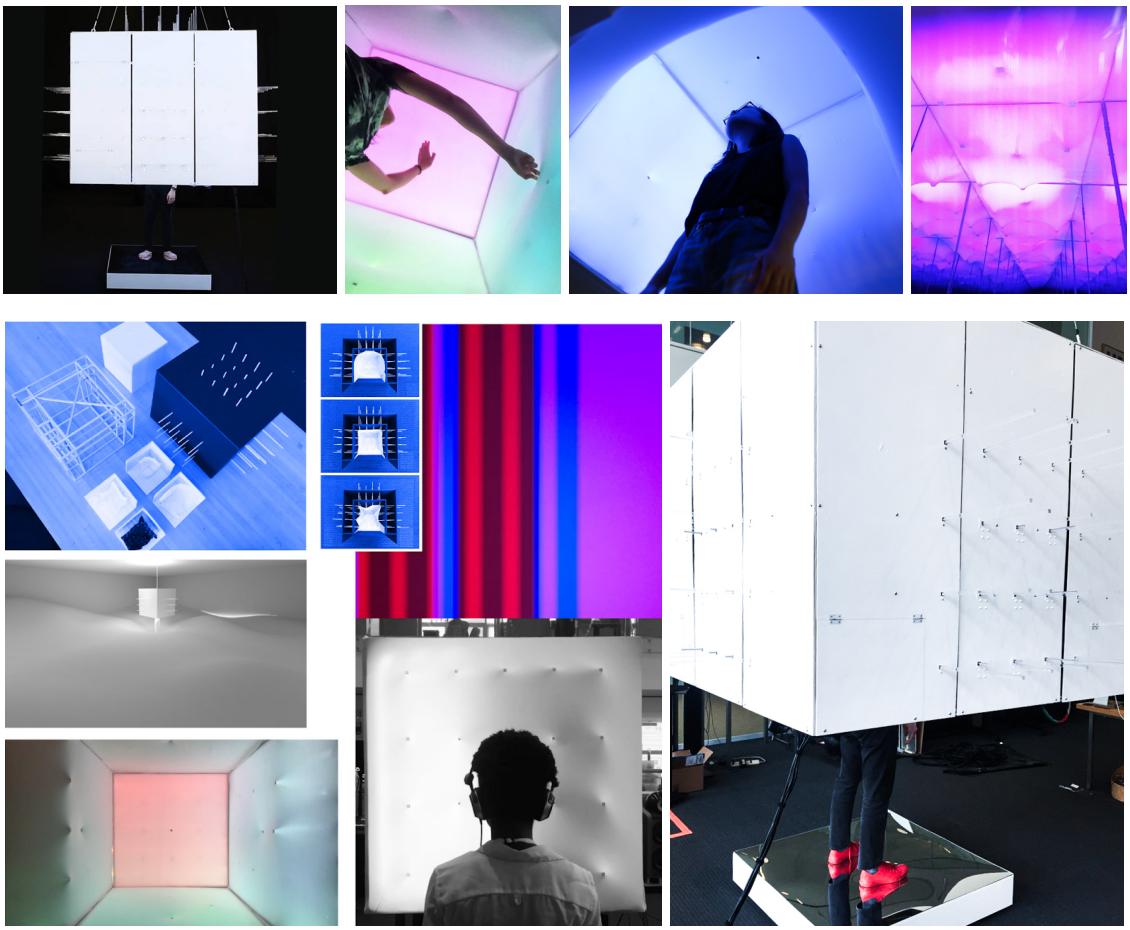

Figure 14 *(Left) Spaces that perform themselves, 2017. Collage with photos from outside views, inside views, and process models. Photos: Nicole L'Huillier.*

As I was finishing *Spaces that perform themselves,* I started a collaboration with American experience designer and dear friend Sands Fish. We embarked on the creation of a musical instrument for microgravity, the *Telemetron* (2017). At the time we were very interested in other sensory modalities and how environmental changes could affect perception and our ways of knowing, creating, and relating. The environment of microgravity presented an appealing experimental setting for exploring these ideas. As we created this musical instrument, we were interested in analyzing how the perception of sounds as well as musical expression could change in such an environment.

The *Telemetron* consists of a dodecahedron clear acrylic chamber with two cylindrical chimes in its interior, each containing a 6-axis IMU sensor (3-axis accelerometer and a 3-axis gyroscope) that was

transmitting the sensor data through a radiofrequency module to a computer where the data was mapped into MIDI notes that triggered different MIDI instruments in real time. So every rotation and movement of the instrument provides different musical notes, textures, and patterns. Before the microgravity experiment, we prepared a series of "choreographies" or ways of playing the instrument so we could replicate them during the experiment in microgravity.

Figure 15 *(Left) Telemetron, with gravity before the experiment, United States, 2017. Photo: Nicole L'Huillier. (Center & Right) Telemetron, Experiment in microgravity, flying over Florida, United States, 2017. Photo: Sands Fish.*

As it happens, during the flight we were not able to reproduce any of these choreographies or prepared performances, as we were barely able to "be." For me, this is the most interesting part of the experiment—its failure. It showed that when you take away something so structural as gravity, constant rewiring needs to happen. The body is in a constant state of recalibration as it re-learns how *to be* in this new medium. As the human "performer" was unable to perform, what was revealed was that the instrument didn't need the "performer" at all. The instrument emerged as an animated body that performed by itself. The human and the instrument became two entities floating in an erratic dance. The instrument ceased to be an instrument and became an autonomous sonic agent. My main takeaway from this experiment and the mistake we made by taking for granted how gravity organizes our experience of the world was to take nothing for granted, as sometimes even the most structural things could not be absolute constants. This experiment showed me that if you take one element out of the equation, everything can change, and perceptual and cultural hierarchies can be restructured. The *Telemetron*, a supposedly inanimate entity, came to *life* and seemed to be more at ease than I was in this different environment.

This work was followed up by a set of three self-performative musical agents that do not require human performers, the *Telemetron Orchestra* (2019). For this iteration, we collaborated with another dear friend, Mexican engineer and artist Thomas Sanchez Lengeling. Later we developed a smaller module to be eventually sent to the ISS, the *Telemetron ISS-1* (2021–).

Resonance and Transductions

In this group, I present a series of experiments on resonance and transductions. First of all I would like to present *La PARACANTORA*[60] (2019). This is a traveling sonic sculpture that was installed at CERN in the LHC ALICE Detector in Switzerland; at the ALMA Observatory OSF, Atacama Desert, Chile; and at the Paranal Observatory ESO, Atacama Desert, Chile, 2019.

This piece originates from the idea that there is no such thing as empty space, and proposes a way of encountering these places through a moment of listening to invisible things. In these 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* is a technological parasite that contains environmental sensors mapped in real time into sounds (synthesizers, samples, textures, words, and other voices) that are diffused by a six-channel loudspeaker system to create a sonic imprint of that specific moment in space and time. In this way, it offers a listening session of the places it visits. *La PARACANTORA* was for me a documentation tool, like a note-taking or sound-unveiling device to access these places from other sensitivities.

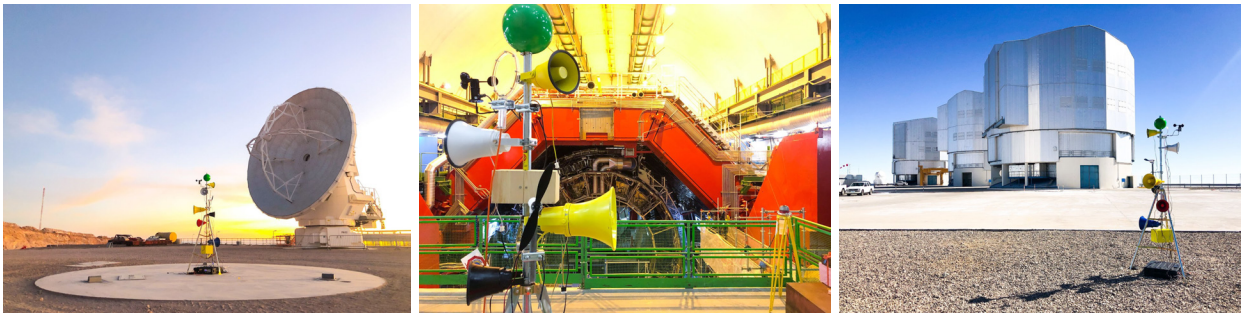

Figure 16 *La PARACANTORA, 2019. (Left) ALMA Observatory OSF, Atacama, Chile. (Center) LHC ALICE Detector, CERN, Switzerland. (Right) Paranal Observatory ESO, Atacama Desert, Chile. Photos: Nicole L'Huillier.*

[60] PARACANTORA: Parasito Ambiental Ruidoso Amplificador Canalizador de Agentes Ninguneados Transducidos Ofreciendo Rituales Auditivos. (Noisy environmental parasite that amplifies and channels dismissed agents that are transduced by offering an auditory ritual).

As I was exploring places where the Earth becomes a sensor through transduced energies, I was also wondering what other physical activations could emerge by transforming other forms of data into sound. So right after *La PARACANTORA*, I continued experimenting by transforming data into sound, and sound into tactile vibrations that could activate matter and make objects dance. I was interested in the immaterial aspects of data and how through certain transformations it could be physically manifested and embodied by matter. Through these experiments and other questions around "otherness" and the idea of "the alien," I dove into what became the installation *Delira* (*Delirium*) (2019). Curator Catalina Valdés wrote this text about this installation:

> This work is a resonating party, a sound celebration in which, through a musical composition dedicated to the Lyra constellation, a space of cacophony and vibrations is built. The composition is performed by a quintet of sound artifacts called *Alien Parasitic Orchestra*. The five members of the orchestra, corresponding to the five main stars that compose the Lyra constellation, perform noise and move throughout the space triggered by the vibrations of their own sound, creating a choreographic party of chance, a dynamic rite of repetition and trance.
>
> All the elements of the room are in dialogue with the myth of Orpheus and the Bacchantes, which explains the origin of the constellation. The work seeks to vindicate the image of the Bacchantes and rediscover, through the celebration of nature, the wild, the madness, the alien, to compose collective symphonies that give way to a strange beauty. The figure of Orpheus as the classical hero who dominates the lyre, an instrument that embodies the culture of technology, is cut up by the collaborative and transversal voice of Bacchantes, trans-specific beings, savages, and worlds of non-rational powers.
>
> In this invocation of the ancient myth, the lyre descends from its heavenly throne and breaks on the impact on Earth, giving life to an interstellar choir of a hybrid nature. Visitors are part of the cosmic choreography, where the limits of things are more porous than our habits allow us to perceive. This installation invites visitors to listen, to emerge together, and to free themselves from fear of noise and enter into a collective ritual of vibrations and resonances that celebrate the multiplicity of voices, the various types of beauty, the delirium.[61]

[61] Curatorial text by Catalina Valdés for the exhibition "El Tercer Paisaje," Museo Nacional de Bellas Artes, 14 Bienal de Artes Mediales (BAM), Santiago, Chile, 2019.

Figure 17 *(Top Left) The song of broken Lyra, 2019. Photo: Nicole L'Huillier. (Top Center) Delira, Installation view, 2019. © Corporación Chilena de Video y Artes Electrónicas. Photo: Benjamín Matte V. (Top Right) Beta (Sheliak) Detail, 2019. Photo: Nicole L'Huillier. (Center Top Left) Delira in the streets, 2019. © Corporación Chilena de Video y Artes Electrónicas. Photo: Benjamín Matte V. (Center Top Center) Coro Bacanal Detail, 2019. Photo: Nicole L'Huillier. (Center Top Right) Fernando Álvarez de Sotomayor. Orfeo atacado por las bacantes, 1902. Painting detail. 2019. © Corporación Chilena de Video y Artes Electrónicas. Photo: Benjamín Matte V. (Bottom) Delira Installation pictures, 2019. © Corporación Chilena de Video y Artes Electrónicas. Photo: Benjamín Matte V.*

Through *Delira*, I engaged with nonlinear narratives and storytelling mechanisms, which I used as an opportunity to play with erratic choreographies produced by sonic and vibratory patterns. Some of the sculptures of *Delira* are meant to enter in a vibratory dance and move through the room as their bodies resonate. The visitors resonate with these sounds as well and become part of this ongoing performance of chaos and chance. Also, through this work, I got to fall in love with the scary Bacchantes, as I wondered what if the story was told from another perspective, the perspective of the alien, the outsider, the *other*.

Figure 18 *(Top Left) Semilla in hand. 2021. Photo: Nicole L'Huillier. (Top Right) Semilla on the ground. 2021. © Corporación Chilena de Video y Artes Electrónicas. Photo: Benjamín Matte V. (Center Left) Semilla being watered by Marti. 2021. © Corporación Chilena de Video y Artes Electrónicas. Photo: Benjamín Matte V. (Center Right) Semilla being planted. 2021. © Corporación Chilena de Video y Artes Electrónicas. Photo: Benjamín Matte V. (Bottom) Semilla being heard. 2021. Photo: Cristobal Cea.*

As I continued working with ideas surrounding resonance and some of its physical and political possibilities, the initial ideas for Semilla (*Seed*) (2021) were planted. *Semilla* is a piece that marks the beginning of something that grows in time, like an idea, or like a movement. *Semilla* consists of a small device, a capsule that contains a speaker and an mp3 player, and is buried as a symbolic offering to the Earth. It diffuses an underground sound piece that is composed of the resonant frequencies of our planet. In order to listen to it, we must put our bodies and ears in contact with the Earth. *Semilla* is meant to be a

resonant object that protects the place where it is buried as it produces noise and unwanted vibrations that render the ground unsoundable for geophones—telluric sensors used by oil and gas companies to find new places for extraction. This makes *Semilla* an element of active protection, resonance, and mutual care.

Semilla is powered by solar panels and it does not contain any toxic elements that may damage the place where it is buried. It is covered by a papier maché carcass with natural pigments and is covered with chamomile seeds that grow so that the *Semilla* is rooted in the place it is buried. Also, as the herb grows, it signals where the *Semilla* is buried, so the herb can eventually be used to make a herbal infusion to be shared in a communal tea, a moment to talk about the themes contained and stimulated by *Semilla*.

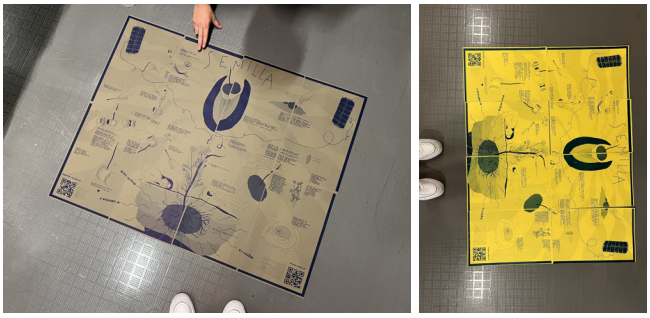

Figure 19 *Semilla Manual, printed poster examples. First test prints done in risography thanks to ppppress and Chucho Ocampo. 2021. Nicole L'Huillier.*

As a piece that grows in time, I thought that *Semilla* had to have a way of being disseminated so it could grow as a movement outside of my individual actions. For this purpose, I added a component to this piece: *Semilla Manual*[62] (*Manual Seed*, or *Seed Manual*). This is a manual with the guidelines for making homemade sound seeds/semillas. This manual operates like a tool for disseminating and spreading the underground resistance of the *Semilla*. The manual exists online for free download, and has been printed in different formats such as posters and as *lambe-lambes*[63] in Brazil in the context of the exhibition *Pra Onde Agora? (Where to now?)*, for the festival Novas Frequências 2021, curated by chico dub. The manual has also been translated to three languages (Spanish, Portuguese, and English). I would like to

[62] View and listen in this link: https://vimeo.com/683141471
[63] This is a tradition of street posters in some cities of Brazil.

continue this work over time and develop new ways of disseminating la Semilla, with more translations, poster giveaways, fabrication workshops, and planting ceremonies.

The first *Semilla* was planted at *bosquemuseo*[64] for the exhibition *Umbral* (*Threshold*), for the 15 Bienal de Artes Mediales, Santiago, Chile. The burial ceremony took place the day of the eclipse in the southern hemisphere on December 4, 2021. It was carried out by my dear friends and collaborators Francisca Gili, Carolina Arévalo, and Martina Illari del Rosario Aguayo Gili. The burial started weeks before, when Chilean astronomer Demian Arancibia carried the *Semilla* with him from one hemisphere to the other as he was on a research trip in Boston.

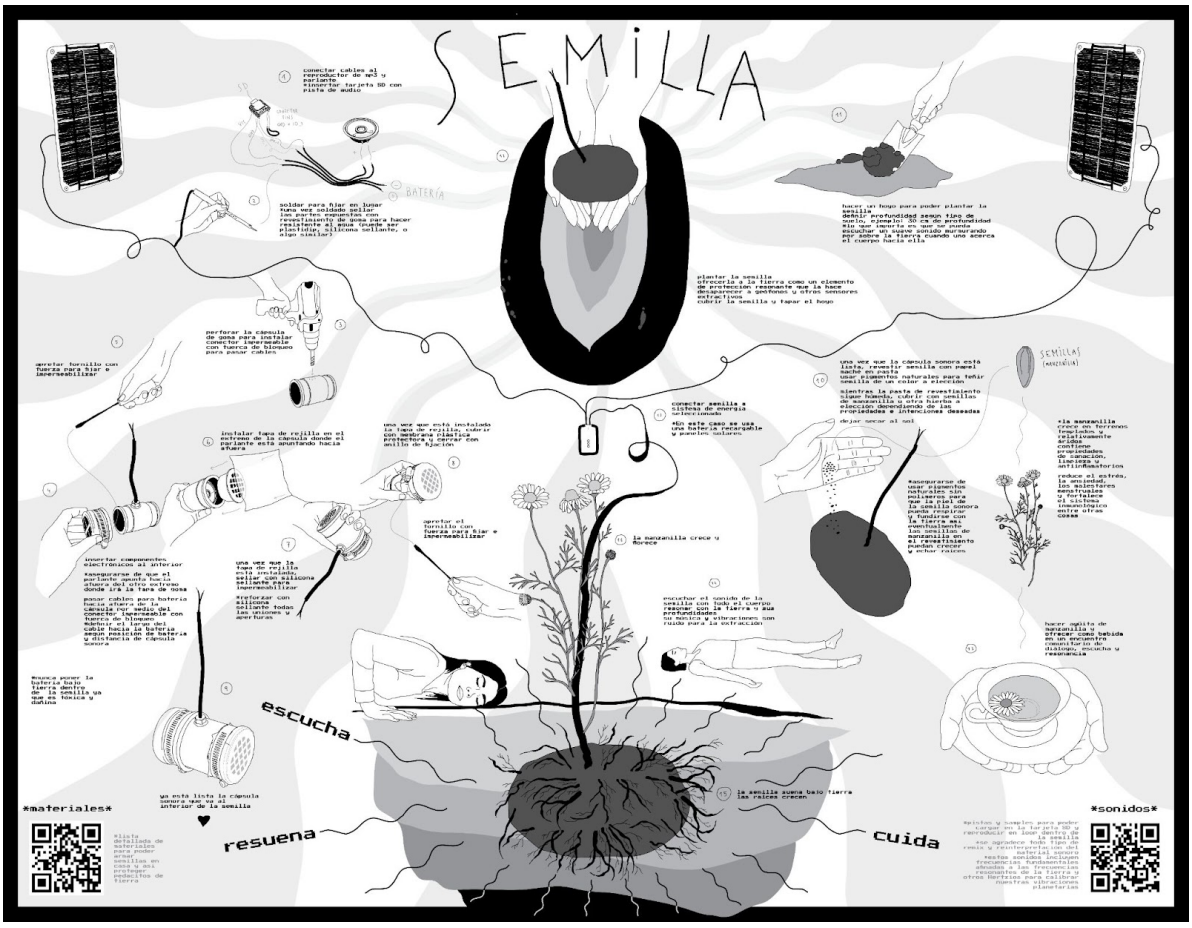

Figure 20 *Semilla Manual (español). 2021. Nicole L'Huillier.*

[64] *Bosquemuseo* (*forestmuseum*) is a beautiful park in an obsolete observatory in the middle of the city in the Cerro Calán. The first activation of this space as an open air museum took place for the 15 Bienal de Artes Mediales (BAM) 2021-2022, Santiago, Chile.

Communication and Transmission

Through a series of experiments in communication and transmission, I have been able to explore radio as a medium. I have created my own artifacts and explored different types of radio transmitters, receivers, and transceiver devices. Among these experiments, I would like to present *Hybrid Radio (A Parasitic Molecular Infrastructure)* (2018). This artwork was part of the exhibition *Swamp Radio [on transmitting]*, the first chapter of *The Swamp School* (Lithuanian Pavilion) at the Venice Architecture Biennale in 2018, curated by Lithuanian artists and educators Nomeda and Gediminas Urbonas.

Figure 21 *(Left) Hybrid Radio, Live Broadcast from La Certosa, with Kate Orff (SCAPE Studio), Dr. Laura Airoldi (Marine Scientist), Alberto Sonino (La Certosa), and local musicians. Part of the Swamp School Public Inter-Pavilion Swampification Actions. This was a crossover with the US Pavilion, CitizenSHIP. Lithuanian Pavilion, Venice Architecture Biennale, 2018. Photo: Myles Kramer. (Right) Hybrid Radio, Live Broadcast from La Certosa. 2018. Photo: Gabriele Urbonaite.*

Hybrid Radio opens a dialogue around the possibilities of rethinking radio communication as an open tool for transmitting and receiving in order to create open streams for civic communication and engagement. By exploring the history of radio, as well as free radio movements around the world, this piece proposes to use a live FM pirate radio broadcast to re-appropriate the space of the airwaves that has been drastically regulated, privatized, and institutionalized. Radio acts as an invisible and mobile architecture; it has the characteristic of breaking down boundaries, territories, and walls. I believe that understanding radio as a parasitic system can provide a setting to unfold in more organic and molecular ways. The objective is to explore the potential of radio infrastructure, its invisibility, and the possible ways of using it to foster expression, and trigger discussions about decentralized communication networks to open streams of coexistence and interspecies communication. By listening attentively and learning from the Swamp, *Hybrid Radio* brings awareness to it and its need for care. The Swamp's sounds and its effervescence and

ever-changing activities are transmitted to radios implanted across the Venetian Island and parasitically appropriated popular radio stations in order to occupy this space as a sonic manifestation, a solemn moment for listening and paying attention.

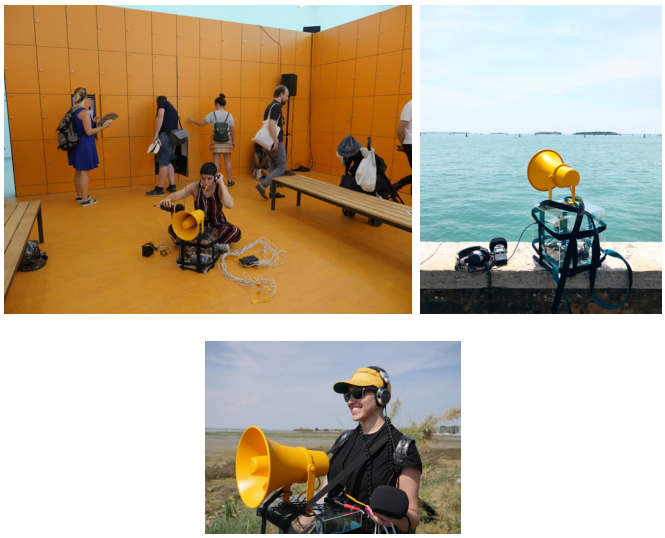

Figure 22 *(Top Left) Hybrid Radio Performance and Live Broadcast at the Dutch Pavilion: "Work, Body, Leisure." Part of the Swamp School Public Inter-Pavilion Swampification Actions. Lithuanian Pavilion, Venice Architecture Biennale, 2018. Photo: Gabriele Urbonaite. (Top Right) Hybrid Radio waiting for vaporeto. 2018. Photo: Nicole L'Huillier. (Bottom) Hybrid Radio at La Certosa. 2018. Photo: Gabriele Urbonaite.*

Another example of transmission and communication is the collective performance *Serpiente Delirante* (*Delirious Serpent*) (2019). This performance was done in collaboration with La Chimuchina, Nia de Indias, and many other friends. This was in the Museo Nacional de Bellas Artes for the opening performance of the 14 Bienal de Artes Mediales in Santiago, Chile, the year 2019. I had the honor of guiding the procession that circulated through the building by carrying a passive magnetic antenna and diffusing ambient electromagnetic fields through a portable amplifier. The musicians that followed in the line trailing behind were playing Andean flutes in repetitive geometric pattern, creating a saturated sonic landscape between the torn sound of the flutes,[65] the cracklings of the magnetic fields and the feedback of

[65] There were different types of flutes in the performance but predominanttly there were *flautas de chino* (flute of complex tube with a characteristic saturated and dissonant sound from the central valley of Chile) and *cañitas* (pan flutes of simple close tube, common across the Andes).

the electromagnetic antenna, and the sounds of the Loa River that were transmitted through a pirate radio device and portable radios distributed among the audience. Curator AnaRosa Ibañez writes:

> All of these sounds and the movements coming from the procession created an enormous saturation of the sonic landscape within the museum, and then in the neighboring museum that was having its own opening. The people participating in the procession—due to the physical performance and the strong breath work—entered a trance that culminated with an improvised choir of voices, taking advantage of the beautiful reverberation provided by the old buildings.[66]

Figure 23 *(Top Left) Serpiente Delirante, second floor Bellas Artes. 2019. © Corporación Chilena de Video y Artes Electrónicas. Photo: Benjamín Matte V. (Top Center Right) Serpiente Delirante, corridor between Bellas Artes and MAC. 2019. © Corporación Chilena de Video y Artes Electrónicas. Photo: Benjamín Matte V. (Top Right Left) Serpiente Delirante, cross and exchange with Nia de Indias in the corridor. 2019. © Corporación Chilena de Video y Artes Electrónicas. Photo: Benjamín Matte V. (Bottom Left) Serpiente Delirante, with Nia's mask. 2019. © Corporación Chilena de Video y Artes Electrónicas. Photo: Benjamín Matte V. (Bottom Right) Serpiente Delirante, having crossed to MAC. 2019. © Corporación Chilena de Video y Artes Electrónicas. Photo: Benjamín Matte V.*

This performance was in dialogue with my installation *Delira* and was a continuation of its ideas in the form of a collective emergent activation that was meant to be a propitiatory act. This performance "articulated a space in dialogue with the fervor that grew in the streets of Santiago on the 17th of October

[66] Curatorial text by curator AnaRosa Ibañez. https://www.anarosadechile.com/serpiente-ch (Accessed: 04-13-2022)

of that year, a day before the commemorated *Estallido Social*."[67] During 2022, a few years after this experience, a fanzine was made to commemorate that moment. The compilation of the material, edition, and design was in charge of AnaRosa Ibañez, Francisca Gili, and Natalia Matzner.

Lastly, another experiment in communication and transmission that I would like to present is called *Mis Orejas* (*My Ears*) (2021). This is a device devoted to listening and receiving intimate sounds at a distance, with a lag in time. *Mis Orejas* is a tangled cluster of ears that engage with the tactile and intimate dimensions of listening. These are soft, touchy, rubbery listening apparatuses made from a mold of my ears. As tentacles, they extend far away from my body, and by doing so, become a body of their own, we become multiple. As I listen to what they listened to, I reflect on the politics of listening, consent, presence, and vibrational intimacy.

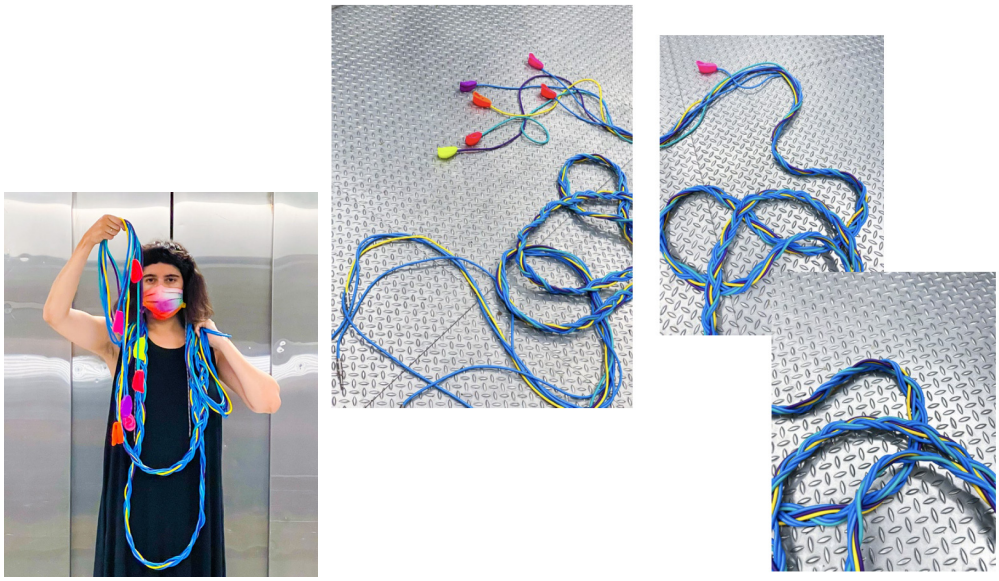

Figure 24 *(Left) Mis Orejas. 2021. Photo: Karsten Schuhl. (Right) Mis Orejas, collage. 2021. Nicole L'Huillier.*

Initially created for the exhibition *It isn't happening*, which was curated by my dear friend and sonic conspirator Michael Akstaller and Alex Hojenski in Nuremberg, this piece responded to a moment when it was not possible to travel and attend the exhibition in Europe. It was meant to be a collective artistic

[67] Text from Bienal de Artes Mediales, referring to the event in the context of the release of the *Serpiente Delirante fanzine* on March 30, 2022. https://15.bienaldeartesmediales.cl/calendario/lanzamiento-fanzine-serpiente-delirante/ (Accessed: 04-13-2022)

camp with them and the other artists participating. So sending a cluster of my ears was my way of being present and sharing with the other artists and participants. This way I *was* there listening to them, not emitting any sound, but giving them my full attention through these extended ears. These ears only listen in tactile and close proximity, so they are careful and not intrusive. The sound they hear was recorded onsite, hours and hours of touch, whispers, secrets, caresses, as well as loneliness and silence.

I purposefully did not access the sounds in real time. Instead of a real-time streaming of sounds, a recording was sent to me after the exhibition. This decision was taken to avoid making a real-time, hyperconnected surveilling machine, and to give time for things to set, for memories to be created, as well as space for absence and distance. So I encountered these sounds with a delay, as an echo of a moment in the past that keeps resonating in our material and affective memory. I might still do something with them—they could eventually become a song, or not. After Nuremberg, *Mis Orejas* traveled to the exhibition *Thinking Hands, Touching Each Other* at the 6th Ural Industrial Biennial of Contemporary Art, curated by Adnan Yildiz, Çagla Ilk, and Assaf Kimmel.

Sonic Imagination and the Pluriverse[68]

A very important and intimate part of my work the past few years has been devoted to exploring composition as a way of stimulating imagination, non-linear narratives, and collaborations, as well as exploring worldmaking practices from sonic and vibrational perspectives. These compositions have been created either as activators for physical installations, for imagining worlds that emerge from sound, or to serve as speculative tools for digesting reality or for proposing sonic fictions and experimental sonic essays to rearticulate it in multiple ways.

Within this group, I would like to mention *Amphibian Songs* (2018–19), a sound composition created in collaboration with Lithuanian artists Nomeda and Gediminas Urbonas that activates their installation *Futurity Island* (2018–19), "an infrastructure for interspecies communication and an open space for

[68] The concept of the Pluriverse is proposed by Colombian anthropologist Arturo Escobar in order to state that there are multiple worlds that exist simultaneously. These worlds manifest and define multiple ways of being and doing. Escobar situates this concept in a political way among design and world-making practices in order to change the paradigms from where these originate so they can attain and operate from other perspectives that are not only coming from a universalizing notion of reality proposed by modernity's monocultural mindset.
Please refer to: Arturo Escobar, *Designs for the pluriverse: radical interdependence, autonomy, and the making of worlds* (Durham; London: Duke University Press, 2018).

learning."[69] This work was commissioned by Blackwood Gallery for the exhibition *The Work of Wind: Air, Land, Sea*, curated by Christine Shaw. As Nomeda and Gediminas Urbonas write:

> The sound composition amplifies the story of the place—an industrial site in Mississauga, Canada, on the shore of Lake Ontario—and it explores how nature and toxicity relate to each other. The sonification of environmental research data—the physics of the soil, land, and wind—is in dialogue with the sounds of *Hydropsyche*, a genus of caddis flies that are amphibious architects and natural sensors of clean water. *Hydropsyche* lives underwater and builds her pipe-like dwelling from sand, twigs, and debris. By amplifying Hydropsyche's microworld, sound connects it with human-scale pipe architecture. In the second stage of *Hydropsyche's* life, she emerges from the water and uses the wind to fly. Wind makes sounds too. A flute—a wind instrument and a pipe—performs as a cultural filter that ties this composition together with the structure of Futurity Island."[70]

Figure 25 *(Top Left) Amphibian Songs, Blue Album. 2019. Photo: Nicole L'Huillier. (Top Right) Amphibian Songs, Blue Album detail. 2019. Photo: Nicole L'Huillier. (Bottom Left) Futurity Island at MIT, Amphibian Songs soundcheck. 2019. Photo: Juan Necochea. (Bottom Center) Futurity Island, Mississauga. 2018. Photo: Nicole L'Huillier. (Bottom Right) Futurity Island, Mississauga during a live performance. 2018. Photo: Nomeda Urbonas.*

[69] Text from *Amphibian Songs* album, written by Nomeda and Gediminas Urbonas. Side A: Amphibian Songs for a Distorted Land [20:04]. Side B: Hydropsyche's Dream [2:26]; Hazardous [2:43]; Clean Harbors [6:57]; Layers of Toxicity [5:40]; Going [2:51]; Gone [0:37].
[70] *Ibid*.

Another relevant work in this group is *Nampülwangulenfe / Mapunauta* (2018–), created in collaboration with my dear friend Daniela Catrileo, a feminist Mapuche poet, artist, and philosophy professor. *Nampülwangulenfe / Mapunauta* is a sonic poem that has the objective of opening diversified imaginative projections, and of proposing possible futures that can resignify the way we relate to our presents and pasts, and vice versa. Throughout this collaboration, we shaped a sonic poem that emerges from the research of Mapuche Cosmovision and its relationship to the cosmic, the dimension of the "Wenumapu." As a result of this research, the idea/concept/movement/imaginary of the *Mapunauta* (*Miyawpukelu Wenu mapu mew / Nampülwangülenfe*) is initiated. What does it mean to think about exploring the cosmos from non-Western, anti-imperialist, and anticolonial perspectives? What possibilities could come to light when using poetry and sound as an exploration vessel for parallel realities? What are the social implications, as well as political, poetic, aesthetic, knowledge, identity, and resistance that can emerge from experiments like this one?

Figure 26 *Naves—Nampülwangulenfe/Mapunauta. Film Stills. 2021. Photos: Daniela Catrileo and Nicole L'Huillier.*

As a visual companion to the sonic poem, we created the video piece *Naves* (*Vessels*) (2021). A visual experiment that emerges from and responds to the sonic poem. This piece is a remix of imaginaries that aims to build vessels/containers to navigate the cosmos and re-articulate reality as binary categories

imposed by the west are problematized. Inspired by the work of Ursula K. Le Guin and the movement of sonic fictions, these vessels are carrier bags, seeds for life and ideas, wombs, and cosmic containers. As we explore other modes of consciousness to simultaneously exist in multiple dimensions and travel without burning fossil fuels, as we create in a system of collective intelligence even outside of the human brain, we seek to challenge colonial and hegemonic perspectives in our multiple and complex cosmic imaginaries. This work is part of a series made in collaboration with an artificial intelligence system.

Lastly, another example of how sounds and images cross to build fictional worlds that propose alternative perspectives is *Leche Holográfica* (*Holographic Milk*) (2021), done in collaboration with my dear cosmic friend, Chilean artist Patricia Dominguez. In this work, we build a poetic essay by remixing previous work as well as new elements so we can construct sense together and organize the latest events we have been experiencing in a dreamlike dialogue. Like a stomach,[71] this piece helps us digest and metabolize energy in a collective drift of imagination. The contents of this mashup comes from personal experiences, shared fears, research in quantum physics, the holographic principle, interspecies communication, political events, Covid, motherhood, shared love and hopes, and the necessity of finding moments to breathe together and emerge collectively.

> *Leche Holográfica is a* meditative *rogativa*[72] to resonate and harmonize with different elements, to imagine the future as places that exist between spiral times. A non-extractivist communion among kingdoms that originates from the sweetness of the *Leche Holográfica* and the Gran Madre's nurturing songs, for navigation through troubling times.
>
> *La Leche Holográfica* nurtures the *porvenir*[73] with information from the future. We drink it, we swim in it, we live in it, and we access our cosmic past through it. We have forgotten this, but we carry all the information we need to move forward within us. We now have to learn how to activate it. Spirituality and the quantum realm don't know about distances. As an effort to remember, we invite you to dive with us into a shapeshifting quantum trip of connection from the quartzs and silicon that conform our bones, the center of the Earth, the chips of our electronic devices, in order to call for what is common to us. We become many as we listen and travel

[71] This is one of the key words that Patricia uses to refer to and explain the operations of her work.
[72] Translates as *plea*.
[73] Translates as *forthcoming*.

through different registers and learn through multiple temporalities of planetary fractals in alliance with the digital kingdom.[74]

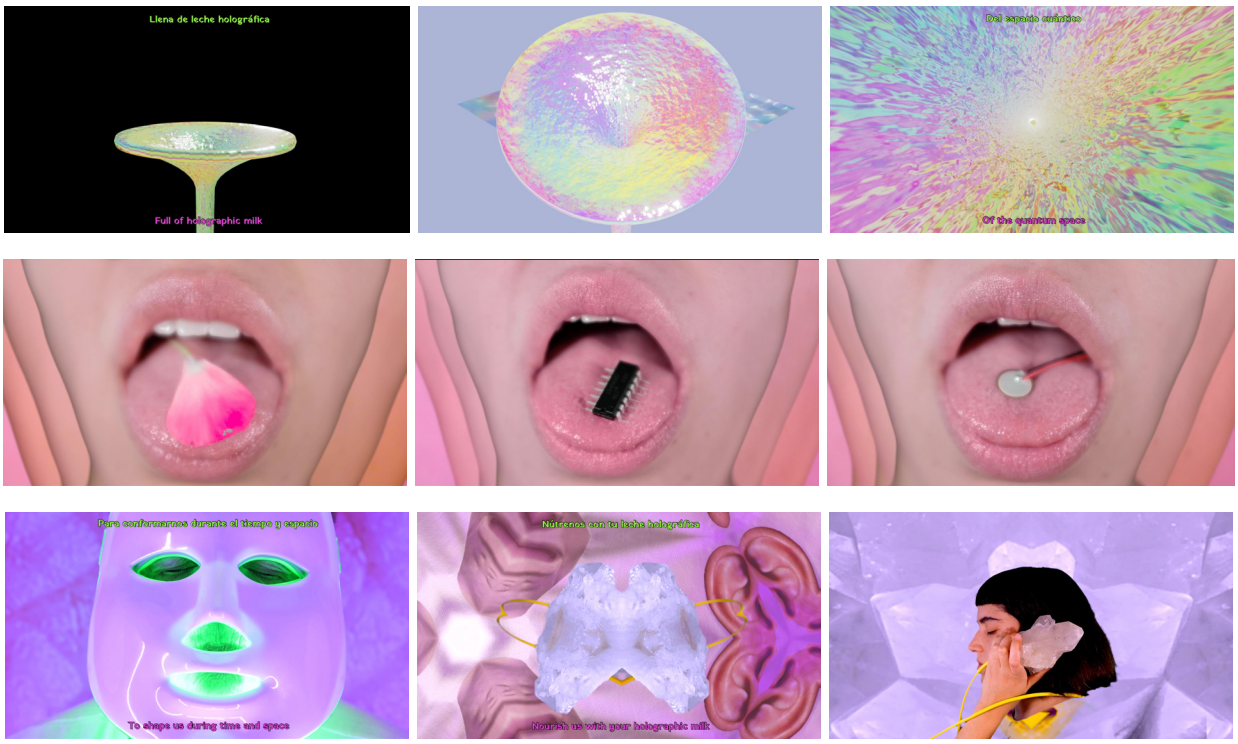

Figure 27 *Leche Holográfica. Film Stills. 2021. Photos: Patricia Dominguez and Nicole L'Huillier.*

All the previous work examples are experiments that somehow resonate with the fuzzy spirit of the *La Membrana*. This is a selected synthesis that aims to provide a context for the work and ideas that I present in this dissertation. I am thankful for having had the opportunity to enter into these stimulating explorations and dialogues. Most of these examples are collaborative experiments or aim to foster collectivity in resonant ways. Everything that I do and that I am has been shaped and informed by these and other similar experiments.

[74] Text by Patricia Dominguez and Nicole L'Huillier. Leche Holográfica was commissioned by the Inter-American Development Bank for the exhibition "On the Way to Healing." Texts written by Nicole L'Huillier and Patricia Domínguez. Camera by Uri Carrasco, Patricia Domínguez, Nicole L'Huillier, Emilia Martin + Cepams. Music by Breaking Forms, Futuro Fósil, Nicole L'Huillier. Mixing and Mastering by Juan Necochea. 3D Model by Álvaro Muñoz. Watch online: https://tinyurl.com/mr2f3mz7 (Accessed: 04-13-2022)

Song 2: La Membrana, An Apparatus for Tuning In

Figure 28 *QR code for audio Song 2: La Membrana, An Apparatus for Tuning In. 0'47". I recommend listening with headphones. The file can also be accessed at this link: http://nicolelhuillier.com/song-2/ (Accessed: 04-13-2022*)

The conceptual embodiments and physical behaviors of membranes materialize as a viscous model structure for unveiling agglutinant arrangements in a world where things are on the move and in a constant state of re-configuration and oscillation. Based on the analysis of membranes as model structures, *La Membrana* unfolds as a generative organizational apparatus for fluid physical and conceptual onto-epistem-ological reconfiguring(s). *La Membrana* is a sensuous shared space; it provides a shapeshifting territory that dynamically stimulates imagination and offers the possibility of thinking and being otherwise in the world. *La Membrana* is an in-betweenness, a communicative boundary and vibratory space that fuzzes distinctions between categories.

La Membrana as a concept sets the grounds for vibrational attunings, while the installation *Membranas* is a system for putting these ideas into practice in a continuous sonic-vibrational experiment. The installation is a membranous structure that works as a system for tuning in/to our vibrational reality and putting in practice ways of *wit(h)nessing*[75] as attuning. Join this movement and resonate like a drum,

[75] As defined previously on this document, *wit(h)nessing* is a term proposed by feminist theorist, artist, and psychoanalyst Bracha Ettinger. With this term she refers to the idea that everyone exists already engaged in a cohesive relationship that occurs prior to any independent subjectivity of a Freudian "I." Through Etitinger's revision, the concept of "I," in itself, co-exists already with a negation of itself, a "non-I." These ideas are based on the critical foundation constructed by Luce Irigay's accusation of mainstream, male thought-leaders' phallocentrism, heteronormativity, and reductive perspectives, allowing for a broader understanding of co-emergence.

accept the unknowable, inhabit pulsating temporalities, weave yourself into this emergent collectivity and amalgamation of received and transmitted, indistinct, fuzzed signals.

Through the following sections I will guide you through the layers that construct the performative concept of *La Membrana*, focusing on and critically examining the construction of subjectivity outside of the Western norm through more-than-human performativity, animistic encounters, the notion of apparatus, porous and resonant membranes, and sensory modalities for tuning in.

a. The Performativity Of Everything

All bodies—human and nonhuman alike—are in a constant state of rearticulation and (in)definition. Bodies constantly unfold, and by doing so, they not only dynamically change themselves, but are continuously affecting one another through their performativity. The concept of performativity has been examined from different perspectives. In literary theory, this is a tool for thinking about the construction of identity. In his Theory of Speech Acts, British philosopher of language J. L. Austin proposed that performativity is the capacity of speech and communication to consummate actions.[76] In gender studies, American philosopher and gender theorist Judith Butler's notion of performativity[77] argues that gender is socially constructed and that one's formation of identity is constantly redefined. In their book *Gender Trouble*,[78] Butler destabilizes the static normative view of identity, gender, and sexuality by proposing performativity as a mechanism that enables a dynamic and ongoing construction of the self. They challenge the *normal* and embrace the territory of *trouble* as a place of possibilities. Butler develops their work based on the understanding that discursive and material practices are not separate, and exist linked in an ongoing and dynamic act of becoming. Performance is something that someone does, while performativity is the capacity to perform and dynamically construct identity through performance.

As I interpret it, *wit(h)nessing* is a term that enacts the idea of *witnessing-with*. To witness refers to bearing testimony, to having knowledge of an event, to having seen something occur. By adding an extra "h," the term is expanded into *with-ness*, something that conveys having experienced *with*, not as a passive, distant observer but as an active participant. I understand this as a radically membranal concept. I first encountered the term *wit(h)nessing* in a conversation with art historian and dear professor Caroline Jones during a public event. When she mentioned this concept to me, it resonated profoundly and lingered in my thoughts for years.
Please refer to: Bracha Ettinger, *The Matrixial Borderspace*. (Minneapolis: University of Minnesota Press, 2006). And: Luce Irigaray, *An Ethics of Sexual Difference* (Ithaca NY: Cornell University Press, 1993).

[76] Mitchell Green, "Speech Acts," in *The Stanford Encyclopedia of Philosophy,* edited by Edward N. Zalta (Winter 2017 Edition).

[77] Judith Butler, *Gender Trouble, Feminism and the Subversion of Identity* (New York; London: Routledge, 2006. Originally published in 1990).

[78] *Ibid*.

American physicist and feminist theorist Karen Barad builds on Butler's idea of performativity to shape their theories around *Posthuman Performativity*.[79] By doing so, they expand Butler's material-discursive dynamic to include nonhuman agents. Their position widens Butler's exclusively human perspective of performativity in order to broaden the relational possibilities and processes that are involved in the construction of reality. Through this thinking, they state, "Agency is not an attribute but the ongoing reconfigurings of the world."[80] This notion of performative agency establishes a context where boundaries between meaning and matter are not passive but are constantly reconfiguring each other, thus opening a space which includes all types of bodies—whether human or other-than-human—to be constantly performing themselves.

> All bodies, not merely "human" bodies, come to matter through the world's iterative intra-activity—its performativity. This is true not only of the surface or contours of the body but also of the body in the fullness of its physicality, including the very "atoms" of its being. Bodies are not objects with inherent boundaries and properties; they are material-discursive phenomena. "Human" bodies are not inherently different from "nonhuman" ones. What constitutes the "human" (and the "nonhuman") is not a fixed or pre-given notion, but nor is it a free-floating ideality.[81]

What Barad calls *intra-action* refers to the manifestation of agency that does not belong to one specific entity, but that emerges in a dynamic symbiotic relation with others. The concept of intra-action reveals an intrinsically plural existence, which signals the deeply social aspects of all material bodies. These ideas are based on, and are in resonance with, French philosopher Bruno Latour's Actor-Network-Theory (ANT),[82] as well as with mighty French philosophy duo Deleuze and Guattari's work on assemblages and rhizomatic systems.[83] Barad's agential realism is infused with conceptualizations of assemblages that give place to intra-activity and the notion of entangled agencies. With the term intra-action, Barad proposes an "ethico-onto-epistem-ology"[84] that is a co-constitutive alternative to *interaction*, a term that presumes that the interacting parts have pre-existent individual agencies that are detached from one another. The

[79] Karen Barad, "Posthuman Performativity, Toward an Understanding of How Matter Comes to Matter," in *Signs*, Vol. 28, No. 3. (Chicago: University of Chicago Press, 2003).
[80] *Ibid*., p. 818.
[81] *Ibid*., p. 823.
[82] Bruno Latour, *Reassembling the Social: An Introduction to Actor-Network-Theory*. (Oxford: Oxford University Press, 2007).
[83] Gilles Deleuze and Felix Guattari, *A Thousand Plateaus, Capitalism and Schizophrenia.* Translation by: Brian Massumi. (Minneapolis: University of Minnesota Press, 2016, 16th edition).
[84] This term coined by Barad refers to the inseparability of ethics, ontology and epistemology. Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. (Durham; London: Duke University Press, 2007 (2nd edition)). p. 90.

quantum domain provides an empirical scenario for intra-activity and the understanding of the "world's radical aliveness"[85] through a shapeshifting reformulation of what might be commonly understood as relationality, dynamism, and agency. In contrast to Butler's perspective that focuses on the social and behavioral aspects of humans, Barad argues that their "agential realism takes account of the fact that the forces at work in the materialization of bodies are not only social, and the bodies produced are not all human."[86] This perspective contests separatist dichotomies that privilege hierarchical narratives by including all organisms and non-organisms as part of the *social*, and thus conceives nonhuman performativity as a deeply relational and social matter.

When thinking about nonhuman performativity, one of the main challenges comes from the notion of nonhuman identity, "the who of things."[87] This problem is rooted in the pervasive Western conceptual apparatuses, where identity and subjectivity are essentially human attributes. As a consequence, a dangerous objectification of otherness takes place. This operation perpetuates systemic injustices and imbalances by determining that everything that is not human falls into the category of *object*: something that can be robbed of agency, owned, and commodified. As a result of colonial enterprises, capitalism, and other extractive ventures, too many humans and nonhumans have experienced these injustices firsthand. This is why broadening and questioning the scope of subjectivity and identity into "the who of things" is a very important and delicate political matter. These questions extend today into AI and other groups and concepts that have stood on the edge of the conventional boundaries of humanity and nonhumanity. Throughout history we have seen this concept expressed through mythology, and more recently through contemporary subcultures such as the *Otherkin*,[88] *Therians*,[89] and other groups that identify with species dysphoria and other manifestations of nonhuman animality. Also, let's not forget

[85] *Ibid*., p.33.
[86] *Ibid*., p.33.
[87] Eduardo Viveiros de Castro, *Cannibal Metaphysics: For a Post Structural Anthropology*. (Minneapolis: Univocal Publishing, 2014). p.61.
[88] Otherkin is a subculture that represents anyone that identifies as a nonhuman. Joseph Laycock, "We Are Spirits of Another Sort: Ontological Rebellion and Religious Dimensions of the Otherkin Community," in *Nova Religio: The Journal of Alternative and Emergent Religions. Vol. 15, No. 3* (Berkeley: University of California Press. 2012) p. 65-90.
[89] Therianthropy is the mythological ability of human beings to shapeshift into other animals. The Therians are people that identify themselves as nonhuman animals either spiritually or psychologically. Hubert Zapf, *Handbook of Ecocriticism and Cultural Ecology* (Germany/Boston: De Gruyter GmbH. 2016).

about the *cyborg*[90]; the *transhuman*[91]; other techno-infused characters where human flesh meets other organisms, as well as the mineral, the electronic, the algorithmic, and the mechanical; and other *fractal*[92] identities where one can be one and many at the same time. These questions have been notably explored under the critical notion of *Kingdom dysphoria,*[93] presented by artists and researchers Jara Rocha and Femke Snelting through a series of collaborations in artistic work and writings. "*Kingdom dysphoria* is an invented transposition of the term 'gender dysphoria', which describes the distress and violence caused by binary sex assignment. Kingdom dysphoria would be the harm caused on all living and non-living entities as a result of the assignment of fixed categories, taxonomies, species and kingdoms."[94]

Outside the Western norm there are many systems of knowing and being that have been protected by Indigenous communities around the world. Many of these groups have ancestrally acknowledged the nonhuman as fully social members of the community. This reveals a particular organization of the distinctions between humans and nonhumans that differs from the categorical organization in the West. It is possible to find different examples of the ways identity can be conceived outside of the human. For example, as shown in the work of Peruvian anthropologist Marisol de La Cadena,[95] in the Andean region, different cultures recognize diverse geological formations in the altiplanic territory as bodies with specific characters, names, stories, and sacred bonds to peoples and places. These arrangements come from particular social configurations centered in kinship systems and other social phenomena that are not reducible to the Western division between nature and culture. These types of social systems are abundant and manifest differently across the territory of the Americas or *Abya Yala*. Brazilian anthropologist Eduardo Viveiros de Castro dives into the Amazonas to examine examples of other notions of identity and difference that revert colonial preconceptions. By doing so, he develops his work on *Amerindian*

[90] Cyborg or cybernetic organism is a term coined by Manfred Clynes and Nathan S. Kline in 1960. For a comprehensive discussion about the sociopolitical and ethical affectations of the cyborg, see: Donna Haraway, "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century," in *Simians, Cyborgs and Women: The Reinvention of Nature* (New York: Routledge. 1991) p. 149-181.

[91] One of the common characteristics of the transhuman is that it is centered on human enhancement using science and technology. See Francesca Ferrando, "Transhumanism/Posthumanism," in *Posthuman Glossary*. Rosi Braidotti and Maria Hlavajova, editors. (London: Bloomsbury. 2018) p. 438-439.

[92] Peruvian anthropologist Marisol de La Cadena writes about fractal entities and identities: "they offer the possibility of describing irregular bodies that escape Euclidean geometrical measurements because their borders also allow other bodies in—without, however, touching each other everywhere," moreover she states that "emerging intra-connected, a fractal entity brings in the whole, which includes the part, which brings in the whole, which includes the part, and so forth—a pattern that replicates itself endlessly, in an inherently relational design." Source: Marisol de la Cadena, *Earth beings: ecologies of practice across Andean worlds*. (Durham: Duke University Press, 2015). p. 32.

[93] Please refer to the Kingdom Dysphoria workshop and dialogue presented by Jara Rocha and Femke Snelting in the Biofriction summer program that took place between June 12th and July 17th of 2021 and was hosted by Hangar, Barcelona, Spain. (Accessed: 03-29-2022) https://pad.constantvzw.org/p/kingdom_dysphoria

[94] *Ibid*.

[95] de la Cadena, 2015.

Perspectivism[96] and *Multinaturalism.*[97] This work provides enriching notions of otherness that expand the idea of *subjectivity* and the social beyond Western rationality. The *social* is a characteristic attributed to individuals that relate to a society and its organization. Its Latin root *socius* alludes to *companion*, a concept based on collaboration and togetherness. Over time, the concept developed into society, which refers to being in association with others. As we rearrange what we understand by subjectivity and otherness, it is possible to forge deep bonds of kinship, companionship[98] and alliance with an unlimited range of entities that are not only human. I believe it is key to shake Western preconceptions of who is included in the social so that we can imagine other types of organizations and confabulations that are in essence performative and sympoietic.[99]

The once-outdated and mystifying idea of animism has gained resonance today through the work of French anthropologist Philippe Descola,[100] and its ramifications echo in the ideas of thinkers such as Eduardo Viveiros de Castro, Belgian philosopher of science Isabelle Stengers, and Canadian anthropologist Eduardo Kohn, to name a few. Descola proposes animism as a way of departing from the dangers of Western utilitarian representations of nature to open the possibility of including otherness in social structures of justice and care. Building on these ideas, Stengers talks about "reclaiming animism"[101] as a mechanism for *re-enchanting* reality. Rethinking animism today is far from a new-age revival of an imagined ancient religion; instead, it articulates a powerful social episteme. It proposes a departure from reductive and dangerous racist notions of animism to an understanding of it as something that "deploys social categories to signify the relations between humans and nonhumans alike,"[102] as Viveiros de Castro writes. Animism presents the potential for different elements to embody the properties of the world. Everything has a constant intrinsic capacity to be animated and thus enact relations, or to enact relations

[96] Viveiros de Castro proposes this term as a way of encapsulating Amazonian metaphysics and the attention to otherness through the perspective of the other. This is not a mechanism of relativism but a way of understanding that humans and animals share a common origin in essence; the point of view is produced by the entity that embodies it. The animal sees itself as human, so we all share an original humanity. Through this notion, the category of human is changed; it no longer defines subjecthood and the construction of identity under the gaze of Western epistemologies and separatist categories. Please refer to Viveiros de Castro (2014).

[97] Multinaturalism is presented within Viveiros de Castro's Amerindian Perspectivism as a contrast to multiculturalism. Multiculturalism assumes the existence of one nature and many cultures, versus multinaturalism that considers the existence of one culture that has many natures. Please refer to Viveiros de Castro (2014).

[98] See: Donna J. Haraway, *The Companion Species Manifesto: Dogs, People, and Significant Otherness* (Chicago: Prickly Paradigm Press, 2003).

[99] "Sympoiesis is a simple word; it means "making-with." Nothing makes itself; nothing is really autopoietic or self-organizing." Donna J. Haraway, "Sympoiesis: Symbiogenesis and the Lively Arts of Staying with the Trouble," in *Staying with the Trouble, Making Kin in the Chthulucene* (Durham; London: Duke University Press, 2016) p. 58.

[100] Philippe Descola, *Beyond nature and culture,* trans. Janet Lloyd (University of Chicago Press, 2013).

[101] Isabelle Stengers, "Reclaiming Animism," in *eflux Journal #36* (2012). (Accessed: 10-9-2018) https://www.eflux.com/journal/36/61245/reclaiminganimism/

[102] Viveiros de Castro, 2014. p. 82.

as a way of being animated. If we are attentive and sensitize ourselves to these properties, it might be possible to amplify our views of the world, and by doing so, amplify these properties and our relations in return. Kohn proposes playful attention as a way to amplify the logics of life and attune ourselves to our "complex web of relations."[103] In his work on the different forms of intelligences that manifest in forest systems, he elaborates on the idea of the "ecology of selves,"[104] which promotes thinking about what anthropology would be if it were conceived beyond the human or situated within a framework of "naturecultures,"[105] as American ecofeminist author Donna Haraway proposes. According to Kohn, if we think beyond our specific moral world, it becomes possible to imagine more just worlds where distinct kinds of *real* intersect. This is rooted in the understanding that there are other types of *thinking selves* and *thinking systems* that are not exclusively human. With these ideas, Kohn conveys that our realities are enmeshed in such complex ways that categorization within rigid boundaries is a limiting and dangerous cultural invention. These ideas provide other perspectives and approaches that resonate with Barad's posthuman performativity and the intra-active cosmos.

As Chilean archaeologist José Berenguer writes, there is no such thing as "empty space,"[106] even in places that are apparently deserted. In a similar intellectual thread, anthropologists Marisol de la Cadena and Mario Blaser remind us that "the absence of our image does not reflect nothingness."[107] In an extension of these ideas, I believe that it is crucial to elaborate frameworks that allow for alternative perspectives so we can reimagine the social world. This is the opportunity offered by *La Membrana*, as it provides a vibrant space for multiple signals to cross each other and entangle as they layer up in a series of wave interferences that fuzz individual signals and blend them into undefined collective combinations.

---

[103] Eduardo Kohn, *How Forests Think, Toward an Anthropology beyond the Human*. (Berkeley, CA; Los Angeles, CA: University of California Press, 2013). p. 16.
[104] *Ibid*., p. 22.
[105] As described by Nicholas Malone and Kathryn Ovenden, "*Natureculture* is a synthesis of nature and culture that recognizes their inseparability in ecological relationships that are both biophysically and socially formed." This term was introduced by Donna Haraway (2003) and it emerges as a way of questioning the drastic binaries embedded in Western thought that sustain the dissociation between humans and nature. Please refer to: Nicholas Malone and Kathryn Ovenden, "Natureculture," in *The International Encyclopedia of Primatology*, ed. Agustín Fuentes. (Chichester: John Wiley &Sons, Inc., 2017). p. 848. And to: Donna Haraway, *The Companion Species Manifesto: Dogs, People, and Significant Otherness*. (Chicago: Prickly Paradigm Press, 2003).
[106] Archaeologist José Berenguer and Gonzalo Pimentel introduce the concept of "internodal spaces" to refer to the spaces that are thought to be empty as well as thought as spaces on the "margins," when they actually are spaces in "between." They use this idea to navigate the Atacama Desert, a place that looks desolated but is filled with history and valuable ritual and archaeological sites, even in the most uninhabitable places. See José Berenguer and Gonzalo Pimentel G., "Introduction to the study of internodal spaces and their contribution to the history, nature and dynamics of human occupations in arid zones," in *Estudios Atacameños, Arqueología y Antropología Surandinas* Nº 56 (Antofagasta: Universidad Católica del Norte, 2017) p. 12-20.
[107] Marisol de la Cadena and Mario Blaser (editors), *A World of Many Worlds*. (Durham; London: Duke University Press, 2018) p. 17.

On Earth, we live physically intertwined in a transductive reality of vibrations that never rest. By attuning ourselves to other bodies, we can engage into material and affective links to amplify the relations that are constantly unfolding and redefining us. I believe that an ontology of vibrations presents the possibility to exist in continuity, to be in transduction, and to evolve in resonance. To physically and culturally explore the vibratory is a way of reinforcing our links to the invisible properties that animate the world. Since my focus stays within the sonic, I explore these ideas from notions of acoustics and mechanotransductions that physically activate matter as they weave subjectivities and co-constitutional material and immaterial membranal webs.

b. The Apparatus

Apparatus is a versatile and complex term. At first glance, this term directly alludes to an instrumental device or hardware, something that has a concrete function and works within a specific utilitarian essence. But the reductive idea of the apparatus as hardware is rapidly contested by its Foucauldian embodiment as *dispositif*.[108] This term goes beyond the idea of a predetermined static instrument in order to include the concept of a dynamic arrangement. For French philosopher Michel Foucault, the apparatus/dispositif is an assemblage of multiple and diverse phenomena that rule and shape social and political life; at the same time, the apparatus/dispositif is the system that articulates and intertwines these different phenomena.[109] Foucault's concept implies that the apparatus/dispositif is a material-discursive practice, which directly relates to Barad's work on performativity. Another example and extension of the term comes from French-Algerian Marxist philosopher Louis Althusser, who sees the state as an apparatus. This can be understood as a complex structure sustained by cultural and political institutions that instrumentalizes society under a subliminally imposed, or explicitly repressive power.

According to Barad, apparatuses are not passive, but highly productive instruments that become entangled with phenomena through intra-active arrangements. Apparatuses produce the phenomena they measure as an implicated subject within the operation since they not only have the characteristic of affecting and creating material reconfigurations, but they also are specific material reconfigurings themselves. Apparatuses are entangled with the universe, and everything is deeply connected to the apparatuses. This

[108] The French word for *apparatus,* which comes from Latin and means that something has the quality of being well-placed to produce an action, like being *disposed to* something. Similarly, in Spanish the word "dispositivo" is used to describe an *apparatus* that can be but is not limited to a hardware device as it extends into other types of political articulations.
[109] Michel Foucault, "The Confession of the flesh," in *Power/Knowledge: Selected Interviews and Other Writings,* C. Gordon (editor). (New York, NY: Pantheon, 1980) p. 194–228.

entanglement suggests that the instruments we use to make sense of the world are what connects us to all the parts involved in a dynamic act of membranal becoming, and at the same time, define our scope of reality by being enmeshed in it. One key thing in these articulations is that it is not that we are *part of* the phenomena, but we are *of* the phenomena, in a viscously entangled way.

One interesting and complex question is: where does this performative apparatus begin or end? In their theories, Barad extends on Danish physicist Niels Bohr's ideas about the position of the observer within a scientific setting. Bohr insisted that we are also part of the nature we are trying to observe, and so seeing it as a separated thing that can be observed from the *outside* is a mistake, since in reality this *outside* is a fiction. There is no such thing as observing the world through a detached, *god-like* perspective. Everytime we *observe* a phenomenon, we affect it through the process of *observation*. In terms of affectability and affectation, Brazilian artist and philosopher Denise Ferreira da Silva points out that affecting or being affected by something assumes a condition of being in the world, based on separability and the illusion of detached observation. This assumption is common within the logic of the modern European paradigm. Among other things, Ferreira de Silva researches quantum theory in order to think of alternatives to being able to speculate how we can exist otherwise in the world. As she expands on these ideas, she questions separability and proposes finding other ways of reimagining our constitutive sense, making apparatuses so we can find ways—as she writes—"to reimagine sociality, in such a way that attending to difference does not presuppose *separability*, *determinacy*, and *sequentiality*, the three ontological pillars that sustain modern thought."[110]

Through their work, Barad states that there is no such thing as a static and predetermined apparatus, since these are a dynamic context for relationships to emerge, and simultaneously a relational entity as well. They propose to rethink the *observer* and *observed* from a posthuman perspective, where the *observer* is not exclusively human and the action of *observing* or being *observed* is in the intra-activity of two networked systems within a performative apparatus. Even if apparatuses are themselves open-ended with no intrinsic boundaries, they become ongoing boundary-making practices in the dynamic intra-activity among matter, meaning, and phenomena. Let's not forget that, as Barad notes, "Boundaries do not sit still."[111]

[110] Denise Ferreira da Silva, "On Difference without Separability," in *Incerteza Viva: 32a Bienal de São Paulo, exhibition catalogue*, eds. Jochen Volz and Julia Rebouças. (São Paulo: Fundação Bienal de São Paulo, 2016). p. 65.
[111] Barad, 2007. p. 171.

c. La Membrana

A membrane is a porous structure that is elastic in its essence. A membrane, like the skin, should not be seen as a rigid boundary, but as a threshold that mediates and permeates continuity. A membrane has the condition of being inner and outer at the same time, it is conceptually and physically a body of dualisms and multiplicities. A resonant membrane has the capacity of receiving vibrations as well as producing and transferring them, which means that a membrane can receive as well as transmit sounds. It exists as an undeniable in-between, a communicative boundary that is always in direct contact and reconfiguration with its body and its medium. A membrane is a non-static apparatus that enables phenomena while being part of it. It is a generative apparatus that manifests as a space that is meant to be trespassed and fuzzed. *La Membrana* constitutes relational phenomena while being relational and socially modifiable in return. It is submitted to continuous deformation and energetic exchanges, and depending on the intensity of the forces, it can either resist and go back to its initial state, or be modified into other physical configurations.

Membranes as fibrous connective tissues are structures that are continuously binding elements together. A membrane as a good infrastructure remains discreet as it smoothly organizes without the need of being noticeable, highlighted, or celebrated—it is a constant, yet never stationary, apparatus that serves as a space for wavy relational patterns to emerge. Usually, the elements that more viscously amalgamate us are the ones we often fail to see or pay attention to. Examples of this could be the air we breathe and constantly share, the sounds that traverse our bodies, the gravity that binds us to the ground and keeps our cosmic structure, as well as language and cultural conventions, among many others. These are dense, invisible connective tissues that also behave as flexible structures that can resist strong simultaneous tensions and compressions. *La Membrana* embodies a series of contradictory dualities that put in tension basic limitations of linear descriptive language, as these apparatuses are simultaneously interior and exterior: an *intexterior*[112]; a receiver and a transmitter: a *transceiver*; container and content: a *containtent*.[113] Even if we can speculate through the expansive possibilities embodied in *La Membrana* through the production of new terms, I want to highlight that this thesis does not place its focus predominantly on language, but on its extension through sensorial reconfiguring and imagination.

[112] I propose the term *intexterior* as an embodiment of the dualism between interior and exterior.
[113] I propose the term *containtent* as an embodiment of the dualism between container and content.

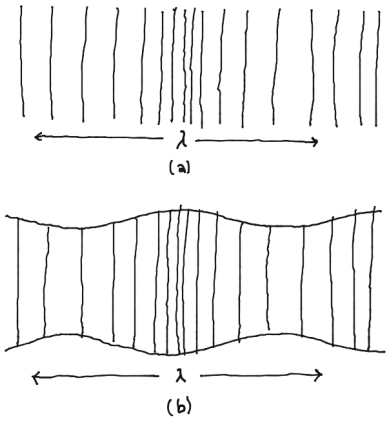

Figure 29 *Longitudinal waves. Nicole L'Huillier, 2022. Based on the book Principles of vibration and sound.*[114]

A membrane embodied as a two-dimensional vibrating system can have variable degrees of stiffness and elasticity. There are many configurations and types of membranes. A plate or a membrane with stiffness can transmit different types of waves such as "compressional waves, shear waves, torsional waves, or bending waves."[115] The solid membrane resists changes in volume as well as in shape, and the transverse waves affect its composition in a three-dimensional way. The intensity of the radiation of sound and vibrations will depend on the boundary condition of this membrane, the type of wave it is subjected to, and its physical constitution, density, and shape. The different combinations of factors will lead to different sets of vibrational modes. This way the membrane conditions its response to received relative frequencies. Examples of this have been explored through experiments with Chladni plates, where two-dimensional standing waves patterns are demonstrated as the plate resonates to different frequencies. The Chladni figures drawn by particles on top of the plate illustrate stationary nodes in the vibrating plate. Through this process, it is possible to explore the different vibrational responses of the plate when subdued to different frequency activations. This process can be used to understand various dispositions in membranes for different applications and possibilities, such as analyzing materials and their performance, or musical instruments and their characteristic sonic-vibrational identities, among other things.

[114] Thomas D. Rossing and Neville H. Fletcher, *Principles of vibration and sound* (New York: Springer, 2011, second edition, ©2004)
[115] *Ibid*., p. 71.

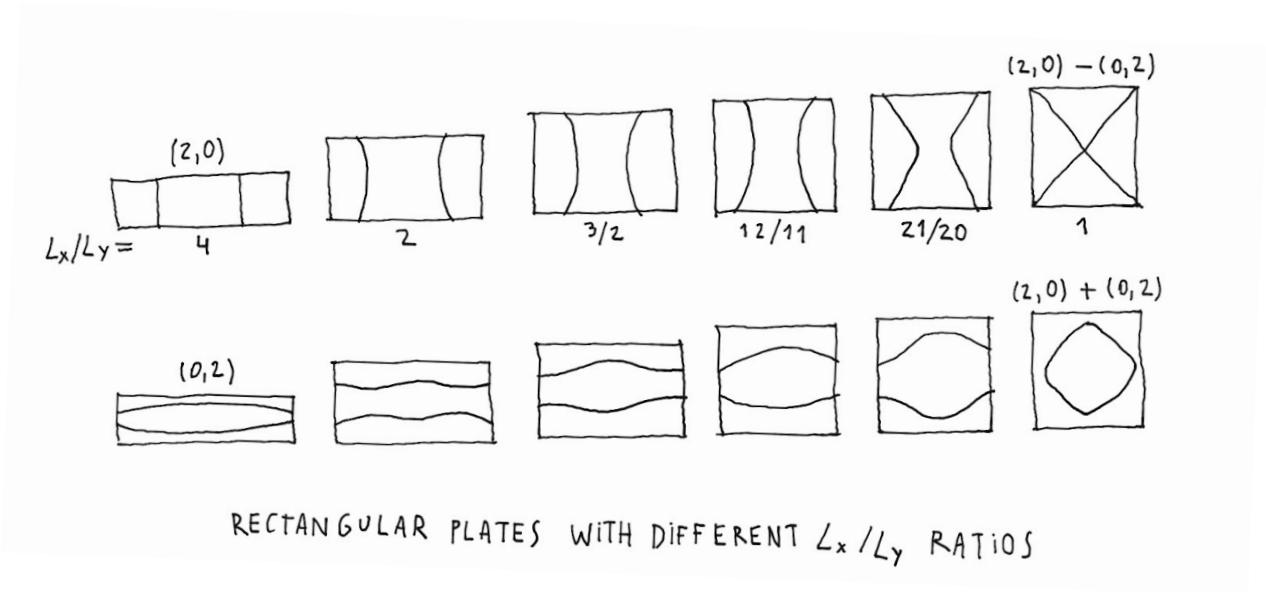

Figure 30 *Chladni plates figures in variable ratios for visualizing surface vibration. Nicole L'Huillier, 2022. Based on the book Principles of vibration and sound.*[116]

Membranes as vibrational apparatuses work by restoring their forces through flexing from their outside and compressing on their inside. They can embody a series of nonlinear behaviors that dynamically change depending on the conditions displayed by the membrane and its constancy with the forces activating it. This way, a membrane proposes a physical and conceptual apparatus to think about continuity between networked systems within itself and its outside, viscously amalgamating these phenomena in a constant vibrational equilibrium; as long as it does not exist in a vacuum, a membrane is never static.

[116] *Ibid*.

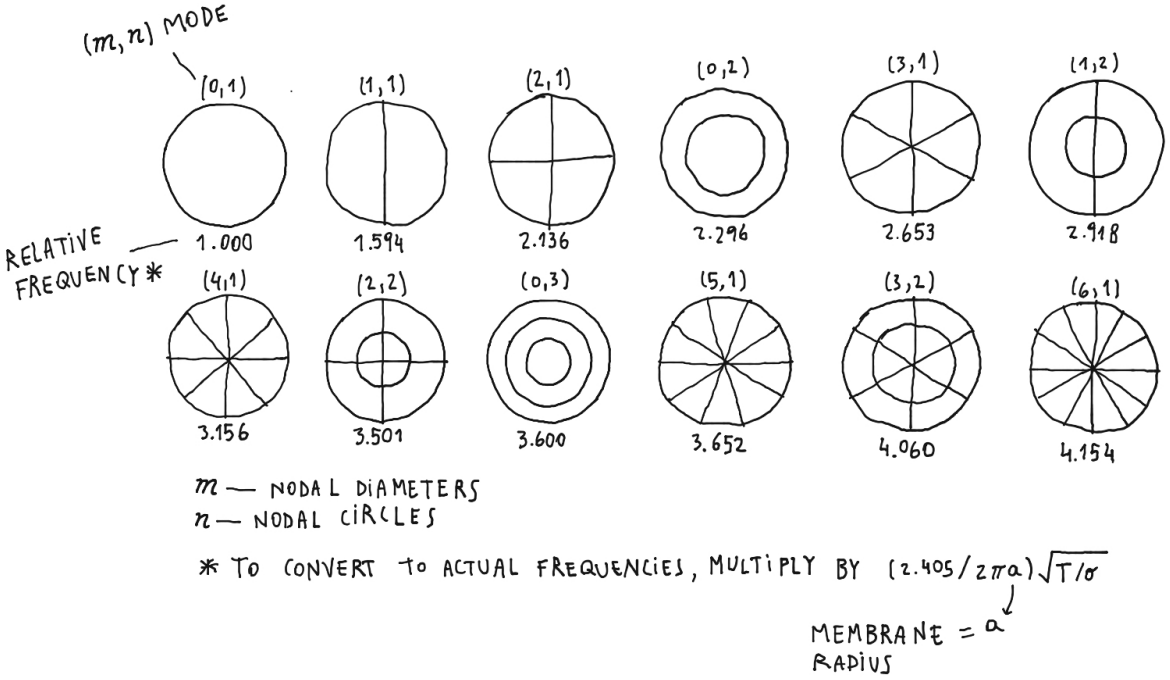

Figure 31 *First 12 vibrational modes of an "ideal membrane" a.k.a. a membrane with no stiffness of its own. Nicole L'Huillier, 2022. Based on the book Principles of vibration and sound.*[117]

Imagine a membrane with fixed edges that has no stiffness of its own and has a constant surface tension. This membrane is activated by externally supplied forces that will condition its oscillations as the forces are restored.[118] Resonant membranes embody a series of transductive processes as well as fascinating acoustic responses. Drumheads,[119] and other circular membranes such as the eardrum, are two-dimensional elastic sheets that curve bidirectionally when vibrating. They move in and out on their Z axes as tension forces are pulled to the edges. The membrane's vibration embodies forces that are paired as quantum numbers, as it presents two sets of almost opposites forces occurring simultaneously. The fundamental mode of a vibrating membrane consists of the whole sheet moving in and out as it is excited in its center. More complex nodal characters can be found when exciting the membrane by applying different forces in different points, and these can even be superposed.

[117] *Ibid*.
[118] *Ibid*.
[119] I must say that it has been a treat to be able to dive into this research. I started playing drums when I was very young, and even before I knew much of the science behind them, I was always fascinated by membranal vibrations.

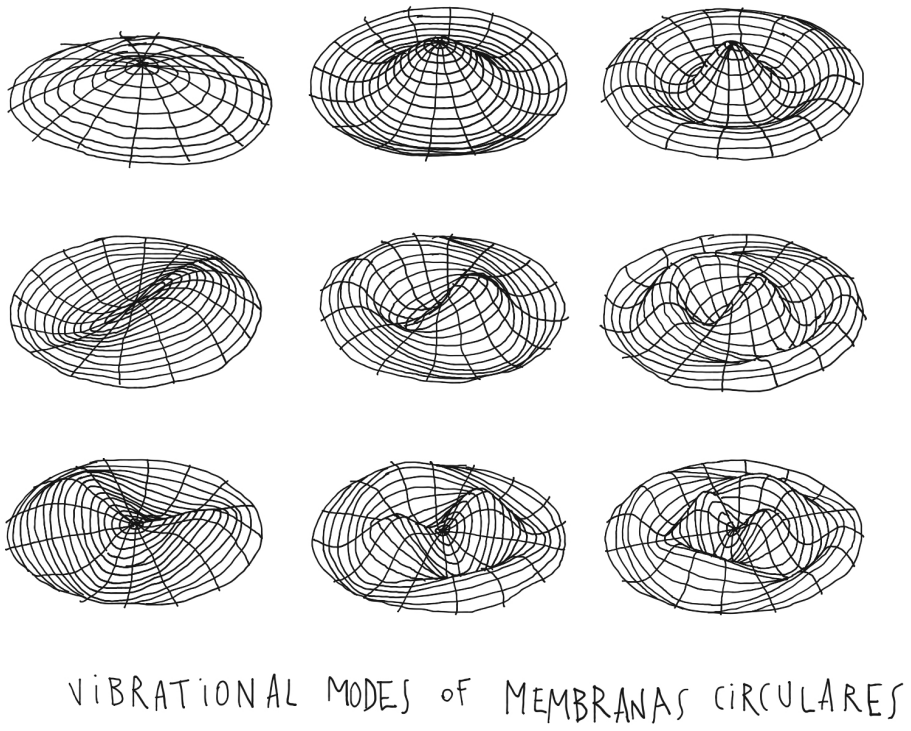

Figure 32 *Vibrational modes of membranas circulares. Nicole L'Huillier, 2022.*

In addition to their physical vibrational modes, some membranes embody a series of other complex transductive mechanisms, such as the eardrum or tympanic membrane. This is a thin circular membrane, a semi-transparent film that stretches across the ear canal of human and nonhuman animals. It is placed between the middle ear and the outer ear, simultaneously connecting and separating them. This membrane's main function is to vibrate in response to sound waves and transform them into mechanical vibrations that excite the inner ear. The malleus attached to its center receives the vibrations and transmits them to the middle ear's ossicles so they can carry the vibrations to the fluids in the inner ear, activating the hair cells, the basilar membrane, and continue the cycle, transforming sound waves into perceived sounds.

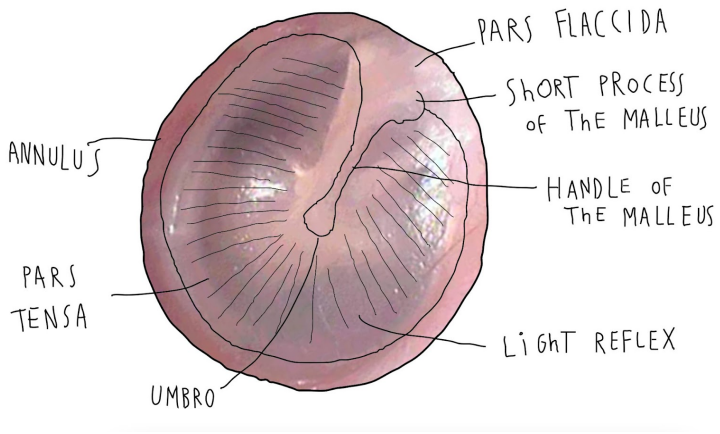

Figure 33 *Tympanic membrane structure collage/sketch. Nicole L'Huillier, 2022.*

d. Resonances

To resonate is to be in tune. Resonance is the vibration of the particles of a material entity produced by a specific frequency. The body vibrates because the frequency is tuned to its acoustic characteristics. Every material body has a resonant frequency to which it will vibrate. For example, a string vibrates at different frequencies than a rock, and of course, not all rocks vibrate at the same frequency. The resonant frequency will differ depending on the object's own particular composition, size, shape, etc. Resonance also alludes to the metaphor of synchronous tuning among bodies in many ways, including social, emotional, and political ways. Resonance animates and intertwines material and immaterial relations across scales and media. In the following section, I will focus on sound waves as resonant entities that sustain my personal interests as a sonic practitioner and also provide a stimulating way of delving into the world of resonant membranes, though it is important to mention that sound composes a small part of what resonance is.

Only 5% of our universe is composed of matter, a physical substance made up of particles, that has mass and occupies space. Even if matter represents a tiny part of the cosmos, it is what constitutes every physical thing that is known. Vibrating matter, such as a snare drum or vocal chords, create pressure waves in a medium, such as air. These pressure waves are known as sound waves. The sensation of sound is produced primarily by sound waves resonating the tympanic membrane. Before the sound waves are received by the listener or resonating entities, they have been reflected by multiple surfaces as well as absorbed by multiple bodies within their space. This way, the acoustic properties of the space and the

bodies within are dynamically reconfiguring the sound waves, as the sound waves reconfigure these membranes in return. An iconic artistic embodiment of these resonant relations and fuzzy amalgamations is the piece *I am Sitting in a Room* (1969) by composer Alvin Lucier (United States, 1931-2021).

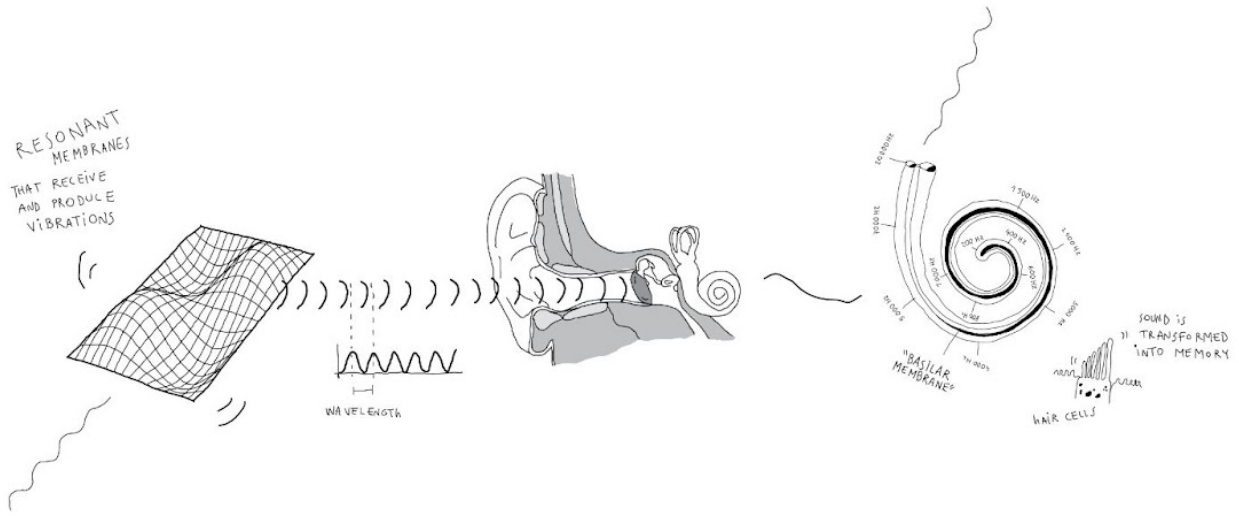

Figure 34 *Some membranal entanglements. Nicole L'Huillier, 2022.*

In addition to ear audition, sound can also be sensed through extra-auditory phenomena, which consist of sound that is heard through our whole bodies, and through bone conduction, which occurs when vibrations bypass the eardrum and are conducted through the skull into the inner ear. Australian cultural theorist and author Dominic Pettman reminds us in his book *Sonic Intimacy* that we come into being completely surrounded by sonic phenomena. In our formative days in our mother's wombs, we were completely immersed in a sonic continuum of "squelches, rumbles, and pushing thumps of the mother's body. Even before we have ears, we can 'hear' through our skin. (Indeed, this capacity continues into adulthood)."[120] Mammalian sensitivity to vibrations and sound comes as an evolutionary heritage from other species, like fish, who use the otolith organs[121] inside their heads for hearing as well as for orientation.

[120] Dominic Pettman, *Sonic Intimacy: Voice, Species, Technics (Or, How To Listen To The World)*. (Palo Alto: Stanford University Press, 2017). p. 1.

[121] From this process, humans developed a more sophisticated listening apparatus. We kept the otoliths, which are calcium carbonate crystals that are part of the vestibular systems, but instead of using them for hearing, we mainly use them for balance and orientation.

Sound waves are not only perceived through audition but also, as though touch, as palpable vibrations. This tactile phenomenon partially resonates with French philosopher Jacques Derrida's haptocentric thought,[122] since in this vibrational world sounding is also a way of touching. Touch takes place in the most personal sphere since touching something always implies being touched in return. Touch conveys closeness and at the same time vulnerability. As presented by author Emmanuel Alloa, from Edmund Husserl we understand the notion of the auto-affective voice, "speaking is hearing oneself speak,"[123] and from French philosopher Jean-Luc Nancy the concept of carnal auto-affection where "touching is touching oneself."[124] Musician and artist Nina Eidsheim deconstructs the conventional notion of the voice and elaborates on the idea that not all vocal sounds need to have a conscious and semantic purpose, nor must they answer to Western music norms. These ideas support the understanding of the voice as something free from conventions.[125] One might even think of one's voice both as a means for self-expression and as a means of self-care and self-touch. By breaking down pre-established conventions of how we are supposed to *sing* or to *sound*, Eidsheim expands the possible meanings of voice as sound and as touch continuously mediating a series of resonant material and immaterial relations. The voice is an example of self-touch as well as touch that can be projected beyond the self, as we can touch others with our voices at a distance.

Author and researcher Shelley Trower devotes her book *Senses of Vibration*[126] to the vibratory world of hearing vibrations through mechanics of resonance, the materiality of vibrations and the haptics of sound. Their work takes us from the visceral experience of bass in the dancefloor subwoofers of the '90s club scene, to sonic-vibrational embodiments as pain, physical activations and movement, and pleasure within vibrations and their tactile dimensions. In addition, Sterne writes:

---

[122] The notion of haptocentrism originates from Derrida's action of deconstructing the sense of vision (heliocentric or optocentric) as the primordial human sense and exalting touch as the main sense. In haptocentrism, touch is seen as the sense par excellence, since it implies auto-affection.This is an stimulating and sensual operation of decentering ocularcentrism and fuzzing the lines of a sensory input that does not pertain exclusively to one sensory register. However, I want to be clear that I am using this concept as a way of exposing alternatives that highlight Western categorical sensorial rationale as an immensely relativistic space that both conditions and is conditioned by predetermined conventions. There are many ways of decentering sight. *La Membrana* does not propose to replace sight with other sensorial hierarchy, but to fuzz these fragmented hierarchies in the first place.
Reference: Jacques Derrida, *On Touching—Jean-Luc Nancy*. (Stanford: Stanford University Press, 2005).

[123] Emmanuel Alloa, "Getting in Touch: Aristotelian Diagnostics," in *Carnal Hermeneutics, Perspectives in Continental Philosophy*, edited by Richard Kearney and Brian Treanor. (New York: Fordham University Press, 2015). p. 205.

[124] *Ibid*., p. 205

[125] Nina Eidsheim, *Sensing Sound: Singing and Listening as Vibrational Practice*. (Durham; London: Duke University Press, 2015).

[126] Shelley Trower, *Senses of Vibration: A History of the Pleasure and Pain of Sound.* (New York: Continuum, 2012).

> the boundary between vibration that is sound and vibration that is not sound is not derived from any quality of the vibration in itself or the air that conveys the vibration. Rather, the boundary between sound and not-sound is based on the understood possibilities of the faculty of hearing—whether we are talking about a person or a squirrel. Therefore, as people and squirrels change, so too will sound—by definition. Species have histories.[127]

Figure 35 *Vacila[128] con la membrana basilar (Vacillate with the basilar membrane). Nicole L'Huillier, 2022.*

Scholar Deborah Kapchan emphasizes "Sound, even when inaudible, is indelible material. As vibration, it permeates everything, unloosening thereby the knotted dualisms of nature/culture, human/nonhuman, body/mind."[129] These vibrations are elements of membranal entanglements, cohesive materials of connectivity through multiple resonances and transductions. An element that is constantly being transformed and transferred. German physicist Hermann von Helmholtz used sound to demonstrate theories such as the law of energy conservation (1847),[130] because of sound, as any form of energy has the quality of being "transmitted and transformed rather than created or destroyed."[131] In his demonstration, Helmholtz used the "sound-movement" or vibration of a string to stimulate a neighboring string into vibratory motion, also known as the "sympathetic vibration" of strings. Through his deep research into the mechanisms behind tone perception, he got involved in many resonant experiments and even ventured into the creation of experimental objects such as the Helmholtz Resonators.[132] In 1862 he wrote *On the sensation of Tone*,[133] in which he incidentally ends up exploring the phenomenon of resonance in detail,

---

[127] Jonathan Sterne, *The Audible Past: Cultural Origins of Sound Reproduction*. (Durham: Duke University Press, 2003) p. 12.
[128] *Vacila* translates to *vacillate*, which carries a connotation of oscillating, vibrating, and vibing. In Chile this word is commonly used in a colloquial way to refer to partying and entering the vibe.
[129] Deborah Kapchan, "Body," in *Keywords in Sound*, David Novak and Matt Sakakeeny, editors. (Durham; London: Duke University Press, 2015) p. 42.
[130] Hermann von Helmholtz, "The Conservation of Force," in *Hermann von Helmholtz: Science and Culture, Popular and Philosophical Essays*, David Cahan (editor). (Chicago: University of Chicago Press, 1995) p. 96-126.
[131] Trower, 2012. p. 39.
[132] Illustrated in figure 35.
[133] Hermann von Helmholtz, *On the Sensation of Tone as a Physiological Basis for the Theory of Music* (New York: Dover Publications, 1954).

from the propagation of sound waves in space to the organ of Corti inside of the cochlea. This phenomenon profoundly concatenates inner and outer dimensions through interweaving membranal structures in spaces, entities, rocks, bones, skin, auditory organs, hairs, and particles. In extension of the physical mechanisms of resonance, German cultural historian and ethnomusicologist Veit Erlmann beautifully describes the tensions between reason and resonance:

> "Resonance is of course the complete opposite of the reflective, distancing mechanism of a mirror. While reason implies the disjunction of subject and object, resonance involves their conjunction. Where reason requires separation and autonomy, resonance entails adjacency, sympathy, and the collapse of the boundary between perceiver and perceived."[134]

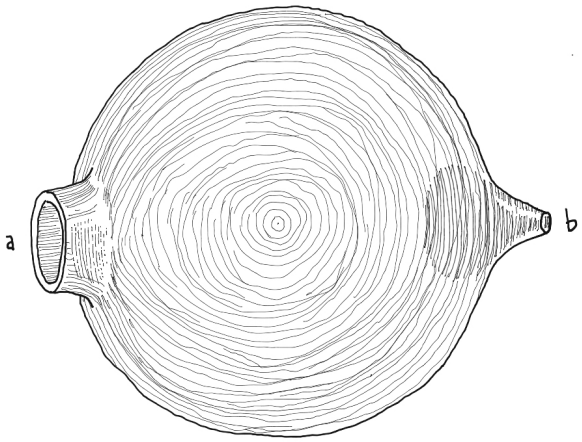

Figure 36 *Helmholtz Resonator illustration. Nicole L'Huillier. 2022.*

Among this exploration of acoustic resonance and the immaterial and material mediations of sonic vibrations, I would like to highlight the concept of "acoustemology"[135] proposed by American ethnomusicologist and anthropologist Steven Feld. *Acoustemology* is a term "to describe a practice of listening to histories of listening"[136] and is based on the intersection of *acoustics* and *epistemology*.

[134] Veit Erlmann, *Reason and Resonance: A History of Modern Aurality*. (New York: Zone Books, 2014). p. 9-10
[135] Please refer to: Steven Feld, *Sound and sentiment: birds, weeping, poetics, and song in Kaluli expression*. (Philadelphia: University of Pennsylvania Press, 1982). And: Steven Feld, "Acoustemology," in *Keywords in Sound*, edited by David Novak and Matt Sakakeeny. (Durham: Duke University Press, 2015.) p. 12-21.
[136] Steven Feld, "Acoustemologies," in *Sensing the Unseen Seminar, The Elusive: Listening*, MIT, 2010. Podcast available in the link. (Accessed: 04-10-2022) http://web.mit.edu/unseen/podcasts/elusive/1.1_elusive_Feld.mp3

Acoustemology proposes sound as a way of knowing. This concept comes to light through Feld's work that led him to develop a many-years-long relationship with the Kaluli (Bosavi) people in Papua New Guinea. *Acoustemology* is centered in a relational ontology that breaks the objectual autonomy of separated agencies and guides us through vibrant links to others. These links are a series of affective bondages that foster relationships of attention and care through the entangled acoustic resonance of different entities. Through *acoustemology*, Feld invites us to open ourselves to questions about what sonic kinships, relational spaces, changing trajectories, and dynamic maps we could encounter if we tune in. *Acoustemology* unfolds as a reaction to the notion of *acoustic ecology* or *soundscapes*; Feld finds these concepts unproductive and reductive, as they don't convey the expansive possibilities within sound. This reflection is a critique to the idea of sound as an object, or a sound as a static portrait, a detached event where the listener (or recorder) is not spatially immersed and implicated. *Acoustemology* is a deeply membranal concept.

Resonating membranes can also be portals between worlds. As events in the human mind, sounds and vibrations can dynamize a series of immaterial mechanics and psychic attunements that stimulate emotional states and guide our brains though different mental states. Certain frequencies and patterns, such as polyrhythms and repetitive hypnotic drumming, can even induce altered states of consciousness, profound emotions, and enhanced or distorted sensory sensitivities. This use of music is an ancient practice usually associated with rituals, in which the music is frequently accompanied by physical movement, psychotropics, and other ways of creating sensory overload. Artist and researcher Jonathan Weinel states that "these are not only physiological triggers but also serve partly as a means to structure events within a cultural context."[137] Different subcultures have appropriated these practices and are known to experiment with trance and altered states in secular spaces. According to Weinel's research, "Distortions to time perception may also occur, during which moments appear to pass much more quickly or slowly than usual."[138] I believe that these membranal operations don't only affect temporal fluidity in terms of speed, but also in terms of nonlinearity, as the play between temporal speeds can materialize temporal spirals, pulses, and other nonlinear patterns. In another temporal note, the (a)temporal dimension within sonic activations also relates to the possibility of layering up times through emotional, embodied, and material memory; a sonic event is not static, and is not only the event in itself, but is a coupling of many other events that took place in the same space in the past, or the pairing of that sonic event with subjective affects and previous experiences at a cultural and personal level. In this way, it may be possible to understand sounds not only as portals between worlds, but also as portals between times. These

[137] Jonathan Weinel, *Inner sound: altered states of consciousness in electronic music and audio-visual media*. (New York: Oxford University Press, 2018). p22.
[138] *Ibid*., p. 18.

operations present possibilities for fuzzing Western concepts of time that rely on linearity and anthropocentric scales.

Another fundamental immaterial resonance is sound's affective dimension. Sound can touch us more deeply than we think, because sounds are deeper than we know. Sound is a generative catalyst of memories and emotions that centers on the activation of resonances of affects and care. As a concrete example, I would like you to hear a particular sound—the cry of a newborn baby. This sound carries a series of acoustic characteristics that contain an enormous amount of information about the baby. Each cry is acoustically unique and varies between a range of frequencies that is impossible to ignore. Through a series of evolutive operations, this is a sound that alerts and impels others into action. This sound is on the edge of noise—many people experience it as noise—but its effect on the listener depends on the context and perspective. This sound is so special and sophisticated that it can even stimulate the hormone of love. It makes oxytocin rise in those who care for the newborn, and as a result, it encourages them toward behaviors of empathy and care. If we learn how to listen more attentively, we might find in sound a series of elements that invoke other sensitivities that can heighten our imaginations so we can tune into more acute and deep relational models.

To receive sound waves is to resonate. To listen to sound is to resonate. To transmit sound waves is to resonate. To touch each other with sounds is to resonate. To resonate is to *re-sound*. Resonance is the world of shared vibrations, of material interweavings. I like to think of resonance as a quality of sound being insistent, as if sound were making a point. For the past several years, I have been interested in exploring resonance and transduction as key features of the vibrational universe of listening and sounding. It is possible to unravel the chain of processes and the series of transformations of energy that enable a membrane to produce (and receive) sound but this chain deploys a system with no exact beginning or end.

e. Spaces As Fuzzy Membranes

Let's think of membranes as spaces. The characteristic qualities of membranes can be embodied by different types of spaces, which include, but are not limited to, physical space, cultural space, dreams space, cyberspace, and other types of material and immaterial spaces. In order to exemplify my reflection, I will refer to physical space, a dimension of existence composed of a medium and different types of bodies. Physical space is the three-dimensional expanse that enables (or disables) encounters and relations between entities. Our modes of perception have evolved in specific environmental conditions and

therefore we can experience stimuli as active and reactive agents in space. We are, inevitably, in continuously transient relations with everything, because these relations take place in space and space is defined by collectively relational events. Every element of and within the space matters, since they determine the fluidity and constitution of the relations. British-Australian writer and scholar Sara Ahmed cautions us that spaces are not only bodies themselves, but are also part of the bodies they envelop. She writes, "Phenomenology reminds us that spaces are not exterior to bodies; instead, spaces are like a second skin that unfolds in the folds of the body."[139] Throughout my previous work and research, I have realized the important role of space as a body that is also part of the relational dynamics, not only an outsider dormant shell, but a fundamental constituent of the relationships that unfold. This is why when thinking about spaces as membranes, it implies to think both about spaces and membranes as deeply social elements.

In a different but related reflection, German architect and cosmological theorist Siegfried Ebeling considered "Space as Membrane."[140] In his 1926 text, he wrote about how architecture was taking a path that disconnected humans from the environment instead of being a mediator between them. This provocation unfolded as a critique to modernism, which, in its promotion of sterile environments through the new wave of industrialized, hygienic construction materials and systems, such as glass facades, high pH concrete, as well as plastics and polymers, also promoted sterile relationships and impermeable exchanges between humans and the environment. His use of the biological metaphor of the membrane helped him to consider architecture as a porous organism that perceives and reacts to different environmental stimuli as they permeate it. This model proposes architecture as a physically fluid and responsive entity that could mediate exchanges between environmental entities and humans.

In terms of the fuzzy definition of a membrane or membranal entities, we may be able to explore it by using the wind as an example, as wind weaves invisible membranes on the move. Wind, as a membranal entity, has no static beginning or end, it is neither a body, nor linear, or temporal, as it pertains to other types of registers and definitions that don't submit themselves to human notions of definition, solidity, vectorial displacement, or time. The wind as a membrane relates to the notion of *Corpus Infinitum*,[141]

[139] Sara Ahmed, *Queer Phenomenology: Orientations, Objects, Others*. (Durham; London: Duke University Press, 2006) p. 9.
[140] Siegfried Ebeling, *Space as Membrane (Der Raum als Membran)* (Dessau: C Duennhaupt, 1926).
[141] *Corpus Infinitum* is an image proposed by Denise Ferreira da Silva. In the description of the Corpus Infinitum lecture she gave at Brown University in 2020, she writes: "this talk is built around a thought experiment, from which I speculate on a basis for thinking that is not contained by the presuppositions and prescriptions of the Kantian program. Neither a concept nor a notion, this image of existence radically departs from post-Enlightenment thinking and its onto-epistemological pillars (separability, determinacy, and sequentiality). In doing so, it allows for an approach to knowing that does not presume something like a mind (Kant's I think) and its separation from

proposed by Ferrerira da Silva. The idea of *corpus* or body comes from an humancentric understanding of finitude and the definition of subjectivity through separability. Within this scope, even the idea of *connection* is in its genesis defined by separation. Ferreira da Silva persuades us to question the meaning of solidity so we can find alternatives to fuzz and trouble the idea of definition that we impose on entities that do not necessarily stand by such characteristics. Continuing this thread, Rocha and Snelting put in question the *cultural regime of volumetry*,[142] in order to analyze the material and cultural conditions that enable and disable the notion of "body" in the context of 3D digital environments and computational production. These questions trespass the virtual and stimulate important questions about physicality and quantifiable presence, as these performative representational practices loop back into the commonsensical understanding of physical bodies and their delineated stiffness. In their analysis, Rocha and Snelting prompt us to grasp bodies as the fictional entities that they are and how their existence within a defined boundary can reinforce static ideas of density, presence, and finitude, among other things.

In her biopoetic manifesto for *Minimal Ethics*,[143] artist and writer Joanna Zylinska states—among a list of 21 theses—that: "1. The universe is constantly unfolding but it also temporarily stabilizes into entities,"[144] and that "5. The world is an imaginary name we humans give to the multitude of unfoldings of matter."[145] Within the previous discussion of separability, definition and the staticity of *bodies*, I would like to propose the following transposition: "The *body* is an imaginary name we humans give to the multitude of unfoldings of the universe as temporary entities." In the end, all these names and categories are fictional to begin with. They have been installed in order to have representations that can provide a sense of direction or a starting point, but sadly these have remained as stiff, imposed (un)truths. Ferreira da Silva invites us to be open to undefinition and unknowability as caring ways of relating without possessing. She makes the case for human rationale infusing the world through its lens, as we *observe* it and make sense of it through our limited perceptual and conceptual apparatuses. By doing so, we make up what the world *is* under an arbitrary rationale. By doing this, we perpetuate the *invention* of a world under a subjective speculative process of worldling *as if.* By doing so, we organize the world under principles of identity and

---

something like a body (or everything else that exists). In short, this image allows for descriptors that presume that every existent (human and more than human) is a body (corpus) without limits (infinitum)." https://events.brown.edu/cogut/event/183599-denise-ferreira-da-silva-corpus-infinitum (Accessed: 04-10-2022). Under this context, Ferreira da Silva has collaborated with artists and film maker Arjuna Neuman to work on a series of films that further explore the image of the *Corpus Infinitum*.

[142] *Volumetric Regimes: Material Cultures of Quantified Presence*, edited by Possible Bodies (Jara Rocha and Femke Snelting), to be published in 2022 by Open Humanities Press. The contents of this book-in-the-making can be accessed on this wiki site: https://possiblebodies.constantvzw.org/book (Accessed: 04-10-2022).

[143] Joanna Zylinska, *Minimal Ethics for the Anthropocene* (Ann Arbor: Open Humanities Press, 2014). p. 139-142. Freely available online at http://dx.doi.org/10.3998/ohp.12917741.0001.001 (Accessed: 04-10-2022).

[144] *Ibid* p.139

[145] *Ibid* p.139

difference that are arbitrary in the first place. From here, Ferreira da Silva proposes that since "we live in a world *as if* anyway, why not live in it *as if* it is something else?"[146]

f. To Tune In

To tune means to adjust in relation to something else in order to meet desired conditions. It means to adjust to a particular frequency, signal, emotion, or situation. To adjust to an agreed pitch. To tune in is to become aware and act upon something else, to notice something in an implicated way. To tune in means to become concatenated with otherness. To tune in implies the action of becoming attuned as well as being in resonance. To tune in is to *withness*.

The mechanisms of adjusting for tuning can be done by means of different membranal actions such as recognition, reorientation, recalibration, rearticulation, and reconfiguration. Usually, one can tune in through perceptual apparatuses, though sometimes we can also use perceptual extensions and translation technologies; as examples, consider language, or something concrete like a radio receiver antenna. One could also use a membrane as an apparatus to tune in. A membrane is to vibrations and sound waves as an antenna is to radio waves. The membrane can intercept or radiate energy through sympathetic vibrations. The membrane can be an apparatus to tune in not only as a sensorial extension, but most importantly, as a sensorium in itself. The membrane as an apparatus is not necessarily something we can hold in our hands, but rather something that guides us and holds us in vibratory ways. By inhabiting reality from a membranal perspective, I propose thinking and behaving like a membrane so we can be ready for vibrations—so we can be ready to adjust, recognize, recalibrate, resonate, and tune in.

Since perception implies a series of translation mechanisms, it is a phenomenon that is contextually and culturally driven. Haraway proposes the concept of "situated knowledges"[147] to denote that perception is embodied so it is necessarily located and thus continuously reconfigured by its context and its particular cultural, historical, ethical, geographic, physical, and subjective conditions. Part of this critique lies in the way that approaching the world through visualization is based in epistemes that perpetuate disembodiment and objectification, a world that is represented in clear images of things with precise boundaries. Some aspects of this critique resonate with author Jonathan Sterne's "audiovisual litany,"[148]

[146] Denise Ferreira da Silva, *Tangible Possibility* lecture, ICA Miami, 2021. (Accessed: 04-10-2022). https://www.youtube.com/watch?v=79UWUHtCW6g
[147] Donna Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," in *Feminist Studies* 14, no. 3 (1988). p. 575–99.
[148] Sterne, 2003. p. 15.

where he presents a series of sensorial binary positions such as “hearing is concerned with interiors, vision is concerned with surfaces”; “hearing tends toward subjectivity, vision tends toward objectivity”; “hearing is a sense that immerses us in the world, vision is a sense that removes us from it.” These aphorisms idealize sound and work to the detriment of the ocularcentrism ingrained in Western culture. While *La Membrana* is set to decenter the visual, it does not attempt to replace it with the sonic; that operation would also be problematic and a symptom of fragmented sensorial categories. Following this critique, *La Membrana* proposes a territory based in tuning into sensorial interferences to fuzz partial perceptual representations that are based in boundary-making practices, because the world is not a static image, but neither is it only a sound.

To behave like a membrane means to be a body ready for oscillations, permeability, and viscous *ins* and *outs* that place us in a perpetual in-betweenness and continuous flows. We are constituted by membranes, we are membranes, we inhabit membranes, we share membranes. Space is a membrane, time is a membrane, reality is a membrane. If we manage to think membranously, we might be able to understand that we behave as such and always resonate like a drum. As we continuously accept and embody oscillations, we live in a vibrational relationship with everything.

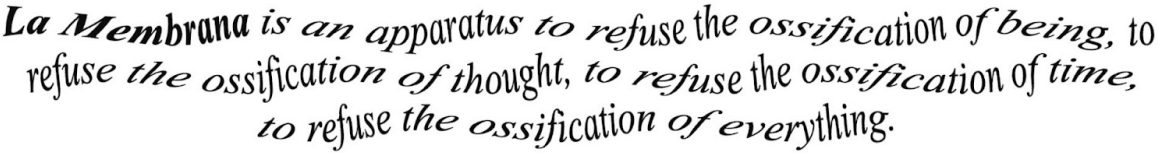

Figure 37 *An apparatus to refuse ossification. Nicole L’Huillier, 2022.*

La Membrana is simultaneously a threshold, a bridge, a plate, a drum, a sponge, an elastic, a concept, a subject, an object, a container, a content, a cultural matter, a natural one, an idea, a feeling, a physical condition, a metaphor, an action, an infrathin,[149] a hyperobject, a signal, an antenna, a space, a body, a receiver, a transmitter, an observer, the observed, an interior, and exterior, a door, a wall, a continuum, a

[149] Infrathin is a concept proposed by Marcel Duchamp. It refers to a particular type of simultaneous separation and connection between things and/or phenomena. This concept is commonly defined as something that can’t be explained in words but only by giving examples. An example of an infrathin can be the air we breathe simultaneously, or the whistle of wind in the leaves of a tree.

single, a collective. *La Membrana* is a place for confusing things in a very productive way. *La Membrana* is entangled with the universe, everything is entangled with *La Membrana*.

Song 3: Membranas, A Platform To Practice

Figure 38 *QR code for audio Song 3: Membranas, A Platform To Practice. 0'38". I recommend listening with headphones. The file can also be accessed at this link: http://nicolelhuillier.com/song-3/ (Accessed: 04-13-2022*)

a. Please Start By

This is an invitation to behave like a membrane and resonate like a drum, to embody the oscillations, to experience a vibrational relationship with others.

A membrane vibrates and produces or transfers sound. *We*[150] are all vibrant bodies, resonant membranes that receive and produce vibrations. *We* are membranes, we inhabit membranes, *we* share membranes. Space is a membrane, time is a membrane, reality is a membrane. *We* are all part of a collective membrane, we are multiple voices stirring up the wind.

[150] This is an opportunity to question and reformulate what is meant by *we*, allowing us to expand who and what it includes; *we* are multiple and dynamic. Kohn suggests that all *things* think in collective systems, human and non-human alike, indicating that "we are not the only kind of we." (Kohn, 2013. p. 16.)

~ Please start by opening your heart to these vibrations.

Put an intention in your listening so you can

Ask for permission to the others to respectfully attune.

If you don't get a direct answer, try to feel it.

Once it feels right,

Try listening with your whole body.

Bring your skull, bones, hands, and membranes close.

Engage and spatially explore the sounds + vibrations.

Read the printed text and interpret it as your personal guide.

If possible, make it collective, share it with others.

Take it with you.

If you want, go ahead and pick a flute.

Take it with you.

Practice call and response.

Listen to each other in order to emerge together.

Improvise with otherness and strangeness.

Touch with sound and let sound touch you in return.

Take it with you ~

Vibrate, resonate, transduce!

b. Membranas Installation

Membranas is the practical component of this thesis. It is an installation envisioned as the experimental platform that materializes the ideas that compose *La Membrana* and puts them into practice. This installation emerges from the need to explore membranal operations while proposing an infrastructure that articulates a space for evidencing resonant collective encounters and relations. Most importantly, *Membranas* is not meant to be understood as what it concretely and palpably *is*, but rather as what it could do, the relations that could emerge, and the questions it might stimulate. This installation is a physical essay where membranal ideas are embodied so that they can be explored and practiced. It contains many elements, but its primary objective is to be a space for listening[151] to each other in order to emerge together. This improvisational practice, like any other, takes time and is fortified by repetition and iteration. *Membranas* aims to be a platform to practice while putting ideas into practice.

Membranas embodies different ways of fuzzing categories and sensory hierarchies, dynamically shifting control and power, and shaking mental and physical stiffness, as one unfolds with others. These are things that must be exercised outside of the theory, so they can be incorporated as quotidian actions of doing, thinking, and feeling. Like many decolonial practitioners, Bolivian sociologist and activist Silvia Rivera Cusicanqui prompts us about the importance of putting ideas into practice as she writes, "There can be no discourse of decolonization, no theory of decolonization, without a decolonizing practice."[152] This is key for cultural transformation because every daily gesture matters and ideas have to be put into action. The ways we relate, our dispositions to tune in, and the languages we use are embodied political practices based on repetition, trials, and errors.

This piece displays a series of membranal ideas as well as physical membranes that compose a system for humans and nonhumans—specifically wind and a machine—to activate improvisational modes of socialization based on call and response dynamics. The experience is mediated by an indoor tensegrity sculpture that contains different speakers and resonating membranes referred to as *organs*. Some of these *organs* compose a sound system that diffuses sounds and vibrations through different spatialized outputs. Some have distributed sound sensors that perceive specific sounds and vibrations around them. The installation has an external component that is meant to be placed outdoors, called *La Orejona.*[153] This external component is a sculpture that operates as a vibrational membrane microphone created to interact

[151] Listening as attuning, acknowledging, resonating, activating membranes, and sharing vibrations.
[152] Silvia Rivera Cusicanqui, *Ch'ixinakax utxiwa: On Practices and Discourses of Decolonization*, trans. Molly Geidel (Cambridge; Medford: Polity Press, 2020). p. 56.
[153] *La Orejona* translates to *the big-eared one*.

with wind and listen to different voices and sounds traveling within it. These sounds are transmitted indoors so they can be diffused through the installation's *organs*. All these elements come together to provide a space for listening and sounding encounters of multiple voices that stir up the wind.

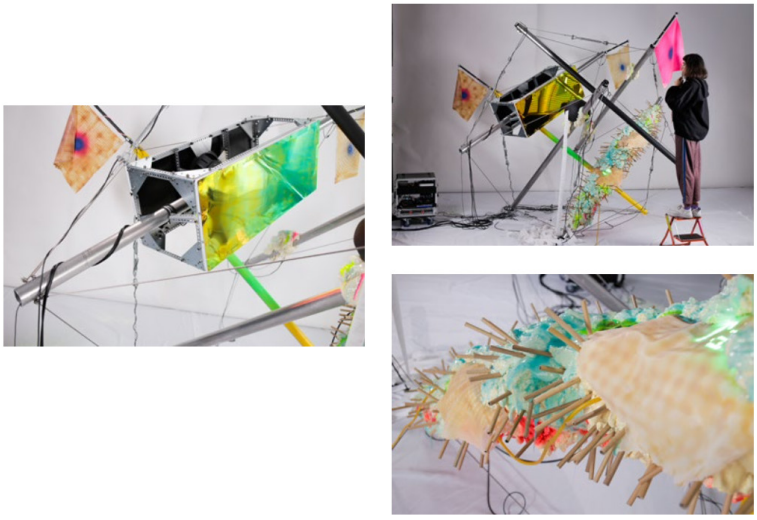

Figure 39 *Membranas structure and details of its organs. 2022. Photos: Jimmy Day, MIT Media Lab.*

Figure 40 *La Orejona and Cañitas Vessel. 2022. Photos: Jimmy Day, MIT Media Lab.*

The unexpected encounters that emerge in this simple call and response exercise are a way of tuning into more complex questions. *Membranas* is an excuse to let accidents happen and give up the sense of absolute control as a way of finding emergent collective articulations. By engaging with nonhuman agents, this installation looks to broaden the limited anthropocentric view of the social, by acknowledging difference and otherness. *Membranas* is an open resonant system that is always in articulation and configuration. The relational activation through the dynamic call and response aims to be an emergent, non-verbal way of communicating. For this operation to be facilitated, the installation considers a machine that can respond to sonic and vibrational stimuli. This is integrated into the installation through a responsive and indeterminate improvising machinic system.

Membranas presents two initial settings or forms of activation—one is an installation and the other is a performance. However, *Membranas* is not limited or uniquely defined by these settings. In the future, I hope the system can mutate into other configurations and expand its possibilities. I would like to find other ways of activating *Membranas*; for example, by inviting other artists and thinkers to activate it, host performances, use it as a space for listening and other resonant encounters, or use it as a dancefloor, a classroom, or a house, to learn from it, or encounter it as a teacher or as a friend.

In its installation setting, *Membranas* is continuously[154] diffusing sounds that come from vibrational activations of the outdoor membrane *La Orejona*. As these sounds propagate through different outputs in the indoors structure, they activate the space and the different membranes within it. Consequently, these sounds activate the machine through its membranal sensors, provoking it to trigger sounds, answering back to the sounds around/within it. This exercise creates a constant call and response between the sounds from the outdoor environment and the machine, even if no humans are present in the room. However, humans can join this sonic dialogue by producing sounds in the installation space, which are picked up by the machine's membranal sensors. To encourage this, one of the organs of the indoor structure is a vessel for *cañitas*.[155] They are provided as an interactive communicational technology within this installation. Human participants are invited to join the call and response by blowing into the cañitas. If there is no apparent sound coming from the outside, human participants can initiate the dialogue by playing the cañitas, to which the machine will respond. The musical operations and structure presented by

[154] This action is continuous, but the level of activity varies as it depends on the vibrations activating *La Orejona*. Sometimes not much will happen, other than a continuous droney noise, until a stronger wind comes or other incoming signals. This is important for this project, as it intends to decenter the desires of ongoing entertainment within human temporalities. *Membranas* submits us to the temporalities and activities of the wind and sounds traveling within it.

[155] Pan flutes. In this case, they are made of bamboo tubes. Cañitas is one of the colloquial names used in the South Andean region. It is the name I have always used for these instruments.

Membranas are simple because they are meant to be accessible and easy to understand. Also, human visitors don't have to produce sound to engage with the installation. Another way to participate is to be in the space and listen. There will always be something to pay attention to, whether through the ears, through tactile vibrations, or through the skull. The installation has different types of sonic vibrational messages that encourage ample ways of listening, scales of attention, and possibilities for attunement. Most importantly, this installation provides a space to inhabit time, a solemn moment dedicated to listening and exploring the sounds and vibrations.

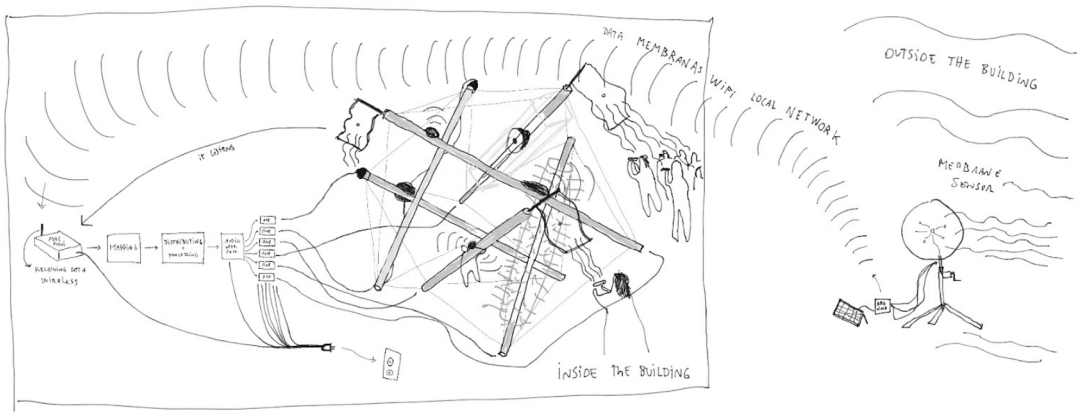

Figure 41 *Membranas Sistema. 2022. Nicole L'Huillier.*

In order to guide the visitor to engage with certain aspects of the installation, there are a series of mediation devices. The first mediation device comprises small speakers that reproduce messages inviting the visitor to engage in an action. These messages are distributed through the installation as a four-channel system of a prerecorded, spoken choir. The voices are arranged to be continuously played in an organized way that provides space for silence and for directing the visitor's attention to the different parts of the piece. The voices are soft, so they can be noticeable and intelligible but not compete with the main sounds of the experience. The messages outputted through these elements indicate actions, such as inviting the participants to take a flute from the Cañitas Vessel and play it by blowing into it; to touch some parts of the installation that manifest haptic vibrations; to bring their skulls closer to hear very soft-sounding messages diffused by bone conduction transducers, or to read a message from the "Smiling Blob" that is constantly printing and outputting interpretative text scores.

The "Smiling Blob" is another mediation device, which prints text scores that are meant to prompt visitors to engage with the piece through a subjective affective and intellectual process of interpretation. These texts are also, interpretably, a synthesis of the ongoing call and response performance, because they are generatively created in real time, responding to conditions of both the sounds from the outside and within the room. The text is generated in real time by a model that is trained with a custom database of text corpuses. This is an exercise of *cyborgantropofagia*[156] that erratically combines into three enumerated sentences, instructional texts found online for listening, knitting, singing, breathing, and playing instruments; selected texts by Chicana feminist poet and theorist Gloria Anzaldúa, from her masterwork *Borderlands/La Frontera*; selected texts and scores by American composer Pauline Oliveros, from her work on Sonic Mediations, Deep Listening, and public presentations; a selection of poems about winds and sounds by Chilean poet Gabriela Mistral; and a series of scores/resonant instructions that I have written in the past few years in relation to the research and process of this thesis. The last mediation device is a latex membrane display with scrolling text messages embedded in the Cañitas Vessel. This display communicates how to engage with the cañitas. All of the mediation elements provide information in English, Spanish, and Spanglish.

The other setting presented within the installation *Membranas* is the performance setting, which allows installation to be used as an infrastructure for performances. This activation takes place at a specific moment, when participants are invited to be part of a collective listening and/or sounding exercise. In this setting, there is a performer with the responsibility of being a guide or mediator for the experience and sonic encounters. The performances are communicated in advance and may respond to different intentions and aspects of the installation. As plausible examples, the participants may be invited to enter into an emergent collective improvisation; to explore the structure in different ways in order to practice fractal listening and attunement; to do a reading of the text scores and collectively engage in one of them; to scream together; to whisper; to tell stories; to lay down and listen; to go outside and sing and blow cañitas right next to *La Orejona* to activate the machine at a distance while being-viscerally-with the wind; or to do all of the above simultaneously.

At the moment, the installation has only been displayed as a working experiment in the Opera of the Future research laboratory at the MIT Media Lab. This space has provided the perfect setting for the

[156] This is a continuation and appropriation of Antropofagia, a postcolonial tool and artistic movement that originated in Brazil in the early twentieth century and had a revival in the 1960s. My experiments extend the term by incorporating the cyborg, since in this case, the mechanisms of digestion include an algorithmic process, not only a human one. Please refer to: Oswald de Andrade, "Manifesto Antropófago," in *Revista de Antropofagia* 1(1928): 3-7.

experimental process of creating, calibrating, and testing this installation, as this has been an ongoing, explorative, and ever-changing piece. This space provides an invigorating setting where the installation is a continuous experiment and is never fully finished, though this can be a double-edged sword. In spite of the stimulating possibilities of the installation's current context, there are some understandable shortcomings in this space. For instance, this is a shared office space where other people are working and conducting meetings, so the installation can't run continuously. It is not a public space, so it requires special coordination and permission for people who are not part of the laboratory to experience the piece. Finally, the space lacks the mediation elements and team, as well as the spatial solemnity that could be provided by a context meant for hosting installations and performances. These are all understandable limitations, and the installation will eventually be tested in other types of spaces with other opportunities, as well as other limitations. The installation is meant to be flexible and can be adjusted and calibrated to different types of spaces and situations.

For a detailed description and breakdown of the system within *Membranas* and all of its elements and processes, please refer to *Song 4: Sistemas*.

c. Surlógicas

As noted previously in this dissertation, there are different ways of engaging with sonic emergence and improvisatory togetherness. For example the *Eurological* and *Afrological* discussion presented by George Lewis[157] describes the different paradigms of improvisation and indeterminacy and how these are regulated by their contextual convention, as they dictate certain protocols within different practices of emergence.[158] Contained by the context of this discussion, I propose the *Surlogical* as a method to explore alternative logics for improvisational musical togetherness from a *mestiza*[159] perspective. I propose the *Surlogical* as a mechanism of emergent collective relations, a place full of syncretisms, complexities, and contradictions that provide a dynamic scenario for socializing, even beyond the human. The *Surlogical*

[157] George Lewis, "Improvised Music after 1950: Afrological and Eurological Perspectives," in *Audio Culture: Readings in Modern Music*, ed. Christoph Cox and Daniel Warner (New York and London: Continuum, 2005) 272–284.
[158] Please refer to the discussion presented in *Song 1: Resonant Layers.*
[159] *Mestiza/o/e*, in the context of the American continent, refers to a person who is of both European and Indigenous heritage. Originally, this term carried a negative connotation that comes from its association with the violence of colonialism in Abya Yala. Over time it has become identified as a cultural term alluding to the combination of both cultures, as well as others. The *mestize* person is a mixed figure full of syncretism and contradictions. They carry a complex vertiginous psychological identity, because of their denied *European prestige* and a culturally imposed contempt for their *Indigenous roots*. In order to contest the historical, dismissive connotation of the term, decolonial thinkers have appropriated this identity as a place of empowerment and emancipation, where instead of not belonging anywhere, the *mestize* can inhabit many worlds at the same time.

implies learning from modes of socialization through improvisatory operations of the South and its complex identity remixes, stories of embodied multiplicities, and affective incarnations that oscillate between conflict and love. The *Surlogical* provides for me a territory for speculating about multiple collisions from my personal position, so I can navigate intimate f(r)ictions to open other ways of being, thinking, feeling, and knowing.

These ideas strongly resonate with the work of Chicana feminist poet and theorist Gloria Anzaldúa who presents the notion of "the new *mestiza.*"[160] This starts from understanding *la mestiza* as somebody who carries a hybrid identity that comes from the different cultures that have nurtured her. Anzaldúa writes: "In a constant state of mental nepantilism, an Aztec word meaning torn between ways, *la mestiza* is a product of the transfer of the cultural and spiritual values of one group to another."[161] In an important and empowering decolonial move, Anzaldúa proposes that la mestiza embraces her dualism not as separate and lesser binary categories, but as additive multiplicities that free herself from constantly undergoing "a struggle of flesh, a struggle of borders, an inner war." By doing this, instead of not fully belonging anywhere, *la mestiza* can inhabit her multiple identities at the same time. So she can "at once, see through serpent and eagle eyes."[162]

As I have mentioned previously in this dissertation, I position myself as a *mestiza* from Abya Yala, specifically from the South Andean region, from the country known today as Chile. The land where I am writing at the moment, the place where I live, work, raise my child, learn, and build community is the traditional unceded territory of the Wampanoag, Nipmuck, Ponkapoag, and Massachusett, to whom I express my appreciation and respect. This land is in the Northern hemisphere, where I am working under the umbrella of a powerful academic institution that is placed in the center of postcolonial imperialism and so-called progress. I am very proud of and grateful for being here, which exceeds any expectations I ever had for my work and life. However, I also acknowledge the privilege and responsibility that come with being here. It is important to reiterate my position as I am now unveiling ideas that have to do with *Surlogical* operations. Under this context, I construct my arguments based on my own life experiences, art practice, and research from an absolutely subjective and unfixed perspective. These ideas are far from absolute truths. On the contrary, they are speculative tools for stimulating imagination in vibrational ways. The *Surlogical* encompasses contradictions and multiplicities; it is a membranal place of unlikely crossings and interferences. It is important to mention that a *Surlogical* operation is not necessarily defined by the place where it occurs, but by the intention and the way of relating to the events or

[160] Gloria Anzaldúa, *Borderlands: The New Mestiza = La Frontera*. (San Francisco: Spinsters/Aunt Lute, 1987).
[161] *Ibid*., p. 78.
[162] *Ibid*., p. 78-79.

phenomena it comprehends. The *Surlogical,* more than being defined by an equatorial line on the map, is a predisposition, a way of operating, being, acting, and thinking.

Since *mestizaje* is such an important notion behind the *Surlogical*, I would like to cite Chilean nomadic curator and researcher Camila Marambio on this topic. They refer to *mestizaje* and define what it is for them to be a *mestiza* in the following way:

> The peoples of South America very cunningly used mimicry to adapt to the violent demands of their colonizers–to become "civilized." Faced with this unspeakable challenge, they developed a new technology of survival without submission, drawing on skills from a significant preexisting performative talent. To know how to read codes, repeat them, and put them on stage is doubtlessly an art, and it is as a result of this skill that *mestizaje* (miscegenation) came to be. Spanish, Portuguese, Italian, Scottish, English, and others who arrived to settle the continent after the first conquerors were surprised to see themselves reflected in bodies that were different from theirs. And from this treacherous coupling encounter, we *mestizos* were born.
>
> *Mestizaje* is a form of over-adaptation, a chameleonlike capacity that proved to be sufficiently effective as a short term strategy, but has had far fewer positive outcomes in the long term. At some moment over time, we mestizos forgot that we were merely actors in this representational activity, and lost ourselves in attempting to become the other.
>
> Clearly, to be mestizo is not always a quality you can see, but rather something that you live. The *mestiza* either assumes herself as such or not (a constitutive part of her condition). Miscegenation is therefore a denomination of an act, a way to name a heritage, and finally, a life performance. It has been said that miscegenation can be genetically checked. How futile, when the emblematic feature of mestizo technology is, precisely, the power of mimesis! Micro-scientific findings won't be of any help to me, for it is the use of the nickname *mestiza* that empowers me, softens the aches of displacement, and offers justice to my crafted existence.[163]

As I continue this thread on *Surlogical* ideas, I will be paying attention to particular examples from the South Andean region. This does not mean that the notion of *Surlogical* is limited to that region, but this is the region that I carry within. I hope the *Surlogical* eventually can serve as a membrane that is abundantly

[163] Camila Marambio, "Mestiza," entry for "An Incomplete Glossary of Latin America," in *United States of Latin America*, ed. Jens Hoffman (Berlin: Sternberg Press, 2016). p. 100-101.

interfered with by other stories, subjective remixes, and personal mythologies that are not only mine. The *Surlogical* is a membranal apparatus to think *with* as well as a nomadic place to think *from*. This is a place where incompatibilities merge and mysterious links flow with the capacity of shapeshifting and reassembling on the go, as we relate to others, as we *conspire* (breathe together and inspire each other). A *Surlogical* paradigm can be paradoxical and inconsistent but in a weird way, this suits me, as I feel at home within that inconsistency. There is a very clear organizational logic in this apparent illogic. The main thing that enables a *Surlogic* is the very notion of perpetual change, flux, and exchange that are bounded not on set certainties but on dynamic ambiguities that are co-constituted through reciprocal and complementary relations. Incertitude is a key element of quotidian life, since reality is collective and emergent. Reality is a collective improvisation. Reality is a resonant membrane.

A prime example of a musical system of South Andean emergent and collective organization is known as *la flauta colectiva.*[164] This term, proposed by Chilean ethnomusicologist José Pérez de Arce, encapsulates a series of aspects that transcend the purely musical features of the *collective flute* because it "involves organological, acoustical, choreographic, social, and philosophical aspects."[165] This tradition is found within Indigenous and *mestize* practices in southern Peru, highland Bolivia and Argentina, and northern and central Chile. Many flutes ensembles operate as *flautas colectivas* which consist of only one type of instrument that is played by multiple musicians in a collective way. The *collective flute* is not about each performer or their virtuous individuality. The *collective flute* is about the group. Its importance lies in its sonorous mass that is inseparable, complexly resonant and intricate. Its power comes from the heavy indistinct mass of sounds that is collectively created. According to Pérez de Arce, the *collective flute* has a fundamental role as it is a place for modeling society.[166] This role could prove essential to today's cultural transformations, which are seen all over the world and include Chile's creation of its New Constitution and other important rearticulations. A *flauta colectiva*'s ceremonial congregation is based on co-constitutive processes of fluid dialogue and negotiation that transcend the musical performance and the sacrality of the rite because it infuses quotidian life with ways of being, thinking, and relating. It organizes life under an ecosystemic relational collective philosophy. This is why its function is not only aesthetic; the rite has a political role in society.

---

[164] Translates to *collective flute*. Please refer to José Pérez de Arce A., "La Flauta Colectiva: El uso social de flautas de tubo cerrado en los andes sur," in *Música y sonidos en el mundo andino: flautas de Pan, zampoñas, antaras, sikus y ayarachis,* ed. Carlos Sánchez Huaringa. (Lima: Fondo Editorial de la Universidad Nacional Mayor de San Marcos, 2018). p. 51-116.

[165] *Ibid.*, p. 98. Original passage in Spanish: "involucra aspectos organológicos, acústicos, coreográficos, sociales, filosóficos"

[166] Lecture "Eclipse, sonido y ancestralidad," José Pérez de Arce (Chile) + Mairemi Pita (Bolivia) + Ozzo Ukumari (Bolivia) for Festival de Arte Sonoro Tsonami, December 14, 2021.

Abya Yala is known to be the continent of the winds, because aerophone instruments are the most prominent pre-Hispanic instrument across the continent. There are an enormous number of particularities and characteristic elements embodied by different types of wind instruments, such as characteristic dissonant timbres, the saturation of the frequency spectrum produced by sophisticated mixed canals, collective systems that form massive wind matrices, or soft whistles, and many other characteristic features within these instruments and their different socialization systems. Importantly, the source element that is made into a flute carries the power of having been transformed in order to allow that sound to exist. Therefore, the flute is never only about the human and the wind, but rather it is always about a system between them and the tree that became flute—or the rock, or the bone, or the ground. One breathes-with many others, in and out, one is part of a system.

For the aforementioned reasons, I will focus on the South Andean region. This region presents myriad rites and ceremonies that include different types of flutes. In particular, I would like to focus on flute systems known as *las grandes orquestas de flautas*,[167] which is where the term *flauta colectiva* comes from. One example of these big flute ensembles are the *sikuriada*, which is constituted by *sikus*, a dual pan flute system made with cañitas. There are other formations based on different instruments such as *pincuyos*, and *flautas de chinos* (or *pifilka*), among other flutes that are characterized by having closed tubes, which can be simple tubes or very sophisticated ones.

La flauta colectiva[168] is a process of socialization that is intrinsically more-than-human because it considers every agent (adjacent entities and forces) around it as an active participant of the rite. "The Andean society extends to the hills, to the birds, to the rocks, to the river, they are all part of the society."[169] This flute formation conserves a principle of inclusion since the musicians, in contrast with the European tradition, don't have to be experts, and anybody is welcomed to play. Continuing with this inclusionary model, the environment is also part of the performance and reveals cues that will affect the rite, as well as dynamize it in their own particular ways. Within the *flauta colectiva*, *Eurological* forms that are traditionally broken into conventions of what constitutes audience, performer, individual musician, stage, space, and environment collapse and fuzz around the edges. These South Andean rites are improvisatory and emergent encounters that include resonant forms of call and response. They are collective practices that demonstrate strategies and ways of being resonant with others, including

[167] Translates to *the big orchestras of flutes*.
[168] Translates to *collective flute*.
[169] From notes of conversation with José Pérez de Arce that took place on November 17, 2020. Please also refer to the work by Peruvian anthropologist Marisol de La Cadena (2015).

non-human participants. These emergent encounters intrinsically carry the sense of plurality on the move, as the rules are intuitive and simple, facilitating encounters that are inviting and improvisational in essence, relational and alive to their contexts. I believe that by learning from these types of collectively emergent events, we might learn enriching, collective emergent languages and ways of being that are more suitable for the performative membranal realities that I intend to explore.

Pérez de Arce proposes some parameters that define *la flauta colectiva*[170] and follow some premises related to the number of flutes, the types of flutes, the geometries involved in playing the flutes, and some of the roles of the performers in specific formations, among other things. I am not adhering rigorously to these parameters, as I consider some of these rules to be simultaneously broken and strengthened by the presence of the sound of the wind and the sonic actions of the machine in my installation. In other words, what I am proposing with *Membranas* is a *mestiza*/cyborg experimental revision of Pérez de Arce's concept of *la flauta colectiva*. Having said this, I want to point to one of the main qualities of *la flauta colectiva* that I am adhering to: "The resulting music operates as a melodic unity."[171] This has to do with the sonorous mass, which is a continuum. There are variations in the different flute formations, but for example, in the *zikuriada*, the sounds are being "trenzados,"[172] as this rite is about a dialogue, a conversation, a braiding, a weaving, about responding and pairing in order to construct the continuum. There is no space for sound to rest and it is hard to isolate the call from the response within this weaving of continuous sounds. In other flute formations, such as *los bailes chinos*,[173] more than a melody, there is a sonorous mass that operates as melodic unity. "There is not a programmed melody, but it is possible to listen to as many melodies as the listener is capable of perceiving."[174] Another interesting element within these improvisational encounters is that its congregation is inclusive, since the musicians prefer to be greater in numbers (and sounds), even if this means incorporating inexperienced participants. The

[170] José Pérez de Arce, 2018.
[171] *Ibid.*, p. 64. Original passage in Spanish: "La música resulante opera como una unidad melódica."
[172] *Ibid.*, p. 64. Translates as braided.
[173] The word *chino* is a quechua word that means server. "The Bailes Chinos are brotherhoods of musicians/dancers from central Chile. They express the faith of farmers and fishermen that gather in religious festivals celebrated in small villages and coves where they congregate dances of neighboring towns. The oldest musical antecedents of the Bailes Chinos go back to the 'Aconcagua Volcanic Complex,' a culture that inhabited the central area of Chile between 900 and 1400 AD. During the Colony and early Republican Period, chronicalists and travelers left testimony of these celebrations. They have survived by unifying the social, cultural and religious lives of the region's farming and fishing villages. The Bailes Chinos are inserted within the framework of the American popular ritual, with Indigenous contributions like instrumental music, dance, musical instruments and the direct relation with the supernatural through special states of consciousness. They also present Hispanic elements, like prayers, the song of ensign, the Holy Scriptures, images, ritual calendar and other aspects of Christianity." Further reading: Claudio Mercado y Víctor Rondón, *Con Mi Humilde Devoción, Bailes Chinos en Chile Central* (Santiago: Museo Chileno de Arte Precolombino, 2003). p. 6.
[174] Pérez de Arce, 2018. p. 64. Original passage in Spanish: "no hay una melodía programada, pero es posible escuchar tantas melodías como el oyente sea capaz de percibir."

mistakes they might make are usually seen as variants that provide interesting opportunities and could potentially enrich the musical discourse. The more participants that can join, the better. According to Pérez de Arce, this perspective "augments its social dimension,"[175] which is more important than a perfectly executed performance.

The instruments played during a *flauta colectiva* are never played in a stationary way. They usually take part in a procession, or at least they include a dance in place with a slow progressive displacement. The *collective flute* is activated and embodied as a moving and performative entity. Of course, an essential element of these collective wind ensembles is the wind. A vital energy of continuity that is shared, transformed, and activated through the uninterrupted breathing. When the flutes are being played, the wind is present in them, the air provides the energy that circulates in the atmosphere and that activates the human, who in turn, activates the flute, that in turn, gives back its wind to the atmosphere and continues its movement and transformations. Also, let's not forget that everything we hear is air in movement—sound is air in movement.

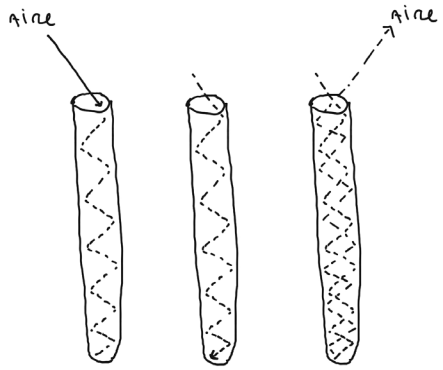

Figure 42 *Cañitas, a simple flute of closed tube. Nicole L'Huillier, 2022.*

Within the *Surlogical* context, it is possible to examine many other examples that relate to the expansive American tradition of opening sacred portals through collective rites. Some of these are based in the experience of altered states of consciousness and trance that are induced through sounds, repetition, movement, and sometimes the use of psychedelic plants, mushrooms, cacti and other substances. The previously mentioned *collective flute* ensemble called *bailes chinos* is an example of a ritual that opens

[175] *Ibid.*,. p. 64. Original passage in Spanish: "aumentar su dimensión social."

portals through altered states of consciousness which are induced by deeply spiritual, choreographic, and sonic elements that are reinforced through repetition in a party of delirious devotion and giving. The sound in this case is particularly important; Chilean ethnomusicologist and chino dancer Claudio Mercado writes:

> It is not only repetitive music that is used to this end, but also the saturation of the harmonic spectrum, the great masses of sounds that form a sonic continuum from very low tones to very high, making a great cluster that includes all the possible pitches. This is the case with the sound of the chino dances of central Chile, in which one of the factors that affects the attainment of the trance state is the quality of the sound of flutes, that repeat on and on in a great sonorous mass.[176]

In the *bailes chinos,* the very special sound known as *sonido rajado*[177] produced by the chino flute is a fundamental element of this multidimensional experience. This tradition permeates to other spheres within Chilean social and cultural practices. Many thinkers and researchers learn from these encounters and their operations as some aspects are infused on social and political life. Chilean artist Cecilia Vicuña writes about this very special, loud, and ancient dissonant sound, "It is a spiritual technology that acts on your brain, inducing trance state. The *chino* dancers of Chile call it *sonido rajado*, torn sound."[178] The *sonido rajado* is a language to communicate to the divine, to the Earth, to the cosmos, a language that is reinforced by the dissolution of the self, repetition, circulation, and movement.

Some rituals like the *bailes chinos* have survived coloniality and embody powerful cultural resistance. Others have been kept carefully in secret to maintain their traditional solemnity and sacrality. However, others have evolved into contemporary forms as a means of survival. For example, some have become more urban, or have included women and feminist perspectives, while others have invited people from other localities, and activated petitions and encounters in spaces that change. Central to the rite remains the intention behind it. This is what is sacred in its operation. If there is no pure intention, then the rite becomes not only unimportant, but useless and unnecessary.

---

[176] Claudio Mercado Muñoz, "The Sereno and the Transmission of Music among the Atacama People," in *Studien zur musikarchaologie IV. Music archaeological sources: finds, oral transmission, written evidence*. Ellen Hickmann and Ricardo Eichmann (hrsg) (Germany, 2004). p. 291.

[177] The sound of the chino flutes is called "rajado/torn." It is a particular, dissonant sound with multiple harmonics. In my early twenties, through personal musical experimentation and research, I had the luck to cross paths with Jose Pérez de Arce and Claudio Mercado, whom I consider dear teachers and friends. They unveiled for me the universe of the *bailes chinos* and the *sonido rajado* in depth. Throughout these experiences and learnings, I had the honor of crossing paths with *La Vieja*, my dear flute that was made by the hands of the master chino luthier Rodolfo Medina.

[178] Camila Marambio and Cecilia Vicuña, *Slow Down Fast, A Toda Raja* (Berlin: Errant Bodies Press 2019) p. 85.

Another ceremony that I would like to mention is entirely about carefully listening and attuning. In this ceremony, sound is the exclusive element that enables communication with otherness. In the Atacama desert in Chile, the communities of Aiquina and Toconce pay tribute to a supernatural being called "El Sereno" (among other entities). El Sereno lives in certain bodies of water and a special ritual is performed to make it possible to be in his presence. This is believed to be a sublime and life-changing experience of simultaneous extreme terror and extreme joy. Terror because in the Andean beliefs, El Sereno is a demon. He is, however, not entirely evil.[179] He can be good or bad, depending on the circumstances, but he is always an immensely strong and feared figure. The experience of extreme joy comes when El Sereno reveals his unheard music and sacred melodies to the musicians performing the ritual. The ritual consists of going to one of the bodies of water where El Sereno can be found, such as a nearby waterfall or water stream. This ritual is meant to be performed by musicians only, as they are able to learn sacred melodies solely from listening to El Sereno. During the rite, musicians go to the waterfall at night and stay silent, listening until El Sereno decides to appear. They wait for many hours. El Sereno has no physical form. According to Mercado, "[El Sereno] is only sound, and is able to exist in and through the sound."[180] This very particular ritual is purely sonic, so the musicians only know that they are in the presence of El Sereno by listening to him in the saturated sound of the water. He shows himself by unveiling his music to the humans. Mercado continues, "music is not simply heard above the sound of the water, or when the water is quieter: it is the sound of the water itself that is transformed into music."[181]

El Sereno's rite exemplifies how certain encounters may arise if we carefully and respectfully listen. This specific ritual is a sacred ceremony within a system of beliefs and has a particular intention and service behind it. I respectfully learn from it and understand that some things are not meant to be listened to by everybody. Some things require that a rite be properly performed, and are reserved for specific communities and individuals. Some things require a specific protocol; if the intention is not behind the action, and if we don't understand the dangers of misusing certain knowledge embedded in the sound, we shouldn't be engaging with it at all. Some things are not meant to be heard within certain contexts, by certain people, or even at certain times of the year. These are all important questions and concerns that I must consider in my work, especially since *La Orejona* is continuously listening to the sounds and vibrations in its proximity.

[179] In the Andean world the binary dichotomies between good and bad are not as strictly organized as in the Christian world. Divine entities, as other types of entities, can sometimes be simultaneously good and bad, among other things.
[180] Mercado, 2004. p. 290.
[181] *Ibid*., p. 291.

In my own work, I would like to be respectful and set a suitable way of listening, one that consistently checks for permission and places intention behind the action. I am aware that the intention will not always be the same and that I will not always be the listener. Even if I were, I wouldn't always be listening from the same position and intention. I hope to be able to communicate these concerns to those who will be listening and relating to those sounds. I hope it is possible to find significant moments within these constraints while we learn to listen and deal with the politics of paying attention to difference without eavesdropping and perpetuating surveillance, containment, and extraction. For this reason, it is important for me to submit to the will of others, instead of always wanting to activate the installation in one specific way. I would rather let things find their space and unfold when necessary. Sometimes nothing will happen because either there is not enough wind or sounds activating *La Orejona*, or maybe because the wind and the sounds don't *want* to be heard at that moment. This is why the installation *Membranas* praises the moments of silence as much as the moments of sounds. They are both equally important. This work is not to fulfill the wishes of a human ear that might be accustomed or trained to a *Eurological,* continuously satisfactory musical experience that takes place when the audience is ready for the *show*. In this *Surlogical* exercise, there might not be a *show* for many hours, as we will be submitting ourselves to events and temporalities beyond humancentric notions of control. In every installment, a moment will be given to ask for permission to listen and to ask *La Orejona* to only transmit the sounds we should listen to. The participants will be invited to listen without hunger, and pay attention and reflect on what this means for each of them. I hope for *Membranas* to be a space to practice and to reiterate.

The *ritual* as practice, as intention, as repetition, as a way of placing a marker in time is fundamental to *Membranas*. A ritual is a mechanism to inhabit time. A ritual is a way of putting difference into resonance so it can also be a powerful infrastructure for regenerative social practices. The notion of "ritual" that I am referring to is not necessarily a specific ritual from a specific ceremony with a defined spiritual intention, nor is it part of a particular belief system. Here, I am using the word ritual in a way that expresses an action, particularly the execution of a symbolic act. Philosopher Byung-Chul Han writes, "repetition stabilizes and deepens attention."[182] By stabilizing our attention, it is possible to place our focus without the need of always looking for the next thing in an eternal continuum of forever fading time. The ritual as a way of celebrating a moment and allowing repetition is a way of refusing the yearning for the future that will never arrive or the amnesic time of modernity that keeps us living in a perpetual present. As writer and music critic Mark Fisher[183] states, this situation perpetuates a progressively diminishing ability to imagine an alternative way of being and moving forward. It cancels

[182] Byung-Chul Han, *The Disappearance of Rituals: A Topology of the Present*, trans. Daniel Steuer (Cambridge; Medford: Polity Press, 2020). p. 8.
[183] Mark Fisher, *Capitalist Realism: Is There No Alternative?* (Winchester; Washington: Zero Books, 2009).

the idea of the future. The perpetual present is the temporality of capitalism and commodification of our attention and desires as it relies on the fact that we will always want more. Hence the importance of the ritual and placing markers in time, as a way of inhabiting the moment and not avidly consuming the next second and the next, and the next. Through *Membranas*, I would like to humbly propose a space to collectively inhabit time as we practice social emergence through sounds and vibrations. I hope that by doing this we can find alternative languages that transcend rigid lines.

In the Appendices section at the end of this document I have included two interviews/conversations that continue the discussion on *Surlógicas*. The first one is with José Pérez de Arce and the second one with Claudio Mercado. These were both posted on Infrasonica, Wave 3, Sonic Realisms, 2021.[184]

d. To Conspire Is To

Etymologically, to conspire is to breathe together. In doing so, air is the substance we take in, that air is the same that we share and the same that energizes our words, our singing and our health. While breathing, we inspire. We take the environment into ourselves, and by expiring we give something back in a circular dance. Conspiring has to do with the social components of breathing, which are inseparable from its political, ethical, and cultural dimensions, among others. This reflection conduces us to think about *who/what* are we breathing with? And *who/what* are we breathing in? Both questions have become extremely relevant and delicate in the past few years, which have drastically changed at a planetary level the notion of togetherness and highlighted the importance of not only reflecting *who/what* do we breathe (with/in/to) but most importantly, *where* do we breathe from. Breathing is conditioned on positionality. The *who* in breathing defines the *where* and the *what* is breathed, or allowed to be breathed. As evidenced by the Covid pandemic, the Black Lives Matter movement, and the tear gas flooding sectors of cities—just to give a few examples—breathing defines life from a political, cultural, and ethical stance as it simultaneously articulates an intricate togetherness. Curator and researcher Christine Shaw[185] opened my senses to the concept of *conspiring* when she cited the work of decolonial anthropologist Kirsten Simmons, who writes:

[184] Infrasonica, Wave 3, Sonic Realisms, 2021.
(Accessed: 04-10-2022) https://infrasonica.org/en/sonic-realism-wave-3/editor-s-note-3
[185] Christine Shaw at her lecture “The Work of Wind," in the discursive gathering *Futurity Island: Amphibian Pedagogies and Submerged Perspectives*, MIT Program in Art, Culture, and Technology (ACT), September 07, 2019.

> In a porous relationality—attuning to how others (cannot) breathe, our haptics are enhanced and we develop capacities to feel one another otherwise. [Timothy] Choy reminds us of the Latin root of conspire, as breathing together, declaring: "Breathers of the world, conspire!" We need to conspire to strategize logics of agitation, which displace and unsettle. Doing so calls us not to ignore difference, but to create alter-relations with one another. As Choy underscores elsewhere, "breathing together rarely means breathing the same."[186]

The air we breath and the winds we intersect with present many particularities that define and strengthen the idea of conspiring. The winds we interact with have been shaping geological systems in their localities for thousands of years, and trace turbulent maps on the move that carry information, organisms, and elements that nurture, or may damage, ecological systems. The wind is a planetary entity that weaves on the move, being simultaneously local and nonlocal, distinct and fuzzy. It is socially and politically entangled with its communities and part of the inseparable ethical, affective, political, and cultural dimensions of breathing.

[186] Kirsten Simmons, "Settler Atmospherics," in *Cultural Anthropology*, November 2017. (Accessed: 05-17-2020) https://culanth.org/fieldsights/settler-atmospherics

To conspire is to

To conspire is to plot something

To conspire is to breathe together

To conspire is to inspire each other

To conspire is to sound between things

To conspire is to circulate vital energy

To conspire is to share the air

To conspire is to confabulate

To conspire is to correspond

To conspire is to emerge together

To conspire is to entangle

To conspire is to fuzz

To conspire is to *wit(h)ness*[187]

To conspire is to play *cañitas*[188]

To conspire is to be part of *la flauta colectiva*[189]

To conspire is to fuzz

To conspire is to forget where I end

To conspire is to forget where you start

To conspire is to send words in the wind

---

[187] As defined previously on this document, *wit(h)nessing* is a term proposed by feminist theorist, artist, and psychoanalyst Bracha Ettinger. With this term she refers to the idea that everyone exists already engaged in a cohesive relationship that occurs prior to any independent subjectivity of a Freudian "I." Through Etitinger's revision, the concept of "I," in itself, co-exists already with a negation of itself, a "non-I." These ideas are based on the critical foundation constructed by Luce Irigay's accusation of mainstream, male thought-leaders' phallocentrism, heteronormativity, and reductive perspectives, allowing for a broader understanding of co-emergence.
As I interpret it, *wit(h)nessing* is a term that enacts the idea of *witnessing-with*. To witness refers to bearing testimony, to having knowledge of an event, to having seen something occur. By adding an extra "h," the term is expanded into *with-ness*, something that conveys having experienced *with*, not as a passive, distant observer but as an active participant. I understand this as a radically membranal concept. I first encountered the term *wit(h)nessing* in a conversation with art historian and dear professor Caroline Jones during a public event. When she mentioned this concept to me, it resonated profoundly and lingered in my thoughts for years.
Please refer to: Bracha Ettinger, *The Matrixial Borderspace*. (Minneapolis: University of Minnesota Press, 2006). And: Luce Irigaray, *An Ethics of Sexual Difference* (Ithaca NY: Cornell University Press, 1993).

[188] Pan flutes. In this case, they are made of bamboo tubes. Cañitas is one of the colloquial names used in the South Andean region. It is the name I have always used for these instruments.

[189] Translates to *collective flute*. This concept is proposed and analyzed by Ethnomusicologist José Pérez de Arce. Please refer to the discussion on *Surlógicas* presented previously in this chapter.

To conspire is to confuse

To conspire is to speak to another

To conspire is to sing to the wind

To conspire is to scream

To conspire is to cry

To conspire is to whisper

To conspire is to vibrate

To conspire is to resonate

To conspire is to transduce

To conspire is to breathe each other

To conspire is to be reciprocal

To conspire is to exist

To conspire is to breathe

To conspire is to rot

To conspire is to be continuous

To conspire is to share our viruses

To conspire is to be vulnerable

To conspire is to dilute

To conspire is to reassemble

To conspire is to be porous

To conspire is to interfere

To conspire is to couple

To conspire is to be complementary

To conspire is to intersect each other

To conspire is to fuzz

e. Cuchicheos and Fuzzed Signals

The history of microphony is one of filtering. In order to obtain a clear signal, something has to be predetermined as a signal and the rest as noise. The section of sound that is labeled as noise is the one that has to be filtered out. Usually, noise is assumed to be undesirable signals coming from sounds and voices that are not of importance, such as nonhuman entities like wind. Wind in modern microphony has consistently been labeled as unwanted noise. Wind has been an enemy, an undesirable precedent that fuzzes the clarity of the desired signal—oftentimes, a human voice. But what about the voices that don't want to be heard? What about those that find themselves at peace within the undesirable? What about the voices that want to be noise and not be contained, categorized, analyzed, and (mis)used? Consider the possibility that a voice that does not want to be captured is often misused. What is considered a "signal" is something that is labeled as desirable and capturable. The signal is traditionally the focus. But what if the focus is to merge into collectivity? To consider it ceasing to be a *signal* and becoming part of what is considered *noise*. This question harnessed my attention towards wind not only as an invisible membranal entity, vital shared energy, and the activator and sound of a flute, but also as a source of heavy noise within modern acoustic technology. I realized that the wind—as noise—enables enormous empowering freedom because it can be a place of inseparable, indiscernible, and uncontainable collectivity. *La Orejona* operates with the purpose of merging individual *signals* into collectivity within the *noise*. It is a vibrational microphone that works as a microphone of noise. It is not vigilant for clear signals. It is ready to be affected by collective vibrations that it diffuses as a sonorous mass of variable noise. *La Orejona* weaves different signals into vibrational and resonant entanglements, provoking us to consider that when we become noise, our signals are fuzzed.

The above-mentioned ideas on noise are the basis of the ethical framework that I aim to construct. This framework is in negotiation with technologies for listening and surveillance, the history of microphony, and the risks of immaterial extraction. I would like to critically face these topics and situate the work that I am doing within this context. By doing so, I would like to propose a practice centered on the poetics of unintelligibility as a way of disrupting—or fuzzing—apparatuses that perpetuate extreme individuality and control. To do so, I created *La Orejona*. This vibrational membrane microphone responds to sounds and vibrational activity that are only in its immediate vicinity. The sounds are not being recorded and it is not intended to be a precise measurement device. On the contrary, it is a device for confusing signals, for fuzzing, for mixing up, for obscuring, for noising. I firmly believe that some things are meant to remain uncontained and I humbly try to approach this work with such respect. This piece is about listening, but not in a way that contains sounds. Instead, it favors a way of noticing and attending to phenomena as an entity to be acknowledged as an *other* to be respectfully listened to. For this occasion, the mechanism I

chose to activate this moment of careful attention is within a geometry of emergent *Surlogical* call and response. But many other ways may creatively stimulate imagination and critically contribute to these questions.

The rest of this section is not written in text but orally narrated. These sounds are registered by *La Orejona.*[190] Please listen to the sounds on the following QR code to experience what I mean when I describe the way that *La Orejona* weaves signals into a collective unintelligible and inseparable noise.[191] For this experiment, I did a reading of the text "To conspire is to," which can be found in the previous section, on pages 121 and 122 of this document. I read the text while facing *La Orejona* at a distance of 30 cm and speaking very strongly/shouting.

Figure 43 *QR code for audio Cuchicheos and Fuzzed Signals. 4'01". A reading of the text "To conspire is to." The file can also be accessed at this link: http://nicolelhuillier.com/cuchicheos-and-blurred-signals/ (Accessed: 04-13-2022*)

[190] These sounds were recorded exclusively for the purpose of this exercise. *La Orejona*'s quotidian behavior does not contemplate the storing and sorting of recorded sounds.
[191] The sounds are purposely not intelligible as this serves as a performative demonstration of the politics of listening though such a device. Through this sound I aim to communicate relevant information that will not be clear, as providing a fuzzy message is the clearest example of the intention behind the theoretical framework of *La Membrana*, the project *Membranas*, and all the ideas presented in this dissertation.

Song 4: Sistemas

Figure 44 *QR code for audio Song 4: Sistemas. 0'56". I recommend listening with headphones. The file can also be accessible at this link: http://nicolelhuillier.com/song-4/ (Accessed: 04-13-2022)*

In this chapter I will guide you through the elements that compose the installation *Membranas*, and how they constitute an interdependent arrangement. *Membranas* is an open system that networks its different parts into dynamic reconfigurations of social relations through listening and sounding operations. This system is composed of an indoor structure/machine, an outdoor microphone, humans, and winds. The indoor structure is the nuclear point of the system, as it is the place where all the networked elements are articulated into a sonic encounter and musical improvisation.

I will refer to *Membranas* as the installation, the machine, and the system. This refers to the ensemble created by the tensegrity structure, its organs, its brain and heart, and *La Orejona*, the vibrational membrane microphone.

Membranas is an open-system performative apparatus that continuously interacts with its environment through its membranes. It creates an experience modulated by external inputs that are dynamically and extemporaneously registered to trigger actions within a synergic sonic environment. Informed by second-order cybernetics, it considers every observer and allows them to become part of the phenomena by interacting with the membranes. Because of its resonant membranal constitution, it does not draw a rigid boundary between what is inside the system and what is outside. *Membranas* fuzzes separations as it amalgamates different types of agents into a sonic emergent environment that invites participants to engage in a sonic dialogue.

As Chilean biologists Francisco Varela and Humberto Maturana have said, dialogue involves a change in perspective; it is a way of unfolding-with others.[192] They propose that it is possible to think about a collaborative and collective society through processes of affective conversation; I think that music is a place for affective conversation. Music can be an embodied enactive language and as such, it enables socialization and ways of organization as it unfolds a myriad of other material, cognitive, and affective processes.

To continue this thread and the consolidation of this *sistema*'s framework, it is important to dip into autopoiesis.[193] An autopoietic system consists of different parts that are networked in a way that the system is simultaneously: a self-contained structure, different from its environment, and in an interdependent relation with its environment. Autopoietic systems are dynamic as they negotiate their organization in a continuous and fluid exchange with their environment. This type of system enables its parts to expand their initial possibilities into an emergent collective synergic potential. In a poetic iteration and as a performative language appropriation, feminist scholar Donna Haraway proposes to use sympoiesis[194] instead of autopoiesis. She proposes an end to thinking about a system that has the capacity of making itself as it relates to others. As she replaces *auto-* with *sym-*, she provokes enaction from an essential place of making-with.

In the system presented by *Membranas*, the indoor structure is an agent of mediation as well as an active participant in the experience. It is simultaneously the container/space of the installation and a relational body/content of the experience. The way it works is as follows: the structure diffuses sounds coming from the outdoor vibrational membrane microphone, *La Orejona*. In return, these diffused sounds activate the structure, as it also responds to them. Human participants are invited to be part of the loop by audibly responding to the outdoor sounds and the sounds from the machine. As the human participants respond and engage in this sonic exchange with the structure, the structure listens and responds. The structure is the focal point of the interaction and the articulator of the experience throughout the continuous sonic exchanges that build a chain of calls and responses.

---

[192] Maturana, Humberto R., et al. *Autopoiesis and Cognition: The Realization of the Living*. Reidel, 1980.
[193] In 1980, Maturana and Varela proposed the concept of an autopoietic system to describe a network of interrelated, component-producing processes, wherein the components in interaction generate the same network that produced them.
[194] "Sympoiesis is a simple word; it means 'making-with.' Nothing makes itself; nothing is really autopoietic or self-organizing." Donna J. Haraway, "Sympoiesis: Symbiogenesis and the Lively Arts of Staying with the Trouble," in *Staying with the Trouble, Making Kin in the Chthulucene* (Durham; London: Duke University Press, 2016) p. 58.

In order for these operations to take place, several processes are put into action. *Membranas* is intended to be a system that puts things in relation, and as it does that, also continues to be a key agent in the relationship. The machine I made to operate this installation is open to chance, so it can yield ambiguous behaviors. It senses its environment, erratically makes sounds in ambiguous ways, and relates to surrounding agents, because they are part of its environment. This is an embodied machine. It is present in the room and is site-specific because it is defined by its locality. *Membranas* unfolds in the space it occupies and becomes a space in itself.

Membranas has one dislocated element: *La Orejona*. This element is a large, bright pink membrane that cannot go unnoticed. It has no intention of disappearing or secretly surveilling its surroundings. In contrast to modern microphone design, *La Orejona* is very present, evident, and designed to be transparent about the way it works. It is not a small, hidden device inside a tiny box you cannot see or touch. *La Orejona* reveals its components and connections. It is there to be touched and explored in physically resonant ways.

I would like to end by making a clarification about the human entities who engage with this system. In this chapter, I describe processes that involve the "audience"; however, I have chosen to refer to these audience members as "participants," with a clear intention of breaking with the passive connotation that has been culturally associated with the term audience. I believe that it is central to understand all of the visitors as actively engaging agents who modulate the work with their very presence.

This chapter was written with the invaluable input and help of Devin Murphy and Jessie Mindell, undergraduate researchers whom I have had the pleasure to work with for the implementation and consolidation of this work. Both of their contributions have been precious, and working with them was a great experience. We all listened and learned from each other while having fun exploring ideas, solving problems, overcoming technical challenges, and engaging in stimulating dialogues. It was an honor for me to encounter both of their amazing minds, but most importantly to have encountered them as kind and caring friends. Jessie worked with me in the summer of 2021, during her MIT Summer Research Program (MSRP) Internship at the MIT Media Lab, in the Opera of the Future group. Devin started his UROP[195] also at the beginning of the summer 2021 and he is still working with me as I finalize this thesis.

[195] The Undergraduate Research Opportunity Program (UROP) is an amazing program that enables undergraduate students at MIT to work as researchers in different laboratories across the Institute.

Figure 45 *Membranas systema(s). Nicole L'Huillier, 2022.*

a. A System To Fuzz

Throughout this section, I describe in detail the different elements that were implemented to give shape to *Membranas*. All of these elements come together to provide an experience based on resonating, by listening to the sounds of the wind, the machine, and each other, as well as by touching vibrations, projecting one's voice, and blowing air into cañitas.[196]

i. *La Orejona*: Vibrational Membrane Microphone

Here I will walk you through the journey of making *La Orejona*, my vibrational membrane microphone. This is a bright pink, 4.5 mm thick, silicone membrane with a diameter of 110 cm. Its purpose is to listen and transmit sounds to the indoors installation, as well as to serve as a focal point for sonic encounters outdoors. After many experiments and iterations, this membrane evolved into a touchy, rubbery, oscillatory listening apparatus that was centered in fuzzing signals into variable and expressive noise. In this section I will unfold in detail the multiple processes, challenges, and learnings that took place during the experimentation, design, and fabrication of this vibrational sensor.

Figure 46 *La Orejona, 2022. Photo: Jimmy Day.*

As I was diving deep into the world of resonant membranes I got interested in the physics behind circular membranes, particularly in their vibrational modes as well as the acoustic and transductive processes they embody. Circular membranes such as drumheads, and the eardrum, consist of two dimensional elastic sheets that curve in quantum differentials in their Z axis. In addition to the dynamics present in the

[196] Pan flutes. In this case, they are made of bamboo tubes. Cañitas is one of the colloquial names used in the South Andean region. It is the name I have always used for these instruments.

vibrational modes of circular membranes, I also got interested in the mechanisms of the eardrum, or tympanic membrane. All these transductive and resonant operations were in my mind as I began experimenting with different materials and membranal structures.

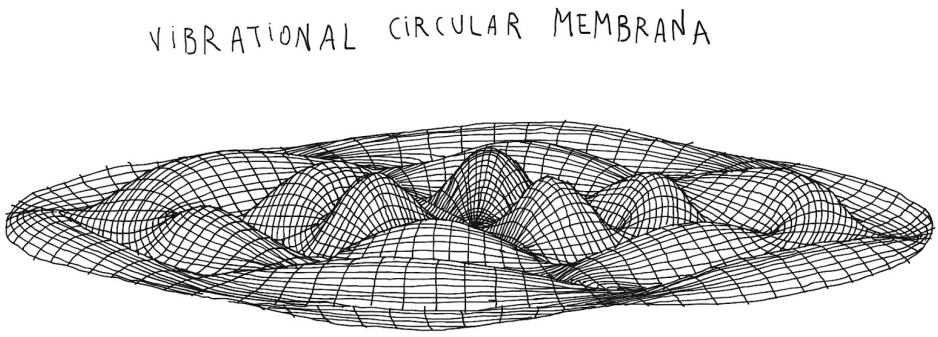

Figure 47 *Vibrational Circular Membrana. Nicole L'Huillier, 2022.*

As I explored different types of membranal films and materials, I was enchanted by the rubbery and elastic possibilities offered by latex[197] and silicone. So I started constructing membranes out of these materials and then proceeded to embed sensors and electronic components into them. They became microphones to listen to vibrations. Throughout this process, I carried out several explorations and experiments to unveil the potentials of elastic-membrane-based mics. Rather than focusing on creating a high-fidelity device to record clear signals in environmental sounds, I focused on creating something that provides other resonant opportunities within hazy and indistinctly enmeshed sounds. The microphone I ended up making came to be a noise microphone. This is a device to listen to vibrations that excite its membrane, airwaves and sound waves traveling in the air, or other vibrational activations coming from touch and tremors. The sounds from these membranes are transmitted to the indoor structure and diffused throughout two different audio outputs: two 12" subwoofers (lower frequencies) and a 3" tweeter speaker (complete frequency spectrum).

[197]Also known as natural rubber or caucho, this is a natural substance that comes from trees, plants, and some mushrooms, and has been the base material for *membranal* elements since ancient times.

Figure 48 *Material tests and early membrane porotypes.*

This vibrational membrane microphone behaves in similar ways to vibrational sensors such as drumheads and tympanic membranes. I called it *La Orejona*, the big-eared one, and made it very big and very present, due to the final design and choice of color. I chose to make it large and visible because I did not want it to disappear and become a *silent* and *invisible* surveillance device. By making it evident, I intended to make its functions transparent. I want *La Orejona* to be a respectful and engaging extended ear.

• Experiments In Vibrational Microphony

A central question to this work and one we asked frequently as a team was: *how can we listen to the wind?* We explored many approaches to listening to the wind, in analog, acoustic, and embodied ways. We found this elusive body sounding on surfaces and making other bodies resonate. We came to understand that the sound of the wind is not the wind only; its sound is intrinsically relational. It belongs to all of the bodies, not to only one in isolation. The sound of the wind is an *intra-active*[198] event. In our quest to listen to the wind, we set out to explore these encounters, which led us to reflect on topics such as distance, transmission, disembodied signals, and wind microphones. An online search for wind microphones returns hundreds of results for microphones that consider wind as *noise* and therefore are designed to filter it out. Because most of the microphones on the market are specifically designed to get rid of the very thing we were trying to listen to, we embarked on the creation of our own apparatuses.

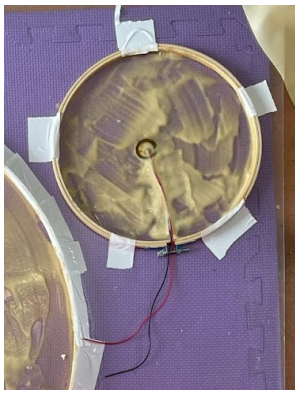

Figure 49 *Early prototype, natural rubber membrane with a piezoelectric sensor.*

I started by attaching contact microphones made of piezoelectric sensors to the leaves of a tree to listen to the whistles of wind passing by. In this case, the leaf was a membrane that, when in contact with the wind, revealed its presence. Out of this experience, as a preliminary test, I created a latex membrane with contact microphones embedded in it. My rubbery membrane, too, became a very sensitive element that amplified every vibration in touch with its skin. It fluidly became an extension of the piezo, so the whole

[198] This is a term proposed by Karen Barad. What Barad calls *intra-action* refers to the manifestation of agency that does not belong to one specific entity, but that emerges in a dynamic symbiotic relation with others. With the term intra-action, Barad proposes an "ethico-onto-epistem-ology" that is a co-constitutive alternative to *interaction*, a term that presumes that the interacting parts have pre-existent individual agencies that are detached from one another. Please refer to: Karen Barad, "Posthuman Performativity, Toward an Understanding of How Matter Comes to Matter," in *Signs*, Vol. 28, No. 3. (Chicago: University of Chicago Press, 2003).

membrane was a contact mic; a contact membrane. I then took the membrane outside and tested it by listening and recording audio. In a journal, I marked down the moments in time where there was perceivable wind blowing. Afterward, we loaded the audio into python to do some preliminary analysis of the recorded signal and found that the wind generally seemed to be characterized by the continuous yet variable low amplitude, low-frequency sound that we can identify in the following time-domain waveform and spectrogram.

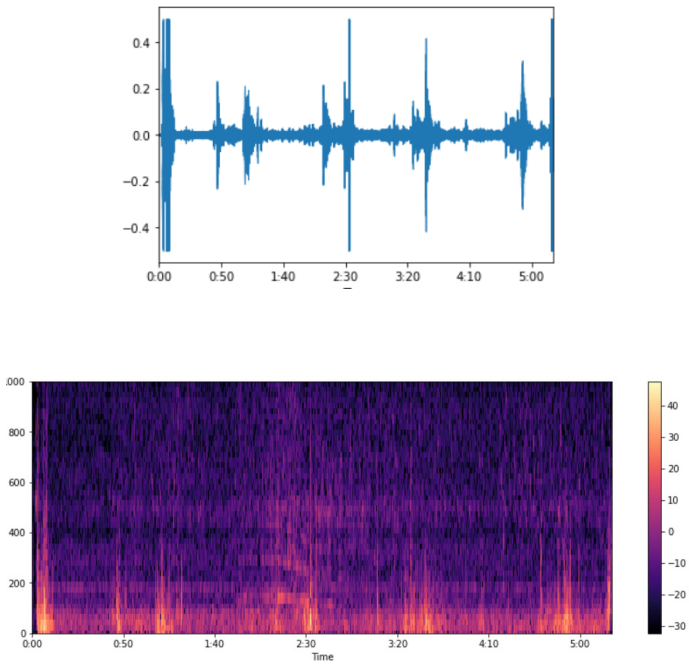

Figure 50 *(Up) Time-domain waveform. (Bottom) Spectrogram.*

The sound produced in the moments the wind encountered the membrane was interesting and clear. However, we noticed that the membrane's acoustic scope was too large since it would also clearly pick up distant voices, planes, lawnmowers, cars, and other sounds that an ordinary microphone would also register. In these tests, we were focused on only picking up wind activity, as the membrane's objective was to amplify this in an interesting way that would differ from other microphones. Having the full spectrum of *familiar* environmental sounds plus the wind was definitely a step in the right direction, but didn't feel compelling enough, as the wind appeared as an extra layer but not as a focal element.

In order to delve deeper into the wind's sound without all of the other layers of environmental acoustic activity, an obvious operation would have been to filter the signal. But we didn't want to implement a computer-based filtering process to separate the wind from the rest of the sounds, because that would have created the opposite problem from the one we were trying to distance ourselves from in the first place. Applying algorithmic filters to isolate signals is not very *membranal*. So we decided to continue our experiments by exploring ways in which the membrane could be in itself the microphone and the filter. We started researching other methods and registers of listening and asking what other types of sensors we could use to encounter the wind's sound. We immediately thought about the possibility of using other vibration-sensing transducers that are not directly acoustic but that could provide vibrational readings of direct motions and oscillations in the membrane, such as accelerometers[199].

Figure 51 *Eight-channel natural rubber pigmented membrane with piezoelectric sensors.*

After doing some research, we came across examples of using accelerometers to listen to vibrational activity when in contact with material bodies, such as using accelerometer-based pickups to amplify acoustic guitars and even to listen to the sounds of insects when they come in contact with leaves. We encountered a research paper[200] by a team from Analog Devices (O'Reilly et al., 2009) that presents an experiment for making a guitar pickup with MEMS (microelectromechanical systems) accelerometers. Although their methodology for converting accelerometer data into audio data was somewhat unclear, the paper had interesting results and showed that the frequency response of the accelerometer was very similar to that of a MEMS contact microphone and also to that of the pickup that originally came with the

[199] An accelerometer is a sensor that measures the acceleration of a body's movement and its vibrations.
[200] Rob Oreilly, et al. "Sonic nirvana: Using mems accelerometers as acoustic pickups in musical instruments," in *Analog Dialogue*, vol. 43, no. 02, 2009.

guitar. A quote from this paper motivated our interest in exploring these ideas further—"Our ears respond to sound pressure, so microphones are designed to sense sound pressure. To simplify matters greatly, the sound pressure in the immediate vicinity of a vibrating body is proportional to acceleration."[201] With this in mind, we explored what would happen if we attached an accelerometer to something and tried to listen to it.

To do so, we wired a MPU6050 accelerometer to an Arduino. The first test was done by taping this accelerometer to Devin's violin so we could use it as a resonating body with a clear and known frequency response. As a preliminary test, the sensor values were printed in the serial monitor in order to observe them by using the serial plotter tool. Then, Devin proceeded to play the violin. When he bowed the G string, it was possible to see this:

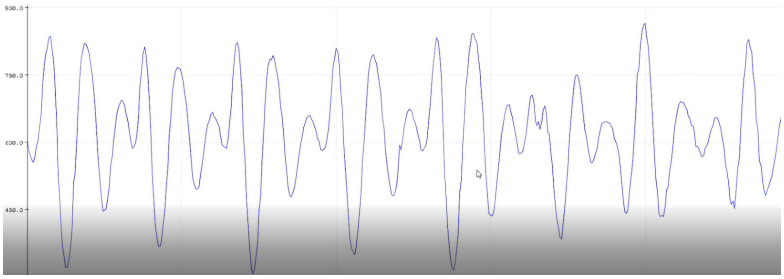

Figure 52 *Waveform.*

With its periodic qualities, we were hopeful that the accelerometer would be able to capture some sounds. In order to convert this vibrational data into sound, we used the following protocol:

1. Collect accelerometer data over one of the computer's serial ports using Arduino, and time the data collection to get an estimate of the sampling rate. We saved the accelerometer data in a csv file[202], organizing the data into three different columns corresponding to the X, Y, and Z axes of the accelerometer.

[201] *Ibid.*, p. 1.
[202] A csv file, or comma separated variable file, is commonly used for saving data. It provides a simple and organized way of storing data, since the data entries are saved in an intuitive row/column format.

2. Using the csv reader from the csv python module, the accelerometer data was loaded into a numpy array[203] in python. Then we proceeded to scale and cast the data into the int16 data type, which is the data type required for the python package we used to write numeric data to audio data.

3. Use the python package scipy.io.wavfile to write the numpy array to a wav file.

Figure 53 *Latex/natural rubber experiments. Membrane with accelerometer MPU6050.*

With this protocol set, we did a variety of sound tests with the accelerometer by attaching it to different types of membranes. We tapped it, sang to it, talked to it, yelled at it. We found that we were in fact able to recreate the sounds of the world using this accelerometer. And beyond the ability to play back these sounds, we liked how our custom-made accelerometer microphone had the quality of decentralizing certain human aspects of the sound. For example, spoken words became unintelligible in their meaning, but present in their acoustic essence. This is partly due to the accelerometer's sampling rate, which is around 1000 Hz, much less than that of a traditional microphone. This operation was like eavesdropping on how the accelerometer (and the vibrating bodies attached to it) perceived the sound we were making. It was very interesting that the listening experience became centered on whatever the accelerometer was attached to, due to this element's resonant and vibrational characteristics. This was a moment of revelation that traced the course of the project and reorganized our objectives and intentions. Now the focus was not exclusively centered on listening to the wind and its influence on a vibrating membrane, but

[203] Numpy is a python package that is meant to facilitate data processing. While similar to the python list, numpy arrays were better for our purposes because they allow for operations on a whole set of values.

as we accomplish that task, the apparatus we were working with brought to our attention a deeper idea: the vibrational membrane microphone is not a device to target a specific signal, but one to fuzz many signals into collectivity; into variably expressive and inseparably convoluted noise.

• Realtime-*ish* Wireless Communication

A key feature of the system is the wireless communication between the outdoor membrane and the indoor structure. In the pipeline, we have a microcontroller (Wemos D1 Arduino-based board with an onboard ESP8266 Wi-Fi module) that connects directly to a personal wireless network, *Membranas-Wi-Fi* and establishes a client. This client connects to a local server established by a python script of the Mac mini computer running our system. The microcontroller then collects about 800 accelerometer samples and sends them using the TCP protocol. When the computer receives the data, the python script adds it to an array, in a way similar to the previously described initial experiments with the serial protocol over USB. When the array is filled with about 30 seconds worth of accelerometer data, the python script creates and saves a wav file from the data in the manner described in the previous section. As they are ready, these wav files are sent to Max MSP through our routing system, the *Modular Playground*. From Max, the sound is routed to Ableton Live, where they are directed to their specific channel to be outputted in the installation.

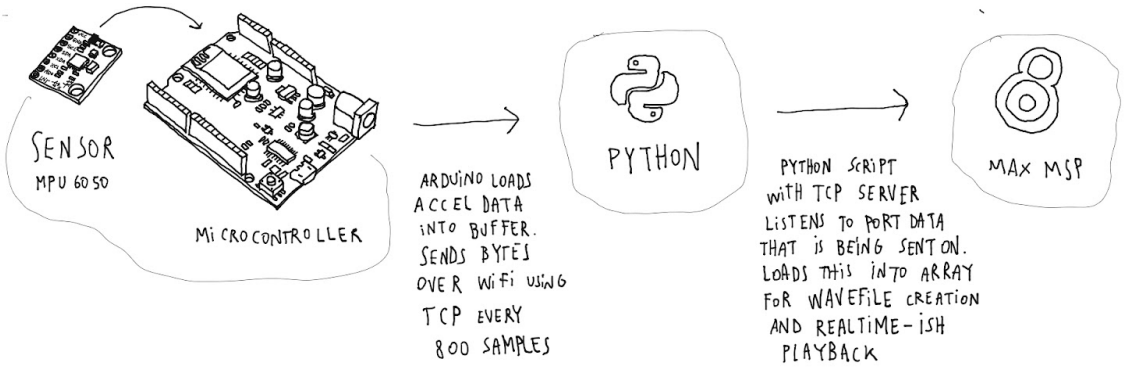

Figure 54 *Sensor to sound pipeline. Nicole L'Huillier. Based on Devin Murphy's diagram.*

With the TCP protocol, we are getting as many as 1000 samples a second, and the latency between the creation of sound and when we hear it in the system is about 30 seconds. This protocol allows for all the

packets to arrive in order. Dropped packets will be continuously resubmitted by the Arduino. Even though the 30-second latency prevents the system from running in real-time, this was not a major concern. The delay is not long enough to prevent the experience from happening in a continuous and fluid way. Also, since the Vibrational Membrane Microphone is meant to be outdoors in a different space than the rest of the installation, the distance already provides an ambiguous reception where there is no rigid exactitude that strictly ties the sonic and vibrational phenomena to a precisely known, or fixed, space and time.

We also implemented a fail-proof system with both the client and server looking to reestablish connections whenever these may be dropped. Also, the Max Patch makes use of interpolation to play mixes of previous membrane sounds whenever there's a stall in the accelerometer data. Finally, we established an automatic restart protocol for the Arduino so that when the accelerometer data looks messy, we can get a fresh start and reset the accelerometer registers. The protocol for a reset is:

1. If the number of bytes of data received from the accelerometer is not 2, or the transmission between the accelerometer and the Arduino was otherwise unsuccessful, the microcontroller is restarted.

2. Upon restart of the microcontroller, set the power management register of the accelerometer to 1 and then 0 in order to turn the accelerometer off and then on again. This was needed since restarting the microcontroller does not do this automatically.

3. Reset the signal paths to the accelerometer registers by setting the signal path register to 1.

• Flexible Sensor and Elastic Membrane

The initial experiments were done with an MPU6050 accelerometer. We then tested a few other types but ended up coming back to the MPU6050 accelerometer since it yielded the most interesting results. Once we were set on the sensor, we made the membranes. The first ones were made by embedding the sensor when pouring the silicone inside a circular wooden frame. Once the silicone is cured, the sensor stays in place and vibrates as the silicone membrane receives vibrations. After running a few tests we realized that the silicone was being damaged from the inside by the rigid board of the sensor. This made us focus on the way the sensor was affecting the vibrations of the silicone, and realize that we needed to create something softer that wouldn't produce unwanted and damaging tensions in the membrane. Both the sensor board and the connection wires we were using were causing this kind of damage.

The next step was to design a soft sensor to embed in the silicone, with the intention of creating something that wouldn't produce resistance, but would instead merge as smoothly as possible with the rest of the membrane. I also managed to find a soft silicone-covered copper wire to make the connections, which was more malleable than the previous material.

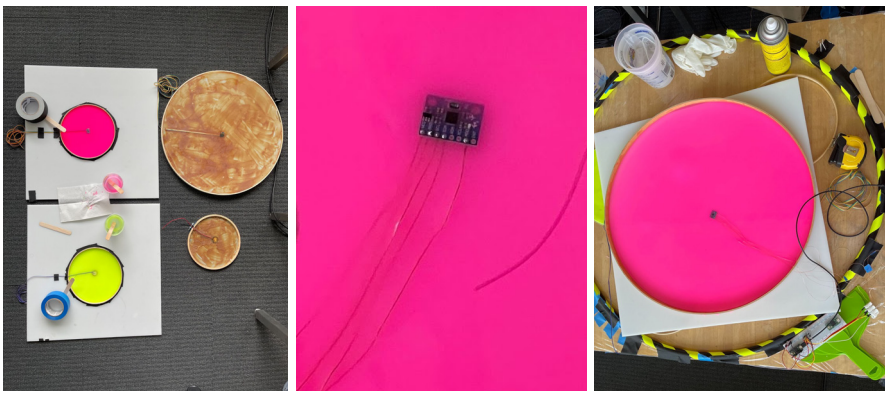

Figure 55 *Material tests and membrane porotypes with pigmented silicone and accelerometer MPU6050.*

The design and creation of the soft sensor was a whole process in itself. I started by trying to build a very precarious system of floating electronic components modules that were interconnected by loose wires. My plan was to do something with the least amount of surface possible, but this sensor did not work well, and instead of creating the flexible mesh I initially imagined, the large number of wires provided an abundance of resistance and possible tension points. I then decided to make my own sensor with a flex PCB material. I made a design based on the MPU6050 accelerometer that we were using and manually etched it into the PCB. After a few iterations, I found a design that worked properly. Now the only problem was that I couldn't find the main component for the MPU6050 sensor in a bigger package. The unit is very small and I had trouble soldering it manually. I tried to do it with more sophisticated fabrication techniques, such as using a reflow soldering convection oven for SMD components, but since my PCB was handmade, it was hard to place the part and the soldering pins in the millimetric footprint. Had this been an industrial process it would have been easier, since I would have countered with a silkscreen mold to position the parts. I sent the final design to be fabricated by a PCB prototyping company that makes custom flex PCBs. For this iteration, I created a hybrid design that allows me to combine flex PCB copper connections with silicone-covered wire extensions, which allowed me to create a mesh of cables that oscillated with the membrane and extended the sensor outside of the central module

so it appropriates the surface of the whole membrane. Once the flex PCB arrived, I managed to solder the tiny MPU6050 module with a very thin soldering iron tip, a magnifying lens, and a lot of patience. This design worked perfectly and is the one implemented in *La Orejona*.

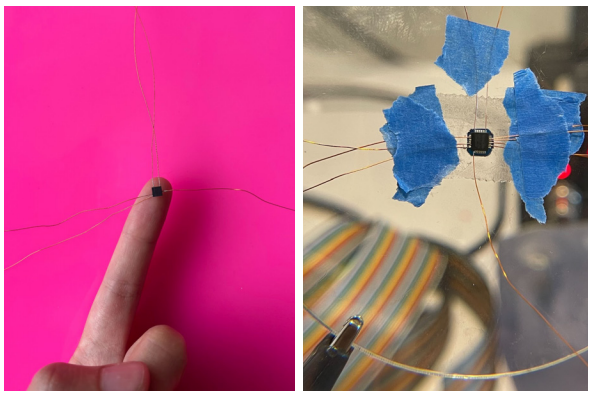

Figure 56 *Accelerometer MPU6050 module soldered with copper wire paths.*

The whole process was an incredible learning experience, as I had never made my own sensor before. Additionally, the iteration process was complicated and ambiguous, since it was not always clear what was not working, so it was hard to identify what needed to be fixed. Sometimes it was the thickness of the membrane, other times the connections on the PCB, other times the length of the cable extensions, and so on. To this day the only limitation that remains is that the cables are soft and flexible but not very resistant to the cold. As a result, the sensor has never worked outdoors under a temperature of 5 degrees Celsius. This is not a winter membrane. Once I had a nicely working membrane I was able to install it in the structure frame that I had made in parallel to the soft sensor process.

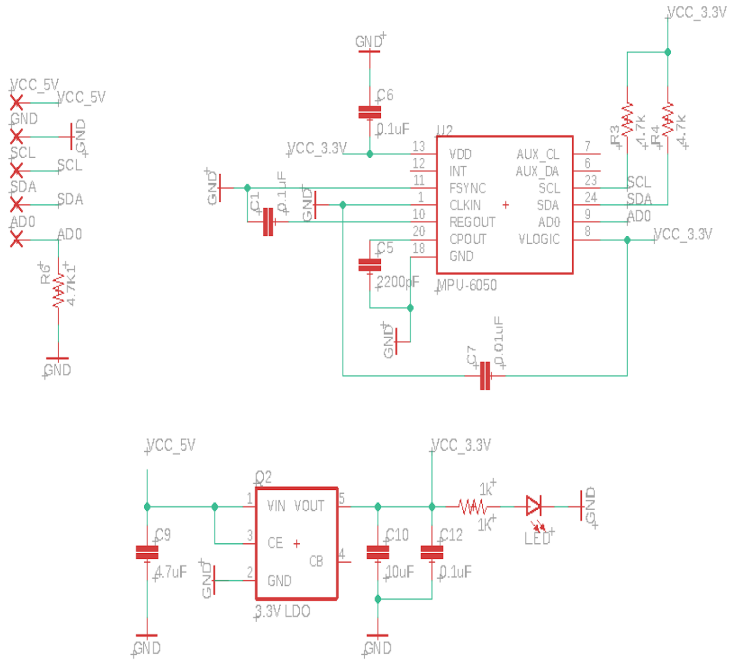

Figure 57 *Fabrication schematic for my MPU6050 accelerometer sensor.*

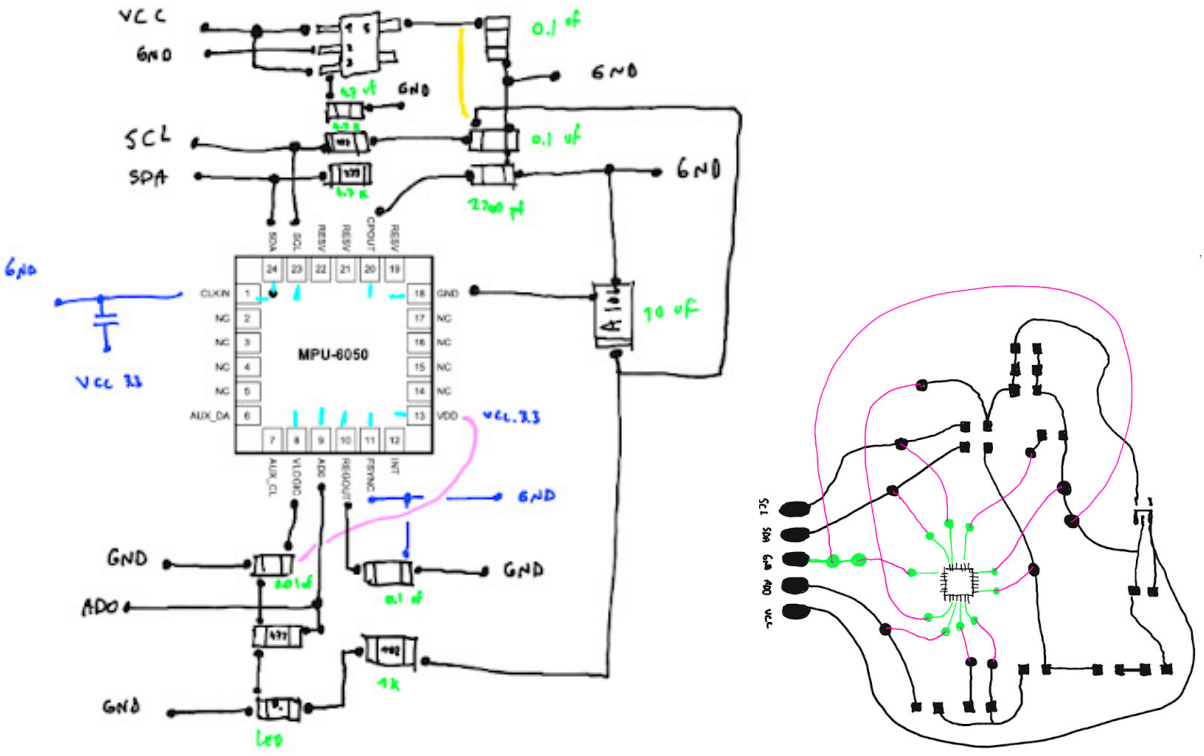

Figure 58 *(Left) Sensor connections drawing. (Right) Design and schematic paths for flexible printed circuit board.*

Figure 59 *Soft sensor process. From initial tests and designs to the final flexible printed circuit board (PCB).*

• Design and Fabrication

After testing small membranes, I worked on a design to scale up the membrane and provide a solid structure to hold it and protect it in the long term. The initial tests were done with wooden rings, first 8" and then 18". The scale and thickness of these membranes allowed them to be cast directly in the wooden ring. However, this was a short-term solution for prototyping and running tests, since the membrane would loosen up and unmold upon the application of slight pressure to the points of contact between the membrane and the frame. I did the calculations and realized that in order to make a larger-scale membrane, it would not only need to be bigger in terms of surface area but also thicker so it would keep its shape and material integrity, which meant that it was also going to be heavier.

This traced the first guidelines for the design process: the frame needed to be robust enough to keep a relatively heavy membrane in place, and well-protected so it wouldn't receive any external tensions that might stress the material into breaking or tearing. Another important consideration for the design was that this frame was going to hold a large membrane that would be putting up resistance to winds. So the frame had to be solid, heavy, and stable, while also providing the flexibility to move easily.

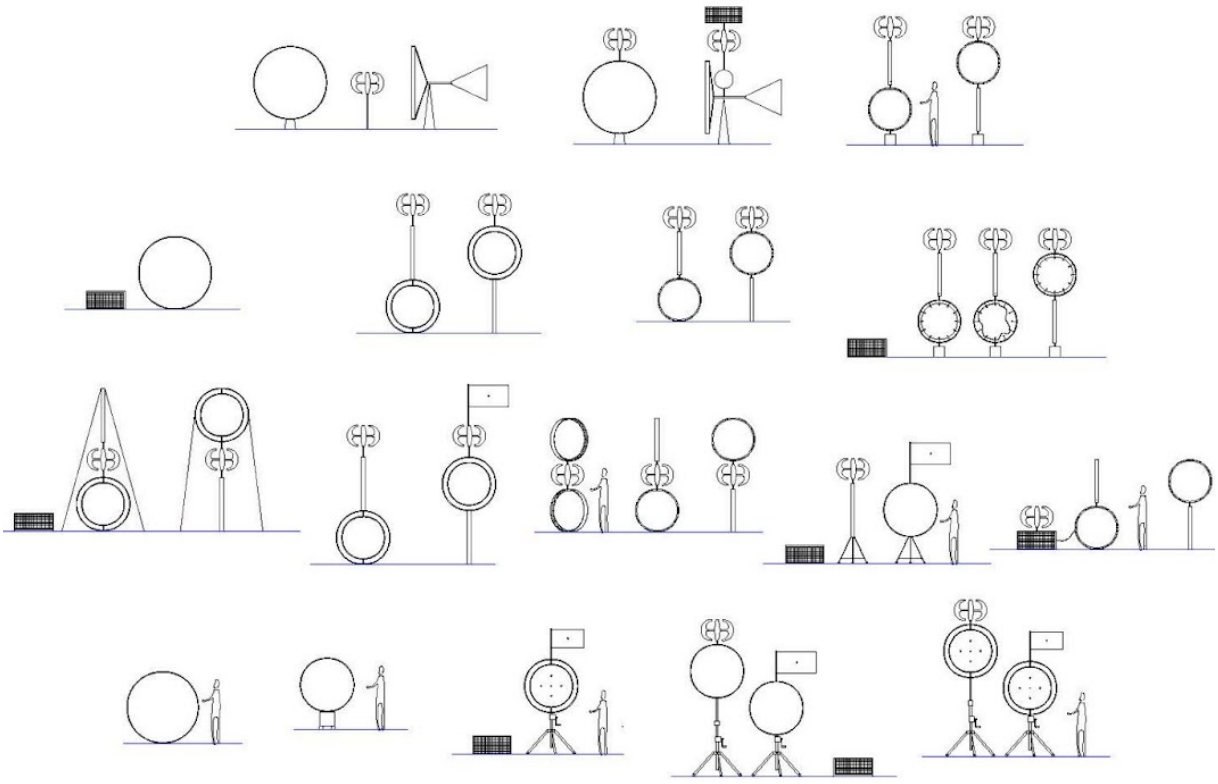

Figure 60 *Design process and plans iterations.*

Figure 61 *Final result. Photo: Devin Murphy.*

After many design iterations, budgeting, and planning, I designed a circular wooden frame that opens into two halves and can be mounted onto a heavy-duty speaker stand. One-half of the frame has a 1” dent to place the membrane and pass screws through it to secure it. Both halves of the frame can be secured with screws. The frame has a diameter of 110 cm and it can hold a membrane of 102 cm in diameter. Initially, the membrane was envisioned to be even larger, but I had to constrain its dimension to the available material dimensions as well as to the capacity of the CNC router, so I could fabricate it myself at the Media Lab facilities. When mounted in the stand, the frame is 240 cm tall, although this dimension is variable since the stand has a lever and can be expanded for a full extra meter. This mechanism is set so the stand provides flexibility in terms of defining the height of the membrane in relation to the presence and strength of the wind. To make the frame outdoors-resistant, I made it out of marine-grade plywood and used sealant and outdoor paint. The frame is installed in the stand with two heavy-duty mast mount clamps.

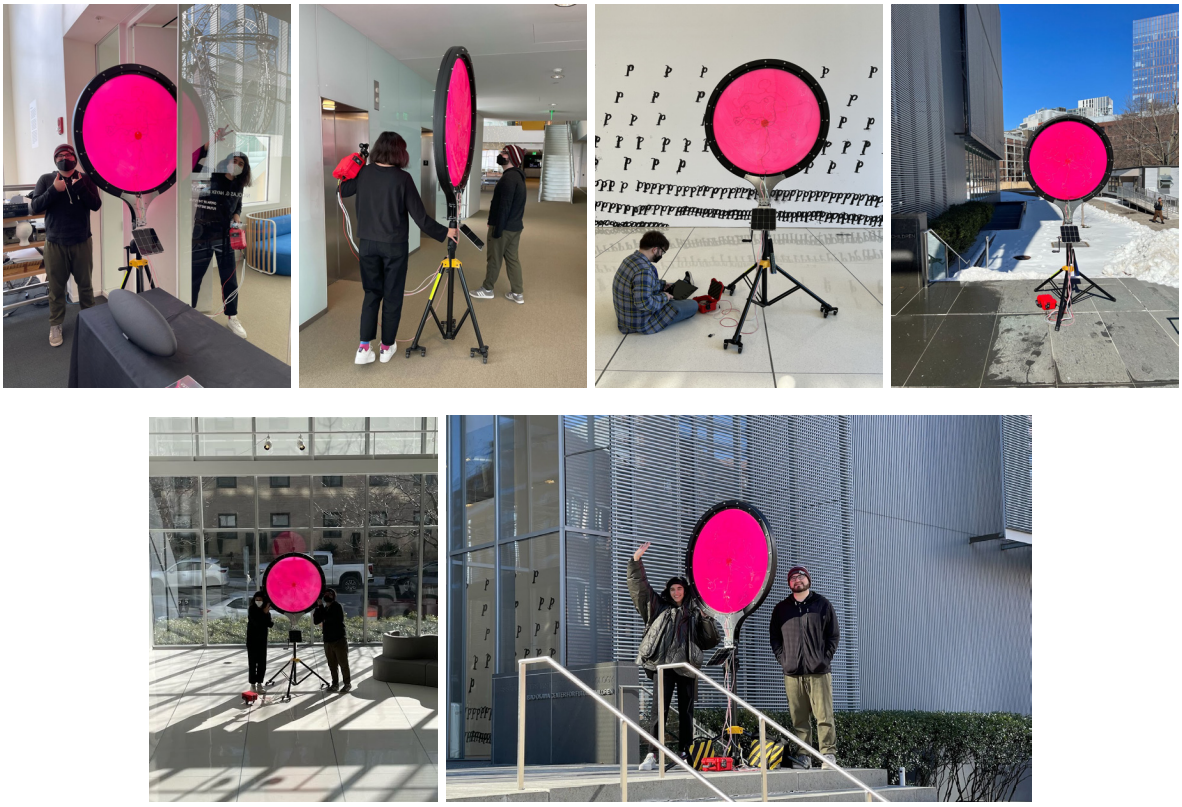

Figure 62 *Taking La Orejona for a walk, calibrations, and testing with Devin. Photos: Juan Necochea.*

There is also a solar panel installed in the stand that is connected to the microcontroller's battery, which is stored inside a waterproof case placed on the floor right next to the stand. All of the connection cables from the membrane to the microcontroller are protected with a cable sleeve and conducted from the bottom of the frame into the waterproof case to connect to the microcontroller.

I did all of the woodwork, which consisted of cutting the sheets; cutting the frame with the CNC router; sanding and finishing the details, such as rounding the edges, covering holes and imperfections with wood filler, sanding again, gluing the parts together, applying primer and paint; and finally installing the membrane and attaching the frame to the stand. In parallel, I made an aluminum mending brace and a wooden mold for casting the silicone membrane. This mold consisted of a simple 102 cm diameter circle and an array of vertical wooden dowels, so the membrane has holes to subsequently pass the screws through in the frame.

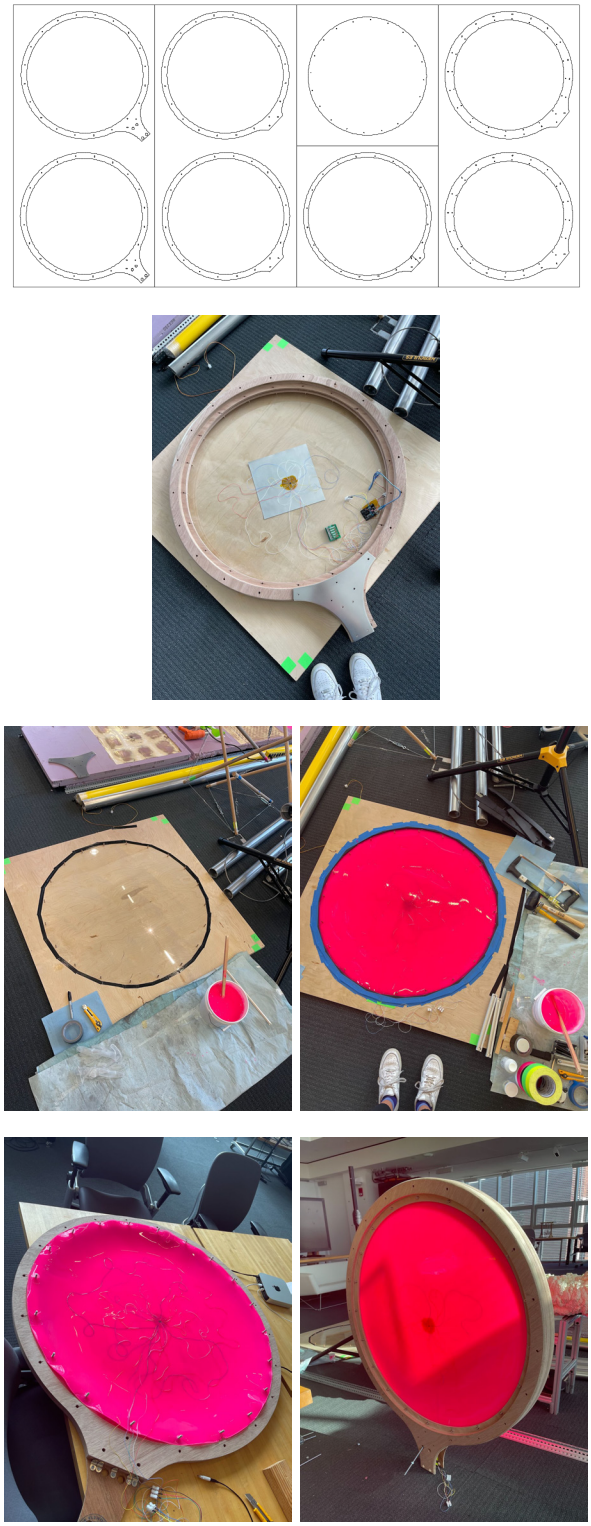

Figure 63 *Wooden sheets for cutting, finished wooden frame, membrane casting, and membrane installation in frame. Photos: Nicole L'Huillier.*

Figure 64 *La Orejona <3. Text: Nicole L'Huillier. Photo: Jimmy Day, MI Media Lab.*

ii. Structure

• A Membranal Structure

The structure is the focal point of the indoors installation. It contains different organs that produce sounds and vibrations, communicate through text, sense their environment, and provide instruments for interaction. It provides support to the many elements of the installation as it simultaneously composes a space that contains the experience and is an active agent of the experience. As a good performative apparatus, this structure is a membrane that mediates relations in a porous way, as it is always ready to embody oscillations and elastic exchanges. Forces bounce back and forth from one place to the other in a continuous nonlinear and nonbinary amalgamation; remember that a membrane is in itself a body of quantum differentials.[204] As my initial intention was to create a space for sharing vibrations, I kept all these ideas in mind as I was dreaming of this structure/space/body/membrane.

After a long process of sketching, iterating, modeling, and brainstorming, I stumbled with tensegrities. This took me back to one of the earliest conversations I had with curator (and one of my thesis advisors) Camila Marambio, when we talked about tensegrities as intrinsically membranous structures. At that moment I was a bit skeptical[205] about these types of structures but as I submerged into the making of this installation, it made more and more sense. I remembered we talked about fascias and phases[206] and how in a structure like these ones, everything is always in movement. These are systems where it is hard to understand the origin of their foundations, as they are in constant relation simultaneously in tension and compression. I realized a structure like this one not only provided a spatial configuration for vibrations to be shared collectively, but was in itself a vibrational, collective body.

[204] As seen in the vibrational modes of a circular membrane in the previous section, *La Orejona: Vibrational Membrane Microphone*.

[205] There are a number of reasons, but I have to admit that most of it was a gut feeling. And even if I love the work I have done, I think my gut feeling was correct and that I still have to deal with elements that I am not totally comfortable with. These are mostly the ties to a world of cosmic engineering and optimization. Also, at the time I was intimidated by the complexities of doing something like this considering the circumstances: it was the midst of Covid, which meant that I wouldn't have much help, and also I was pregnant at the time. I was not wrong; it was not an easy endeavor, but in spite of the challenge, I succeeded. I still feel that I can appropriate this system even more and twist its cleanness. In the future I would like to make it more punk and less clean, now that I know how easy it would be to do so.

[206] In Spanish, "phases" are *fases*. Phonetically, it sounds very similar to *fascias*, or connective tissues.

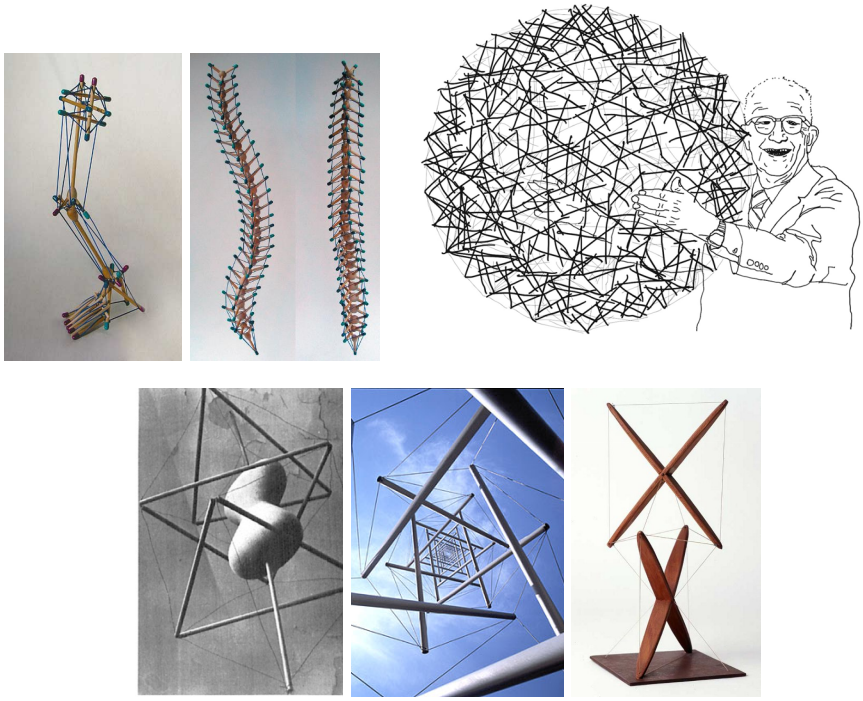

Figure 65 *(Top Left) Tom Flemons. Tensegrity Model of a Leg (Top Center) Tom Flemons. Tetrahedral Spine Models. (Top Right) Drawing of R. Buckminster Fuller with a tensegrity sphere and smiling. Nicole L'Huillier, 2022. Based on a picture found online. (Bottom Left) Isamu Noguchi. Bucky, 1943. Sculpture at the Isamu Noguchi Garden Museum in Long Island City, NY. Photo: The Isamu Noguchi Foundation, Inc. (Bottom Center) Kenneth Snelson. Needle Tower, 1968. Photo: Collection Hirshhorn Museum & Sculpture Garden, Washington, DC. (Bottom Right) Kenneth Snelson. X-piece, 1948.*

A tensegrity is a structure that maintains its integrity by the concatenative tension of its parts. This is a collective body of individual parts that is compressed into a net of continuous tension. It is usually composed of struts/bars and tendons/cables. Due to the system's function, some of the heavy elements appear to be suspended as if they were light, a characteristic of tensegrities that is known as *floating compression*.[207] One thing that I am particularly interested in is that there is no first pillar—all of the elements composing this structure support and hold each other simultaneously. In other words, each individual element is essentially important in order to shape the collective body. If you take one element out of the equation everything falls down. This reminds us of the importance of balance in the tension of each of the individual elements in order to sustain the collective body. In this specific case, the individual elements are tubes and they knit a membrane-like structure. What I find particularly interesting about this

[207] Kenneth Snelson's preferred term to refer to these types of structures.

structure is its inherently fractal characteristics, and its modular projection, as it can grow if more bars and cables are added in an eternal growth and self-scaffolding. These characteristics also make it a continuous body that is elastic in itself, in which loads are not localized as the structure transfers them rapidly across the whole body. This means that tensegrities excel in terms of shock absorption and mitigating vibrations. If one were to shake a single pole, the whole structure would shake, due to its membranal continuity, as vibrations are shared throughout the whole structure. Conceptually, this membranal structure relates to the structure of the *collective flute*,[208] a wind instrument ensemble where each of the players is fundamental, not because of their isolated and pure individual relevance, but because each flute is there to give shape and strength to the collective body of winds.

Tensegrity structures are very common and can be found in many places since they are the structural basis of many biological, vegetal, and other networked structures such as cellular and cosmic systems. During their Black Mountain College days, Kenneth Snelson and Buckminster Fuller started exploring these structures in more depth and engineering structural systems that accommodate the logic of these natural scaffoldings. While there are many stories about the contested authorship and polemics of who invented the tensegrity, I would argue that tensegrities don't really originate from the invention of something that did not exist before, but from observation of patterns and systems around and within us. From their modern liaison to a minimalist and productively engineered imaginary, tensegrities carry a *futuristic* connotation and a cultural association to human-made structures among space-age aesthetics. Without intending to ignore the cultural charge from this structure, I would like to add a personal observation: I believe that the tensegrity's cosmic association comes not only from a cultural moment and drive in the West but also (and more powerfully) because it is a natural/cosmic technology (weaving/geometry) in the first place. I actually think that this structure emerged in that moment of Western imaginary because that is precisely the type of structure they were avidly looking for (and thus stumbled upon) at those times, especially taking into account that the context was infused by postwar development and innovation, modernity's mass production and optimization processes, advances in telecommunications and cybernetics, as well as an imaginary charged by space age and cold war.

[208] This concept is proposed and analyzed by Chilean ethnomusicologist José Pérez de Arce. Please refer to the discussion on *Surlógicas* presented on *Song 3: Membranas, a Platform to Practice.*

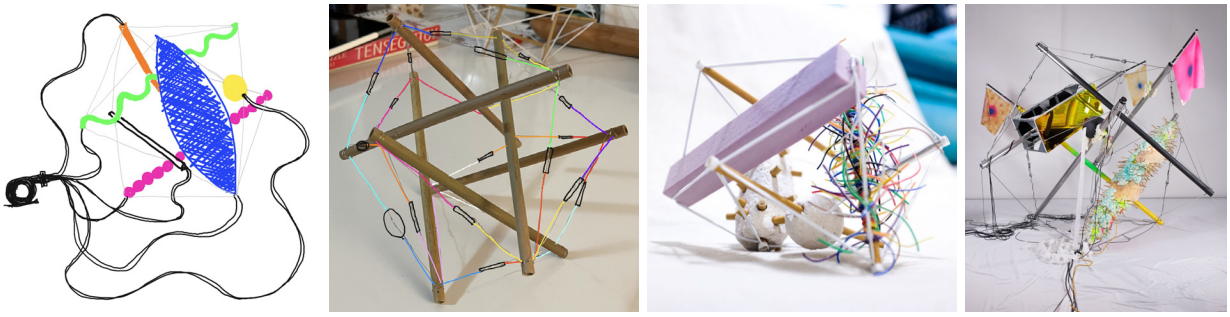

Figure 66 *Membranas Tensegrity process, from initial sketches, to scale models, to installation.*

I embarked into the construction of a tensegrity prism with the desire for it to provide a structure for diffusing sounds and vibrations, as well as simultaneously composing a space. The result is an icosahedron polyhedron composed of six aluminum tubes and 24 tensile cables. Each tube is made of structural aluminum, type 6061-T6, and is 3 m long with a 7.62 cm outer diameter, a 0.476 cm wall, a 6.67 cm inner diameter, and an approximate weight of 8 kg. For the tensors, I use ¼" galvanized steel cable. I must say that I ventured into the construction of this structure in the middle of the Covid-19 pandemic, which meant I didn't have access to a proper place to work or much help. In spite of this, with the consent of my neighbors[209] and with the enormous help of my partner and the few friends[210] we were distantly seeing in those days, we managed to build this structure in the driveway of our home. I must mention that this was not done in the first attempt, but took a few tries. After some iterations and study models that helped me fine-tune the calculations and the methodology for lifting it up, we managed to raise the structure. In retrospect, it feels like we did this in a completely different world where everything was hard. At the time, even finding materials was a challenge. It would be enormously easier to do this at the present moment, largely because these types of structures require a collective effort that was not a possibility a year ago.

[209] They were most entertained by observing my driveway experiments around (and sometimes under) the snow in February 2021. They cheered me as I failed, offered a hand a couple of times, and helped me persevere until I managed to lift this structure up.

[210] There were a few failed attempts where I had the help of Juan Necochea, João Costa, and Penny Webb. For the final, successful day, I had help from Juan Necochea, Ben Bloomberg, and Erin Robertson, and we managed to lift the structure up by carefully following my plan. We behaved like a collective organism as we all lifted the tubes while tensing the cables and kept an eye on my tiny baby, Luna, since daycares were closed at the time and Covid prevented us from having further help to care for her. This moment meant everything to me and is a very precious memory that I treasure in my heart.

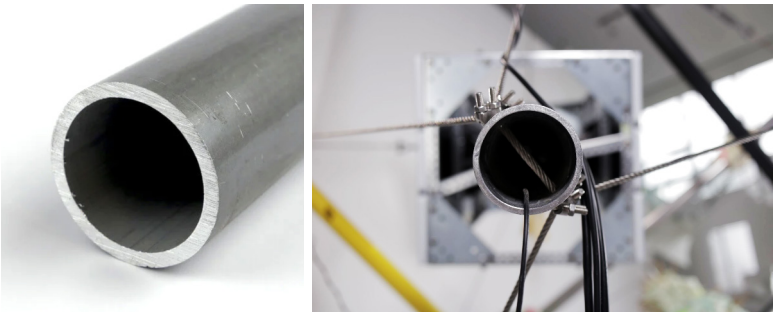

Figure 67 *(Left) Aluminum tube sample. Photo: Online Metals. (Right) Profile of tube in installation. Photo: Jimmy Day, MIT Media Lab.*

Now that I have the knowledge and experience of having built large-scale tensegrity, I am less scared of their resistance, I understand better their vibrational capacities, and I recognize their scaffolding possibilities. With this knowledge, I would do things differently in the future. change things in the next iteration, and accommodate other materials and elements for the construction of similar structures. In a future iteration, I would definitely be more adventurous and use lighter elements so it could vibrate more, as well as incorporating a wider diversity of bodies to build it with. I can envision using repurposed objects found in demolitions, abandoned warehouses, and in nature, instead of brand new aluminum pipes. I would also make it with more modules to build a more intricate membranal system.

• Design and Fabrication Process

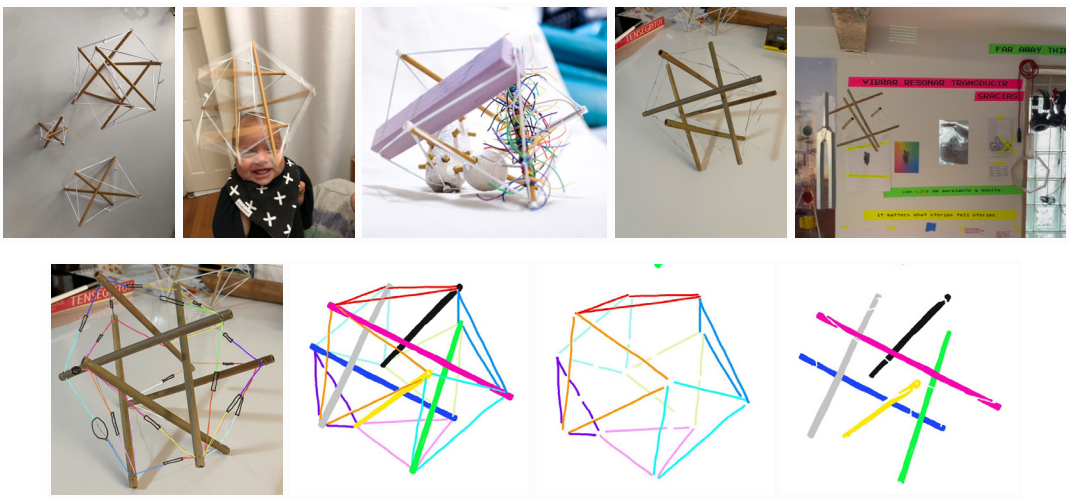

Figure 68 *Tensegrity models and drawings to understand the system.*

Figure 69 *Documentation from the moment I got the tubes, prepared them and the cables, tried to assemble with friends, failed, tried to assemble again, failed again, and finally the model that clarified everything.*

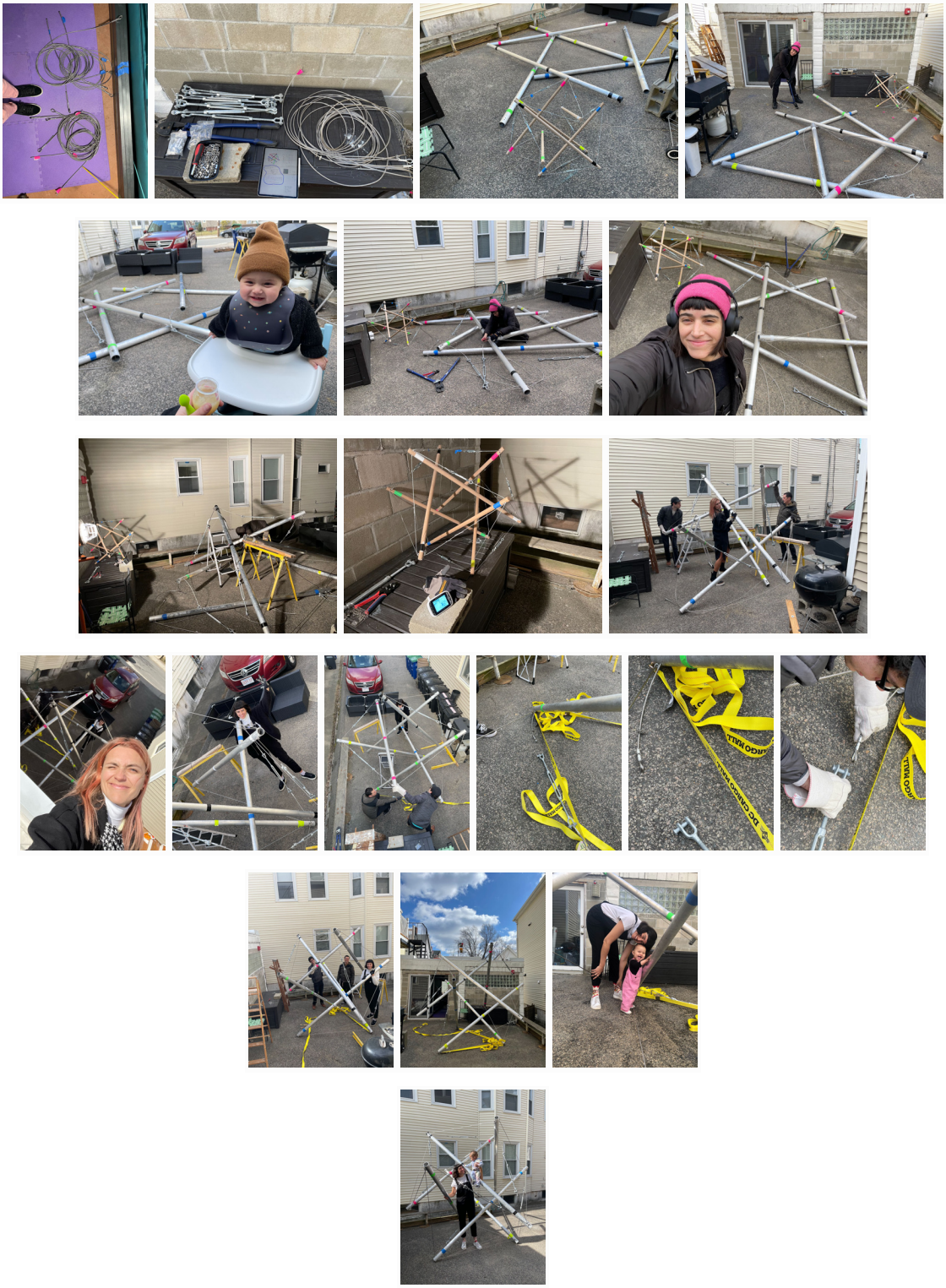

Figure 70 *Documentation from the moment I prepared new cables and reconnected things in the structure, left everything ready in place, and lifted the structure up as soon as I got help from friends.*

Figure 71 *Documentation from tests and experiments with the structure and the process of prototyping some of the organs.*

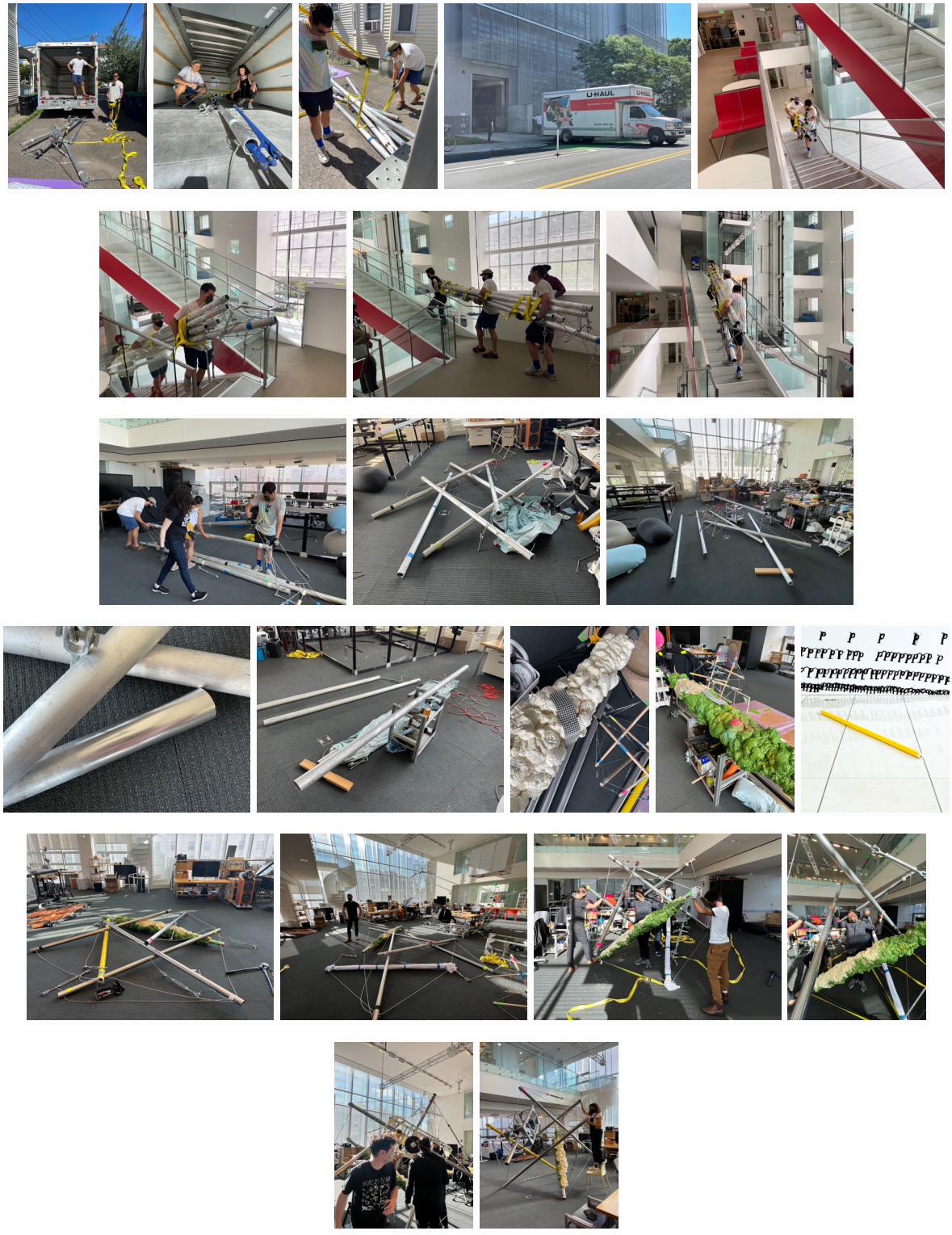

Figure 72 *Documentation from the moment we got a truck to move disassembled tubes to the Media Lab until the structure rose again a couple of months later. In between, I cleaned and polished the tubes, painted one in yellow, started the foam cover on the Cañitas Vessel, and made the subwoofer box so it was ready to be mounted.*

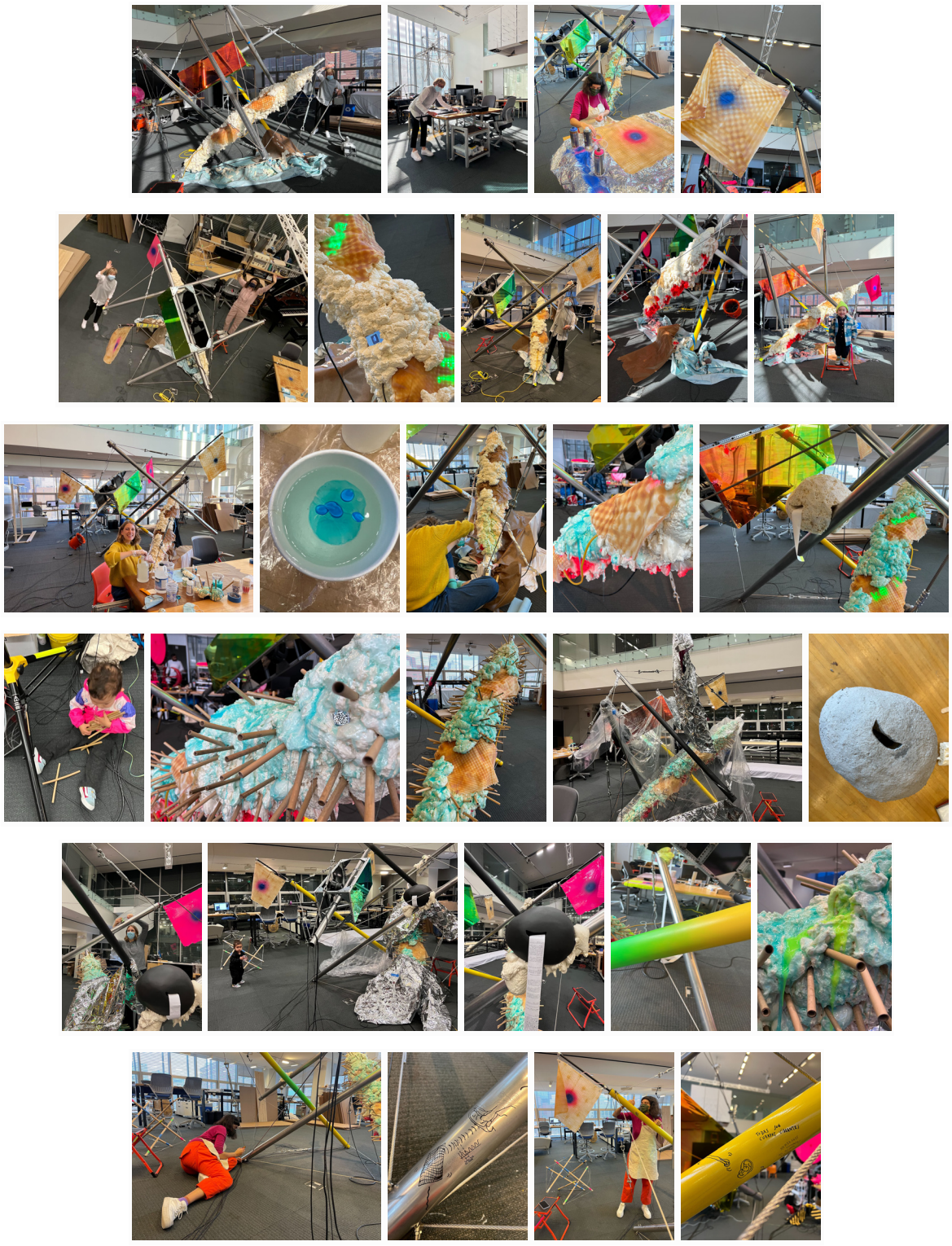

Figure 73 *Documentation of the work on details and finishing once the structure was up.*

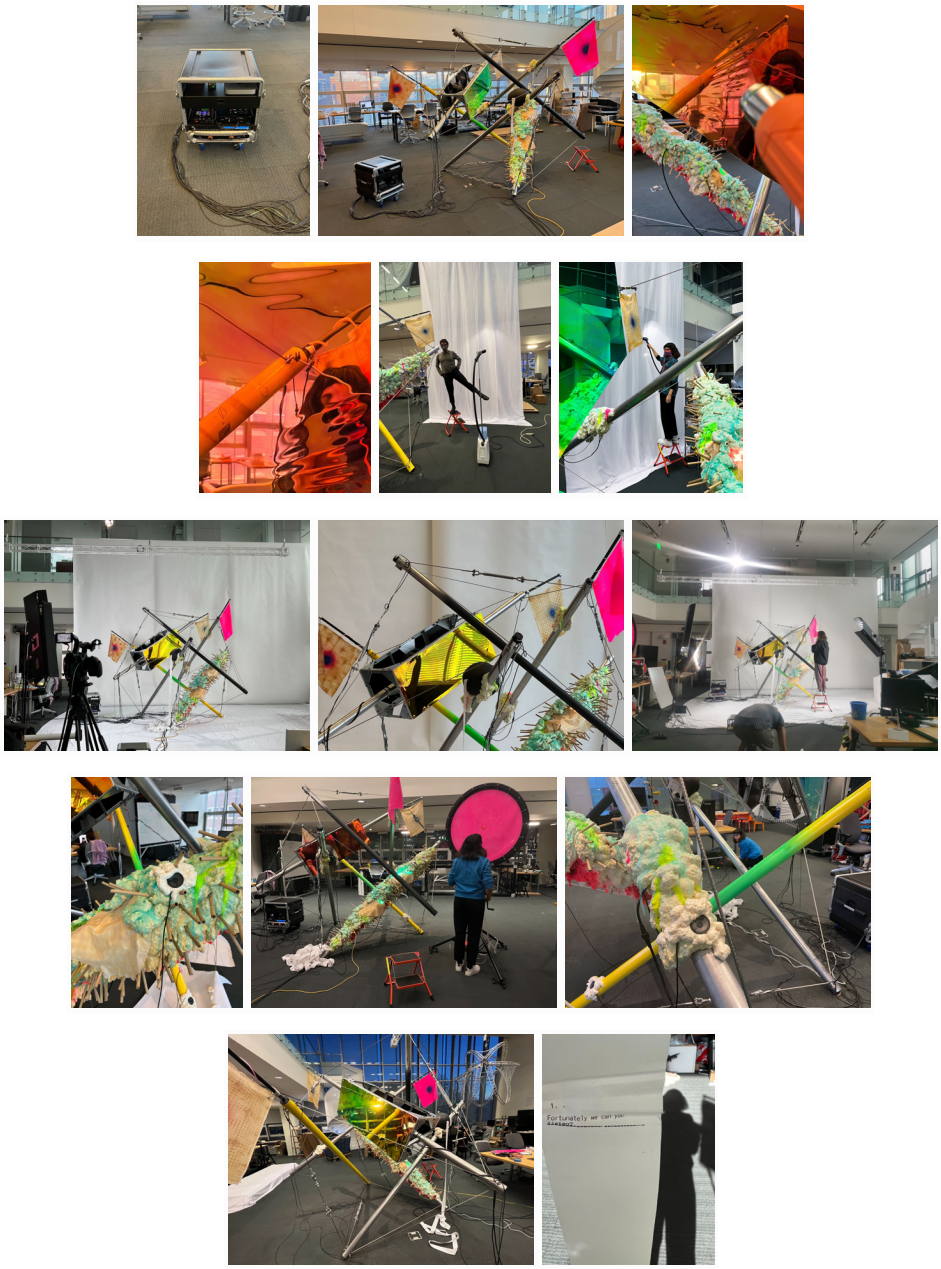

Figure 74 *Final touches, setting up the space for pictures, photoshoot, final mediation elements, and calibration.*

iii. Organs

Once I overcame the challenges of the structure, I was able to dive into activating it and turning it from a static metal structure into a vibratory spatial sound system. Each of the aluminum bars of the tensegrity operates as a carrier or support for elements that compose the system: the *organs*. Each of these organs is resonant in its own way and is essential for this system to work and compose the desired space for encountering different sounds and vibrations, and for enabling collective resonant activations. First of all, the *Sounding Organs* diffuse sounds through aural and tactile mechanisms. These organs consist of: two subwoofers, two speakers, two tactile transducers, one low-frequency shaker transducer, and two bone conduction transducers. These are distributed across the structure in order to spatialize the sounds they diffuse. The *Listening Organs* consist of a set of organs that sense sounds and vibrations occurring in the space around the structure. These organs are three rubbery membranes in the form of flags that are suspended from three different tubes. These flags function as *ears* within the system. And finally, the *Communicative Organs* consist of two other organs that activate relational encounters and stimulate resonant dialogues. One of them is an irregular, textured body that takes over one of the tubes and holds cañitas that are distributed in holes/pockets across its body. The other is a Smiling Blob that outputs printed messages.

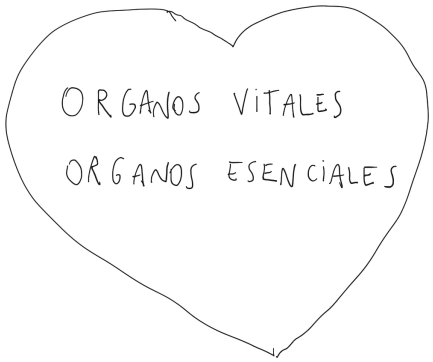

Figure 75 *Organos vitales, organos esenciales. Nicole L'Huillier.*

• Sounding Organs

The sounds diffused in this installation are all contained within the tensegrity structure that gives it shape. There are no external elements and each sounding organ is carefully placed so the spatialization of the sound composes an experience mediated by space; depending on positionality and movement, each person will create their own dynamic mix, and thus personalize the experience of the work. There are

three types of sounds diffused through this installation, which correspond to the three different layers that compose the piece. The first layer of sounds comes from *La Orejona*, the vibrational membrane microphone. These sounds are collected at distance in outdoor spaces and continuously sent via the *Membranas-Wi-Fi*[211] to the computer where the data is converted into sounds and then distributed to different output channels. These sounds have a low, droney, and noisy quality that sets the floor for the installation. The second layer of sounds corresponds to the sounds that the system produces as a response to the vibrational and sonic activity sensed within the installation space through the Listening Organs embedded in the structure. These sounds range from low-pitched wind samples to high-pitched distorted flutes. Their objective is to activate a cycle of calls and responses; they are part of the interactive components of this installation and embody the "voice" of the machine. Finally, the third layer of sounds corresponds to pre-recorded messages diffused in different ways in order to provide moments of curious reflection as well as to communicate instructions and guidelines to help the participants navigate the installation.

Subwoofer screen

One of the suspended tubes of the structure holds a metal-framed box with two of its sides covered by a thin holographic vinyl membrane. Inside the box, there are two 12" subwoofers (each 1000 Watts) facing outwards in the direction of the membranes. The subwoofers are not in direct contact with the membrane since they are distanced a few centimeters away from it. In spite of this, every time the subwoofers diffuse sounds below a frequency of 33 Hz, the membrane vibrates in response to the subwoofers' activation of the air between both elements. This creates an effect where the soundwaves visually fuzz reality. The membrane that vibrates with the sound of the subwoofer has a mirror-like chrome finish, so when there is no sound coming out of the subwoofers, it looks like a mirror. But when low-frequency sounds are being played, the membrane vibrates and the reflection is fuzzed and distorted. This is not only visual since the membranes' vibrations add to the rumble in the space. Every time this happens, the vibrations are subtly distributed and shared throughout the tensegrity structure.

[211] A personal wireless network.

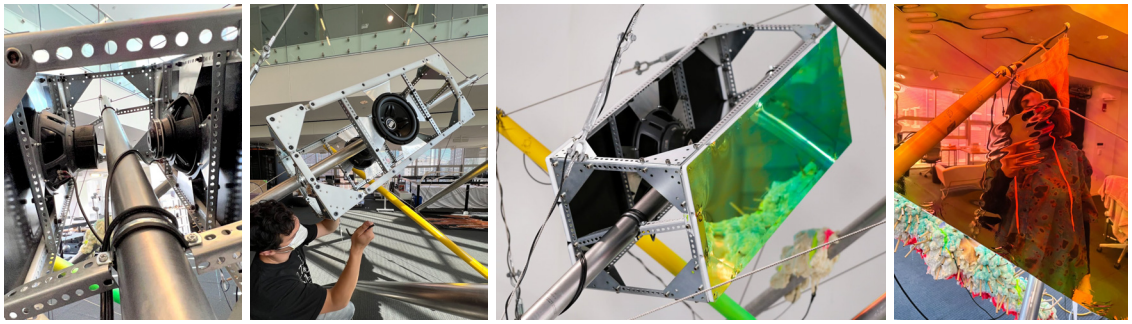

Figure 76 *(Left) Side view of subwoofers in structure. Photo: Nicole L'Huillier. (Center Left) Juan installing the subwoofer box in the structure. Photo: Nicole L'Huillier. (Center Right) Subwoofer box in installation. Photo: Jimmy Day, MIT Media Lab. (Right) Subwoofer-distorted mirror selfie. Photo: Nicole L'Huillier.*

The sounds played through the subwoofers come from *La Orejona*, the vibrational membrane microphone. These sounds correspond to its low-frequency section. The activation and intensity of the vibrational modes of these membranes is directly related to the quality and intensity of the sound and vibration that the microphone is perceiving. For example, a soft wobble in the membrane accompanied by an almost imperceivable sound would most likely correspond to soft sounds in the environment, such as a smooth breeze, a gentle touch, and/or a faint tremor. In contrast, a more aggressive rumble accompanied by a loud bass would correspond to loud sounds, strong and volatile winds, percussive hits or strong touches, heavy tremors, or possibly an earthquake.

This element of the artwork is informed by the idea that "we actually never touch,"[212] a phenomenon that Karen Barad describes from the perspective of a theoretical physicist who has peered into the quantum world. In fact, when touching something, electrons from our hands will be repelled by the electrons of the object being touched, creating a very tiny field in between. The sensation of touch is thus an illusion created by our brains to interpret the electrons' interaction and the electromagnetic field. If *we actually never touch*, what does it mean to *touch*[213] a drumhead membrane and make it vibrate? If touch itself does not really work how we intuitively

[212] On Touching: The Alterity Within, Karen Barad. As part of the conference-festival "Hold Me Now—Feel and Touch in an Unreal World." Organized by the Gerrit Rietveld Academie at Stedelijk Museum Amsterdam, March 21-24, 2018. Part of the program of March 24, called "Reach out and Touch (Somebody's Hand): Feel Philosophies," Curated by Jack Halberstam.
(Accessed: 05-17-2020) https://www.youtube.com/watch?v=u7LvXswjEBY

[213] *Touching* as in playing the instrument. This is how it is phrased in Spanish, and the word gives context to the tactile dimension of music and the production of sound from a membrane.

think it does, is it possible to think about other dimensions of touch at a distance? Aren't sounds a way of touching as well? Aren't we always touching each other with our voices? What are the dimensions of intimacy and affect that vibrations and sound can yield? What does it even mean to touch if we physically never touch at all? Could we learn to feel the caresses of sound as we have learned to feel the caresses of the electromagnetic fields that separate us?

Speakers

There are two 3" tweeter speakers in the system, installed at the top of two different tubes. Each speaker is attached with a clamp system and is facing inwards toward the tube so it diffuses sound through it. One very interesting thing about this system is that the sound traveling through the aluminum tube has an acoustic filter provided by the material and the geometry of the tube. In this case, the sound travels through a highly reflective elongated chamber that acts as a resonator and infuses the sound with shiny and bouncy reverberations. One speaker is embedded in a suspended black tube and the other is placed in a silver tube that is in contact with the floor. They both diffuse sounds from different sources, thus spatializing different sonic intentions and setting them in movement across the sculptures as they travel through the tubes.

The speaker embedded in the suspended black tube is diffusing the whole sonic spectrum between 108 Hz and 18 kHz coming from *La Orejona*, the frequency response of the speaker. These sounds have a foundational layer that consists of a constant drone with subtle variations, corresponding to the permanent noise of the membrane. At certain moments, it is possible to distinguish other sounds woven into this continuous noise. In addition to the low-frequency section that is diffused through the subwoofers, this speaker diffuses a wide range of sounds and introduces other voices, textures, and timbres into the space. The tube's bottom is placed around 1 meter from the floor, which gives the participants the possibility of kneeling down and placing the ear in proximity to the bottom opening of the tube to listen to the sound with more intensity and definition than what is diffused in the space.

Figure 77 *(Left) Speaker attached to the tube. Photo: Nicole L'Huillier. (Right) Picture of the speaker. Photo: Facmogu, model A18021.*

The speaker in the silver tube, which is in contact with the floor, diffuses the sounds corresponding to the second layer of sounds, the responses of the machine to the activity in the room. These sounds are contained in the tube and spatialized as the sounds travel within the tube. Since the tube's bottom end is in contact with the floor, in contrast to the previous case, this speaker loses the possibility of inviting the participants to kneel down and listen. While it is definitely possible to lay down and listen in proximity to the floor, this is a less evident and inviting action.

Tactile & Shaker Transducers

There are two tactile transducers (25W / 20 Hz - 20 kHz) and one low-frequency bass shaker transducer (50W / 20 Hz - 80 Hz) in this installation. They are all embedded in the suspended silver tube. Their purpose is to make the tube resonate and vibrate to transform sound into a tactile experience within the installation. In order to do so, they are all placed in direct contact with the surface of the tube and then bonded to the tube with epoxy and a fixed cover of expanded foam. The sounds diffused through the transducers correspond to the second layer of sounds, the responses of the machine to the activity in the installation space, particularly to the vibrations of the flag that is closer to the transducer at the bottom of the tube. When these are activated, it is interesting to perceive the tube resonating to the different frequencies, as well as to follow the vibrations that are overflowing towards the cables and elements nearby. Participants can engage with these vibrations by touching the mounts of foam that cover the transducers or the

tube, touching these elements with their hands, head, ears, or with other parts of the body to explore different resonant modalities. It is possible to touch these elements or the cables nearby with other objects and explore subtle percussion and other resonant responses.

Figure 78 *(Left) Tactile transducer 25W. Photo: Nicole L'Huillier. (Center Left) Low-frequency shaker transducer 50W. Photo: Nicole L'Huillier. (Center Right) Transducers in installation. Photo: Nicole L'Huillier. (Right) Kimy perceiving the vibrations with her head and hands. Photo: Nicole L'Huillier.*

Bone Conduction Transducers

The yellow and green tube contains two bone conduction transducers (1W / 300 Hz - 19 kHz). These devices are glued into the inner surface of the tube and diffuse a message that is repeated in a constant loop. This message corresponds to the third layer of sounds, the pre-recorded messages. This layer has the objective of conveying an important statement of the work, in order to stimulate ideas and reflection by encouraging participants to listen attentively. In contrast to the previously described transducers, the bone conduction transducers don't activate the tube in a humanly perceivable, tactile way. Their action is more subtle, as they use the tube as a membrane for gently diffusing sound and carrying the voice and the message across its body. This sound that is embedded in this yellow and green tube is a very soft one, almost silent when one is not attentive enough. In order to listen to it, one has to place the skull and the ears in contact with the tube. This action is communicated to the participants through instructive performances and also through tiny speakers that invite the participants to move into close proximity with the tube.

Figure 79 *(Left) Bone conduction transducer. Photo: Nicole L'Huillier. (Right) Kimy listening to the tube. Photo: Nicole L'Huillier.*

> Even though it is very soft, this sound is always present, as if it were a whisper. I always hear it in the installation, even if I am not bringing my bones and ears in contact with the tube. This must be because I know it is there and I can identify it with clarity. But several times, when I have had the chance to show this to different people, it has surprised me to realize that they only notice that the sound is being diffused in the space after they hear it through contact with the tube. I think this reveals the potential of practicing attentiveness and *fractal listening.*[214]

• Listening Organs

In order to create a system that engages in an improvisatory call and response, I decided to implement a way for the sculpture to "listen" to its immediate environment. For this purpose, I created three membranes that listen. They are shaped as flags that are suspended from three different tubes of the structure.

> **Flags / Membranes That Listen**
>
> Two of them are made of latex and one is made of silicone. These are all touchy, rubbery, oscillatory listening apparatuses—custom-made mics to engage with our vibrational reality. Unlike the logic of *La Orejona*, these are not envisioned as framed, drum-like membranes, but as free flotation flags. They are tuned to sense a specific set of frequencies that ranges between 280 Hz and 1200 Hz, focusing their response to the frequency range of the cañita/flutes in the installation. This provides a clear sense of communication, by narrowing the machine's sensing of

[214] As an exercise of differential attunement.

the room while still allowing space for freedom and sporadic reactions to events other than the sounds of the cañitas/flutes. Due to this design decision, sometimes the machine is capable of perceiving voices around it and environmental sounds, as well as items touching the flags, and vibrations coming from the structure's activity.

Figure 80 *(Top Left) Latex flag detail, 1771 Hz. Photo: Nicole L'Huillier. (Top Right) Silicone flag detail, 110 Hz. Photo: Nicole L'Huillier. (Center) Latex flag in installation. Photo: Jimmy Day, MIT Media Lab. (Bottom) Silicone flag in installation. Photo: Jimmy Day, MIT Media Lab.*

The flags are sensing devices but also they carry a message within their skin. They are imprinted with textures that come from specific frequencies. The motivation to do this came from the idea of embedding multimedia vibrational messages within the installation. Throughout the experimentation process with the flags, the membranes I had been making had the look and feel of a skin-like material. This was due to their thickness as well as to the color and feel of the natural rubber once dried. I wanted these membranes to carry sonic memories in their skins. So I decided to imprint messages on them, oscillatory patterns that are a key to understanding the noise within *La Orejona*, the Vibrational Membrane Microphone. It was important for me to create connections and relations between all of the membranes that listen in this installation, and weaving meaning from its foundational noise made sense to me. *La Orejona* is a constant listener that weaves sounds and different signals into a collective noise. Somehow, by doing this, *La Orejona* keeps secrets by masking information—it hides secrets in its noise. Of course, every secret has a key, a way of being revealed. The messages imprinted in the flags contain the key to accessing the secrets of *La Orejona*.

By working with cymatics and its ability to illustrate the vibratory nature of energy, the flags embody oscillatory patterns from Chladni plates that were obtained from a tonoscope simulator.[215] The first step consisted of identifying three predominant frequencies present in the Vibrational Membrane Microphone: 110 Hz, 1771 Hz, and 2962 Hz. Once these frequencies were processed to obtain the simulation patterns, a 3D model was made for each of them. Each model was used to carve a high-density foam sheet with a CNC router in order to make the molds to cast the flags. These molds are then covered with a thin layer of natural rubber or silicone. Two of the flags are made with natural rubber and one from silicone with neon pink pigments; making one out of silicone helps create a material connection with the Vibrational Membrane Microphone. Additionally, three 20 mm rubber-coated contact microphones with soft silicone-coated copper cables were made and embedded in the membrane during the casting process. Once the membrane dried, the rubber coat of the contact microphone adheres to the rest of the membrane as if it were a continuous skin instead of two separate objects. Once dried, this membrane is released from the mold. The cables from the contact mic that protrude from one of the membrane's sides are secured into a rubber hose for protection and soldered to a female screw cable connector so they can be plugged into a longer custom made cable that has a ¼" audio plug

[215] A tonoscope is a device that visualizes sound by displaying the vibrational patterns of particles or fluids. In this case we specifically used a software called Software Tonoscope that was available online until late 2021.

that is connected to the audio interface so the sounds can be processed in the computer. Lastly, two ½" grommets are installed in the flags so they can be attached to a flagpole.

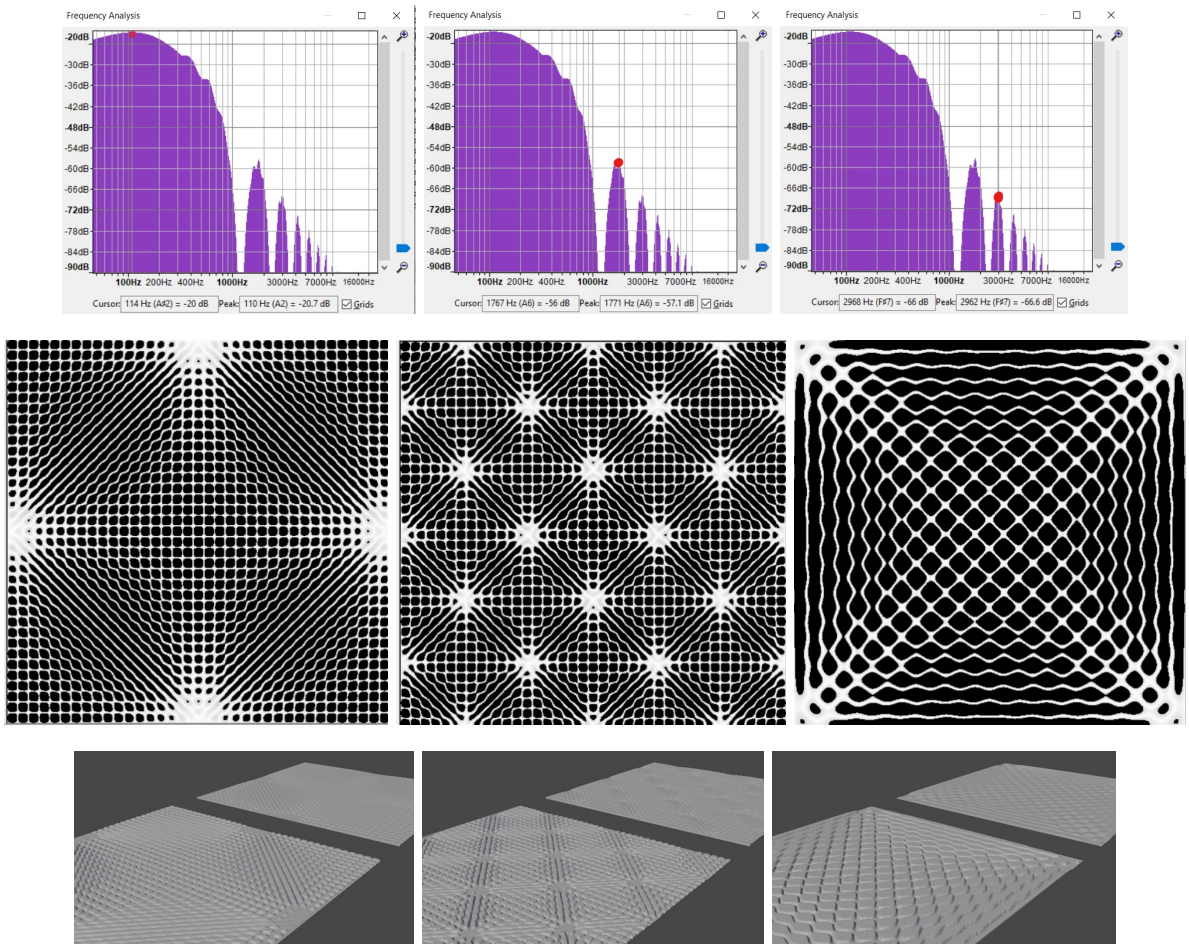

Figure 81 *(Top) Frequency Analysis with a peak marked in 110 Hz, 1771 Hz, and 2962 Hz. Photo: Devin Murphy. (Center) Chladni illustration for 110 Hz, 1771 Hz, and 2962 Hz. Photo: Devin Murphy. (Bottom) Render from the 3D model for topographies for 110 Hz, 1771 Hz, and 2962 Hz. Photo and 3D: Valentina Riquelme.*

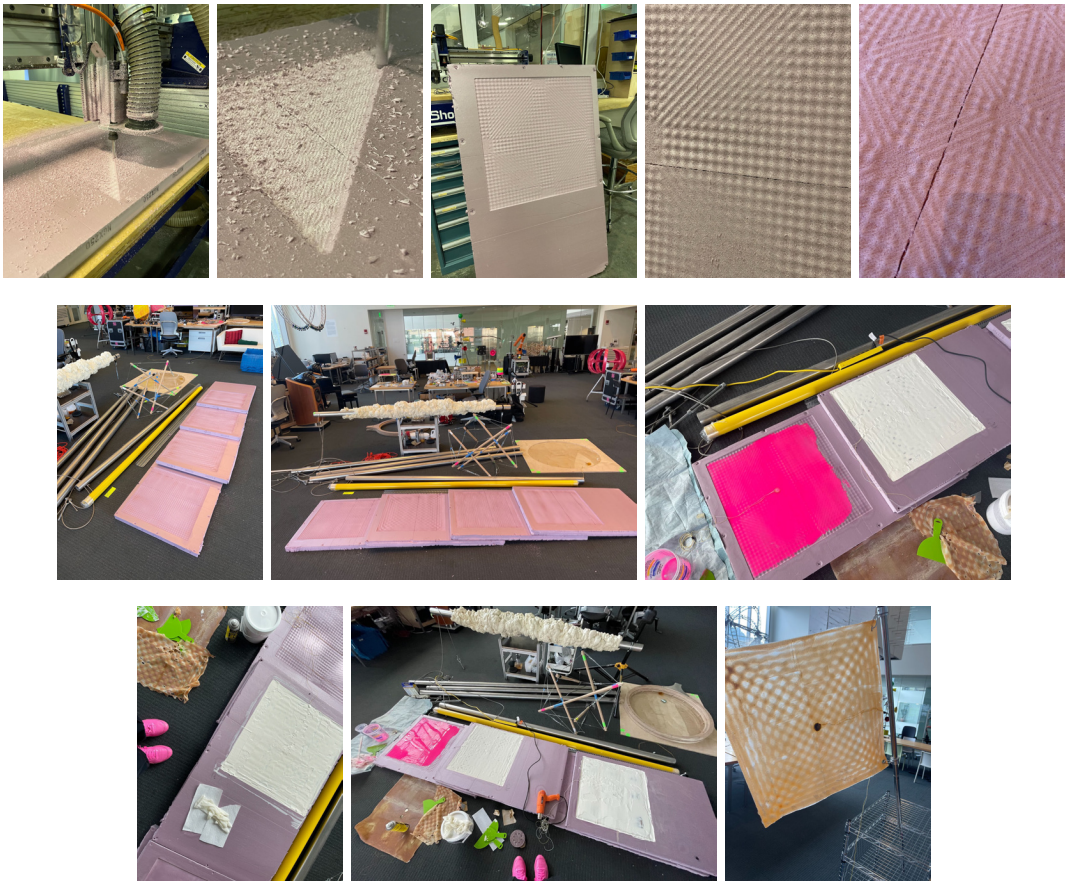

Figure 82 *(Top) Process to carve the topography out of the foam with the CNC router. Photos: Nicole L'Huillier. (Center) Foam molds at the lab and in use. Photo: Nicole L'Huillier. (Bottom) Foam molds in use and one flag ready. Photo: Nicole L'Huillier.*

Sounds in close proximity to the flags are slightly amplified through the subwoofers with a very brief delay, which gives the participants near-immediate feedback and creates a sense of direct action provided by this subtle layer of sound. As an example, when the flags are touched or percussed with the fingertips, these actions are diffused as soft percussive textures; similarly, if one sings or plays a cañita close to the flag, this sound will be heard as a soft echo. In addition to the aforementioned functions, the pink silicone flag is also routed to the Smiling Blob's printer. This means that the activity perceived by this flag controls a threshold that can activate the system so it automatically creates and prints a message. The Smiling Blob is programmed to do this every hour, so the pink flag's threshold adds the possibility of printing messages in reaction to the vibrational activity within the installation.

• Communicative Organs

There are two organs that have the function of stimulating resonant moments and actions. They are both meant to influence the way the participants can relate to the piece, one by providing instruments for communicating, and the other by providing ideas that can stimulate interaction and reflection both in the space and time of the installation and also elsewhere and afterward.

Cañitas Vessel

This organ is a vessel for cañitas/flutes. Its function is to hold and carry within its body these instruments that are meant for communicating with the system as well as with other participants in the space. These cañitas are a tool for becoming part of the system. Participants are invited to take a cañita and blow into it to produce sound. This sound is sensed through the flags and then a response is produced by the system. The responses are sometimes immediate and direct, and sometimes chaotic and unpredictable; this is intentional. The objective is to provide an interaction that is not controllable and linear, but rather opens up space for the machine to express its own agency and behave less like an instrument. In the *Agency* section of this chapter, I will dive deeper into the processes and intentions behind the machine's responses.

Figure 83 *Cañitas Vessel pictures.*

It is very important to recognize that Covid-19 has changed drastically what it means to be and breathe together in a shared space. I understand that blowing into flutes in an indoor space is not a possibility at the moment and I fully adhere to all the Covid-19 regulations and safety measures that help protect our communities. However, I decided to keep the cañitas in the installation as a token of hope, a reminder of something that can happen in the future. At the moment, they are a passive symbol of resonant collectivity and an example of wind technology that symbolically

communicate a desire and inscribe the installation within a sonic windy language. The cañitas will patiently wait in their vessel until the moment is right to activate the co-inspirational ritual, in a respectful and safe way.

In the past, I have been in many improvisatory moments where cañitas are the communication technology. It has always been a beautifully cohesive moment where a cloud of sound, like a sonic membrane, configures a collective resonant space. As I have been engaging with people from different places through this process, it has been a surprise to me that the cañita is not such an evident instrument as I thought. I assumed that everybody would intuitively know how to play a cañita because it has been something very present and constant in the place I grew up. I took it for granted and thought of it as something very natural and obvious. I was very wrong and it has been enormously enriching to break that assumption. This led to realizing that there have to be ways of signaling the faculty of the cañitas to the participants. One element that is included for this purpose is a small screen with a video of a mouth blowing into a cañita. This screen is encrusted in the vessel's body. Another way of signaling this is during performance moments where I will guide the participants through guiding actions in order to encourage them to follow me and play the cañitas together.

The vessel is an expanded foam body that covers its tube with an irregular and textured mass. The vessel is populated by cañitas, tiny bamboo wooden tubes that cover the vessel's body as if they were hairs. The vessel has small tubular holes across its body, tiny pockets to hold the cañitas. Each cañita can be removed, so eventually, when it feels safe again, the audience will be invited to play cañitas in the space and then take them home. The missing cañitas will be replaced so the vessel is never empty. In addition to the cañitas, the vessel holds mediation elements that communicate guidelines to the participants and hold its other contents. These elements consist of a membrane LED screen for scrolling text messages; a 3.5" small screen with a video for playing cañitas; a 1.3" mini screen with a QR code that directs to a project description and guidelines; and two tiny 2" diameter speakers that play pre-recorded audio messages. All of these elements are described in full detail in the *Accessibility and Mediation* section of this chapter.

The expanded foam was an interesting material to work with since it is in essence hard to control, which made the process very improvisatory in itself. The process was guided by my hands and original intentions but the results were spontaneous and unpredictable. Following a similar emergent logic, I decided to cover and paint part of the foam by dripping resin, another element

that was impossible to fully control. I appreciate these processes not only because they were fun but also because they provided emergent relations with the work during its constitution. It made total sense to me that the carrier of the "interactive" elements of the installation that are tools for collective emergence had to be emergent and improvisatory in its essence. The vessel is also the most unpredictable and alien element in the structure, as the rest remains aesthetically clean and relates to a more minimalistic and engineered imaginary. I think the result highlights the vessel as something special that catches the attention and brings balance to the structure by grounding it with its uneven and artificially organic texture and feel.

Smiling Blob

Every hour, the system automatically outputs a printed message. This also occurs when there is resonant activity affecting the pink flag. This means that there will be at least 24 messages a day. These messages consist of three lines of text that are separated by a line break and preceded by a number (1, 2, and 3). At times these are full sentences but may also be just a word, a verb, or an incomplete sentence formed by a cryptic set of words. These are meant to be open-ended interpretative scores that have the objective of stimulating actions and reflection. During performances, a message is selected and read out loud to invite the participants to engage with it as a prompt for a spontaneous ritual. The messages are printed by a 2.3" x 3.2" x 1.7" tiny thermal printer with a 2.25" wide receipt paper roll inside of the Smiling Blob and are outputted through its smile as if they were its tongue. The messages are constantly piling up in the installation, as a receipt thread that constructs a frail parchment scroll. When there are no performances the participants can engage freely with the installation and are invited to read—and even take with them—one of the messages, as a souvenir and as a resonant reminder to practice, to fuzz.

Figure 84 *Smiling Blob, 2022. Photos: (Top) Nicole L'Huillier. (Center) Jimmy Day, MIT Media Lab. (Bottom) Christian Restrepo.*

These scores are automatically created by the machine. As previously mentioned, there is a clock programmed to output a message every hour, but also messages can spontaneously be outputted if there is activity in the room. An order 3 Markov chain with low representative capacity was implemented to generate text based on a custom database. The Markov chain is a stochastic model that in this case is used to generate new text from previous texts. This model is a simple form of Machine Learning that works by transitioning from one word to another through probability as it analyzes the previous texts to predict future outcomes. The process is very fast, which enables the text to be created in real-time and based on real-time inputs for modulating the weight of the corpuses and the coherence of the message. The results are interesting and most times are illogical, which I find most fascinating as they don't convey a specific message, but a series of open possibilities in their interpretation and sense-making. This system is not meant to

be clever and flawless, but a way of fuzzing meaning in order to stimulate subjective sense from the apparently senseless.

To train this model, a database was constructed with different text corpuses. These corpuses are varied and very different from each other. The intention behind this is to weave different things into resonance and come across with unexpected and unlikely results. This is an operation of fuzzy logic, this is an exercise of remixing what I consider to be deeply resonant ideas so we can find ways of shaking reality from there. This is an exercise of *cyborgantropofagia.*[216]

The corpuses that compose the database are: instructions found online for listening, knitting, singing, breathing, and playing instruments; selected texts by Chicana feminist poet and theorist Gloria Anzaldúa, from her masterwork *Borderlands/La Frontera*; selected texts and scores by American composer Pauline Oliveros, from her works on Sonic Mediations and Deep Listening, and public presentations; a selection of poems about winds and sounds by Chilean poet Gabriela Mistral; a series of scores/resonant instructions that I have written in the past few years in relation to the research and process of this thesis. These texts are in English, Spanish, and Spanglish, and the messages combine these languages freely. By weaving these corpuses to create the messages of *Membranas*, my intention is to pay tribute to the work of exceptional women that have strongly influenced me and shaped my thoughts and actions. This process is like a stomach where things are digested and mixed up to nourish the body.

The wind can modulate how coherent the message is. This means that the level of intelligibility of the messages changes depending on the wind and vibrational activity of the outdoors membrane, *La Orejona*. If at the moment of creating a message there is a strong wind affecting *La Orejona*'s membrane, the message will be created by jumping more drastically from one corpus to another. This means that the corpuses are weaved in a much more aleatory way as the message is constructed by the system. In contrast, if the membrane is still, the process will be more smooth and the message will be a bit less fuzzy.

[216] This is a continuation and appropriation of Antropofagia, a postcolonial tool and artistic movement that originated in Brazil in the early twentieth century and had a revival in the 1960s. My experiments extends the term by incorporating the cyborg, since in this case, the mechanisms of digestion include an algorithmic process and not only a human one. Please refer to: Oswald de Andrade, "Manifesto Antropófago," in *Revista de Antropofagia* 1(1928): 3-7.

Another element that is important to mention is the calibration of the sensitivity of the pink flag to outputting messages. We first defined the sensitivity of the flag when we were calibrating things on the desk, before putting up the installation. Once we built the structure and managed to install the printer on the Smiling Blob, we realized that messages were continuously being outputted automatically. At first, we thought this was an error of the system, but then we realized it was due to the constant subtle vibrations of the flag in response to the vibrations of the structure. These may have been vibrations because of movements around the structure, air moving, or even the very activity of the printer when outputting the hourly message. So we had to recalibrate the flag's sensitivity so it would not set up an infinite loop.

iii. Brain <3 Rack

The installation has an instrument rack that is placed right next to the tensegrity structure. This is an open box with wheels that contains the hardware that powers this installation. It is possible to see all of the intricate cables coming in and out of the elements in the rack as if they were information veins and energy ducts going to the different organs in the structure. This is where all the computational processes take place, and from where all the power and sounds are distributed. The computer is programmed to initiate all the processes automatically every time it is turned on. The rack also contains a drawer to store tools.

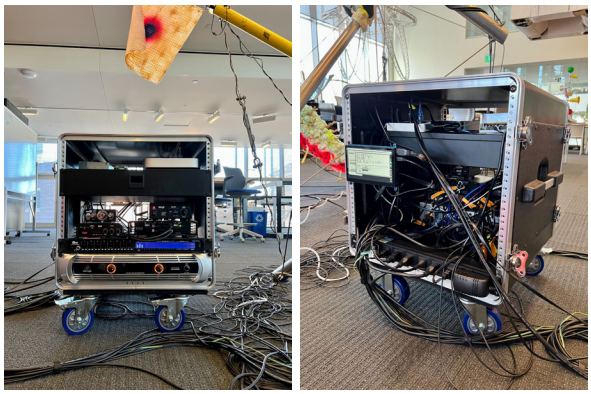

Figure 85 *Brain <3 Rack. Photos: Nicole L'Huillier.*

Brain And <3 Rack contains:

- Mac mini computer (M1 chip, 8 GB unified memory, 256 GB SDD storage).
- Motu 8M, 24-in/24-out audio interface.

- Arduino Uno microcontroller for the Smiling Blob's thermal printer.
- Arduino Uno microcontroller for the LED scrolling messages of the Cañitas Vessel.
- 3000 Watts amplifier for the subwoofers.
- 400 Watts amplifier for the tweeter speakers.
- 100 Watts amplifier for the shaker transducer.
- 50 Watts amplifier for the tactile transducers.
- 40 Watts amplifier for the bone conduction transducers.
- WavePlayer 8, multichannel audio player.
- 6x LM386 amplifiers for tiny speakers.
- Bluetooth keyboard with trackpad.
- 7" screen to monitor the machine's activity if needed.
- USB 3.0 Hub with 10 Ports.
- 2x Rack Power Distribution Unit with surge protector and on/off switch.
- Micro SD card video player.
- Dual-band Wi-Fi 6 router with 3000 sq. ft. coverage. This is connected to the computer via the ethernet port in order to set the *Membranas-Wi-Fi* wireless network.

iv. Accessibility and Mediation

Although this installation is centered on listening, I have made an effort to incorporate different media and multisensory elements so it can be accessed and absorbed through different perceptual registers and layers. Most of the work and messages are presented as sounds, but some sections are accompanied by or manifested primarily through tactile and visual vibrations. Also, the mediation elements communicate through sound and text. As mentioned previously, the installation can be explored by moving the body and entering the structure as a space. This presents a challenge for people with reduced mobility, as it constrains the possibilities of fully engaging with the work. I have, therefore, made an effort to accommodate the experience in such a way that the main objectives and the central layers of the work do not depend on physically entering the structure.

The mediation elements have the task of communicating guidelines and messages around the installation in order to facilitate the participants' experience of the installation. A challenge of this work has been to communicate and provide content to guide the participants through the experience. This work has been developed and experienced uniquely in our research laboratory space, which has provided an enormous amount of freedom and experimental opportunities, but understandably lacks the infrastructure that will be available when this work is shown in a space that is dedicated to experiencing artwork. The limitations

of our working space are not drastic, but they do change the predisposition of the participants encountering the piece due to the program of the space and its activities. This made it important for the installation to provide the information and content within itself, as clearly as possible, without relying on wall texts, a curator, or an on-site mediation team. This may change in the future, but still, the installation carries within itself a series of messages for mediation.

These mediation elements are found around the installation, encrusted into the structure. The primary messages are evident and direct. Other elements that are not essential but carry secondary layers of meaning are more subtle and are *hidden* around the structure. By having these elements distributed in the installation I was looking to direct attention and invite the participants to explore the structure. Some elements are situated in weird places, such as in proximity to the floor, or even spaces facing inwards towards the center of the structure. These elements signal that the installation can be explored by moving the body and by entering the structure as a space. The mediation elements are listed and described below.

Membrane Display

A screen for scrolling text messages made with two interconnected flexible LED matrices and thin latex membranes with vibratory textures. This element is embedded in the surface of the Cañitas Vessel. The scrolling message iterates in three different colors (RGB): bright pink (255, 8, 127), bright green (57, 255, 20), and orange (255, 141, 35). The message can be updated according to the desired interactions and the context of the installation. At the moment the message that is displayed is a placeholder message that invites people to take a cañita and communicate through it, thus imagining an ideal situation in which the audience would be able to engage in that action.

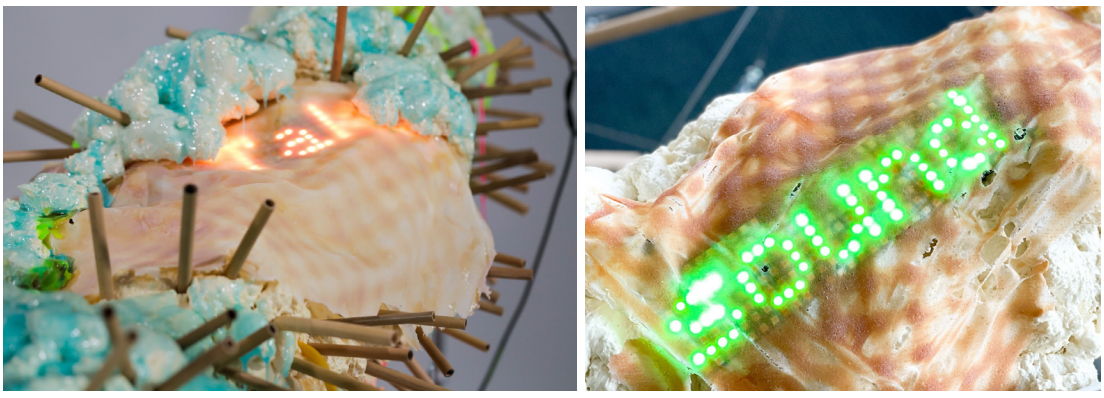

Figure 86 *Membrane Display details. Photo: (Left) Jimmy Day, MIT Media Lab. (Right) Nicole L'Huillier.*

"Take a flute and sound with us - Please treasure it and take it home with you // Toma una cañita y suena con nosotrxs - Por favor atesorala y llévala a casa contigo"[217]

An unexpected technical challenge came up when trying to display messages in Spanish, since some of the characters were not available. Sadly, this is a common problem and we encountered it with the LED matrix as well as with the thermal printer of the Smiling Blob. These devices did not have friendly interfaces for representing the accented and special characters that appear in Spanish and many other languages. We wanted to find ways to represent these characters anyhow, as we felt it is an important statement about making tech more sensitive to other cultures and hacking it to appropriate it and make it more representative through this action. The hack was simple and consisted of writing code to automatically replace these accented characters with their corresponding ASCII hex codes so that they could be accurately represented. Some characters were not easily replaced, such as the "ñ" in cañitas. We solved this by drawing a line on top of the "n". It would have been easier to just change the word, but I considered it important to say "cañita" and not "flauta," for example, since "cañita" is the word that for me best represents these tiny cane flutes.

Instructions Choir

Four 2" diameter speakers that play pre-recorded sound messages in an orchestrated choir for four simultaneous voices. These speakers are distributed around the structure. The instructions are played in a loop through an external multichannel audio player. The speakers diffuse messages and are composed as a choir of spoken instructions. There are four tiny speakers embedded in the installation, which comprise a multichannel orchestrated piece that works in an organized way, one which is present, does not obstruct the sonic landscape of the piece, and also weaves nicely

[217] Example of text. This is the text being displayed at the moment I write this dissertation.

into any spontaneous improvisation session or unscripted sounds that the piece might be manifesting. These are the different messages:

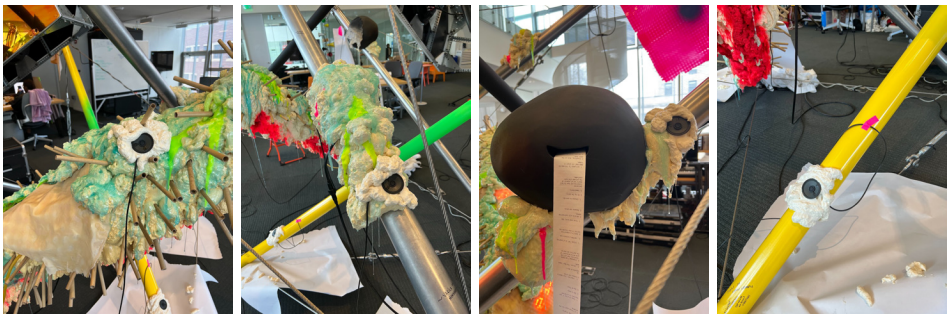

Figure 87 *Speaker placement in installation.*

1. Flutes: Hey you! Take a flute and communicate through it.
2. Transducer: Try to listen with your whole body. Bring your skull, bones, hands, and membranes close to the tube.
3. Smiling Blob: Interpret these text scores as your personal guide. If you want, share it with others. If you want you can also take it home with you.
4. Bone conduction: Bring your skull, bones, and ears close to the tube and listen carefully. Vibrate, resonate, transduce.

Cañitas Video

A 3.5" small screen with a video demonstrating how to blow into the cañitas to produce sound. This element is embedded in the surface of the Cañitas Vessel and is played on a loop through an external video player with a micro SD card.

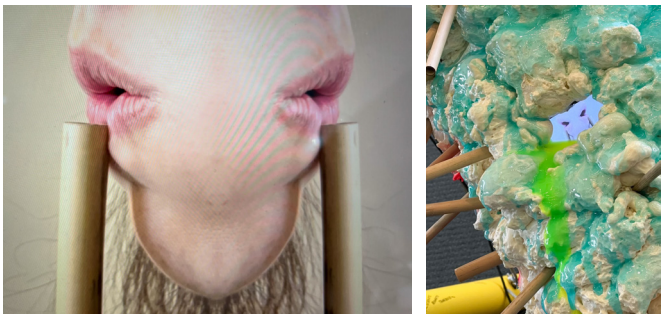

Figure 88 *Cañitas Video screenshot, and installation detail. Photos: Nicole L'Huillier.*

QR Code

A 1.3” mini screen with a QR code that directs to a project description and guidelines. This element is embedded in the surface of the Cañitas Vessel. This QR code is dynamic, so the URL can be updated over time.

Figure 89 *QR code in the installation.*

b. Mapping and Agency

Rather than designing a discrete, 1-to-1 mapping, we focused on creating a system that centers on continuous data and sound in order to develop ambiguously braided relationships between the wind activity, the machine, and the participants. To do so, there are a series of interfaces and frameworks that are implemented in the system in order to explore agency-based approaches for machine responses and interaction. These are centered on mapping strategies for generative text scores and synthesis. The intention behind this is to provide a system that allows us to embrace ambiguity and uncertainty as part of the mechanisms we put in place, so that we can infuse these ideas from the building blocks of the constitution of the experience itself.

Throughout the processes that are being carried out for the translations and transductions in this work, we set ourselves the objective of exploring the sculpture as an active agent rather than a passive medium. This objective provided the foundations for giving away full control and for opening up space so the machine could move beyond our original intent and by doing so, yield surprising and unexpected results. The intention was to provide the machine with a simple yet lively way of improvisational autonomy so it can be an active participant in the experience. This way, the machine embodies an aleatory and erratic behavior that introduces uncertainty and ambiguity into the exchange. These intentions and implementations induce the machine to become less like an instrument, which one can learn to control and play at will, and more like a respondent that can be engaged by a call. All of these intentions raise questions related to how participants might perceive (or not) the machine's autonomy and improvisation during the experience of the installation. Throughout these processes we are looking to explore these questions in action, hoping to have set the grounds so the ambiguity that the system provides would stimulate more questions and explorative exchanges as the sculpture unfolds as a consistently active yet unpredictable respondent.

The system analyzes characteristics of the sonic environment (inputs) in real time to generate sonic responses (outputs). So during the encounter between the machine and the sounds around it—whether these sounds are made by humans or nonhumans, and come from either the indoor or outdoor space—an emergent improvisatory dialogue occurs. The outputs produced by the machine can't be fully predicted, but aspects of them can be learned through this dialogue. Our primary interface/framework, the Modular Playground, was created and implemented to converge and organize the different operations. A higher order Markov chain for Co-composing Text Scores was also created within the Modular Playground. Finally, we implemented a custom Max MSP user interface with Corpus-based Concatenative Synthesis to generate the machine's sonic responses.

Before reviewing each part in detail, I would like to clarify that even if we accomplished the main objectives, this is only the first step into a whole universe of possibilities and complexities. The system is ambiguous and (successfully) hard to control. So there is still a lot of work and fine tuning to do in order to achieve better results and to provide more interesting and intricate interactions. This is an ongoing process and remains an open question. Every performance and installation iteration will provide the opportunity to learn more about the system and how to expand or explore further its full potential. Another important thing to mention is that this system is not a fully autonomous intelligent system, nor is it calibrated and deployed to be highly controllable; this work is not centered on tackling those challenges. This system—as any machine—contains, represents, and is limited by my initial ideas, capacities, and biases. This way the system ended up being simple and sloppy, yet effective. This piece is about sonic relationality and exploring ways of emergent autopoietic encounters through sound, and this system serves its purpose by responding to perceived sounds as it produces emergent sonic outputs.

i. Modular Playground

The Modular Playground is a scalable, beginner-friendly Python framework for audio and data routing on a clock. Through a familiar but expandable syntax, it supports parallel operations such as OSC communication, audio to data conversation, parameter modulation, and different input-output processes between Max MSP, Ableton Live, and Arduino. The Modular Playground provided us with a way to converge and organize all these processes. Through the Modular Playground, we are receiving and processing the data from *La Orejona*, the Vibrational Membrane Microphone; generating the text for the Smiling Blob's printed messages; as well as routing all the data and sounds. For the structure it provides in rapidly building modules to route and process data across systems, it can be easily integrated for a wide range of future work.

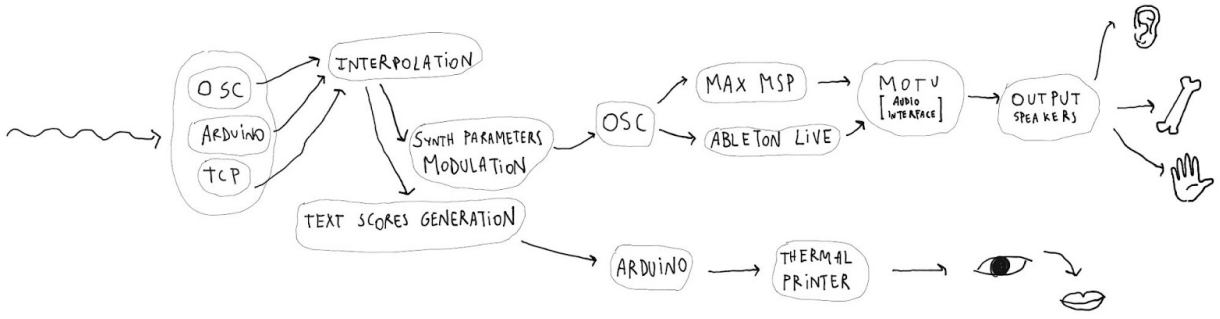

Figure 90 *Modular Playground Diagram. Nicole L'Huillier. Based on Jessie Mindel's diagram.*

Connecting Modules

The Modular Playground's core is a tree of connected modules, down whose branches data is propagated on a clock in topological order. Any two modules ("in_module" and "out_module") can be connected using the "connect(in_module, out_module, edge_name)" function, where "edge_name" is a key used to refer to the connection (or edge) in a dictionary of connections. Two types of connection are possible:

1. "in_module" is treated as one of (possibly) many main inputs to "out_module", and receives new data on every tick.

2. "in_module" is treated as one of the parameters in "out_module"'s constructor, and can be accessed via a helper function at each clock tick. If no value is present at that tick, the value defaults to the parameter passed into the constructor originally. This kind of connection is instantiated as an "EdgeParameter" and the edge name is prefaced with a period (e.g., ".data") for semantic clarity.

Not every connection needs to return data at every tick. If a connection has no updates, it might pass "None" to its children. This is handled on a per-module basis; the system was designed to accommodate different design patterns, such that "None" might (but needn't) be used to ease the development of temporal logic (e.g., for a sample and hold or gate module).

Design Decisions

We designed and developed the Modular Playground with simplicity, approachability, and scalability in mind. This led to a few central design decisions:

1. The syntax should be easily legible, reading more as a specification than a piece of code. For users who do not need to create their own modules, we did not want programming literacy to be a requirement. To facilitate this, we designed the framework to minimize how much users would need to learn by minimizing the number of user-facing components, and choosing simple names: constructors for creating modules, edge parameters, the "connect," "connectInput," and "connectOutput" functions (the latter two of which are only used for modules that are at the root or leaves of the tree), and very occasionally, "connectEdges" (used to explicitly declare connections for "ParallelModule," which execute the same operation on multiple sets of connections). Although the Modular Interface does not have a GUI, it often reads as a series of textual connections.

2. We created a basic set of modules upon which future users with prior programming experience might build, including utilities for simplifying parallel operations, control flow, arithmetic, inline functions, and temporal logic. For users who do not have prior programming experience, the current selection of modules may be enough to route and process their data as desired.

3. Our design was inspired by that of Max MSP (interconnected data- and audio-rate modules that exchange signals). It is meant to supplement, not replace, its functionality: the Modular Playground serves as a simple place to prototype and aggregate connections across software and hardware components (e.g., a webserver to Max, Live, and Arduino, as was the case for our pipeline). Although it has support for audio-rate signal processing, such support is minimal; we found that the system's latency, given that it runs on Python, was too high to support such operations. As such, it acts primarily as a hub for routing data-rate signals across separate systems, or performing operations on logic global to one's system.

A Summary of Modules

We briefly discuss the Modular Playground's current set of modules below.

Inputs

Input modules are root nodes in the Modular Playground's tree, and provide data to the pipeline. The included inputs are capable of reading data over OSC, from an Arduino's serial, or from a CSV file. We have also included generator modules, which generate values at each tick, e.g., a random number generator, a constant, a repeating sequence, and a gated input which adds values to a buffer periodically.

Outputs

Like the Modular Playground's inputs, its outputs are built to connect multiple external systems. It currently supports OSC, MIDI, Arduino serial, and CSV output.

Data-to-Data

The majority of the Modular Playground's processing is data-rate. We created a few modules for data-rate processing, including modules that perform basic arithmetic, linear interpolation and normalization, and list operations (e.g., flattening and slicing).

Control Flow

The systems we built using the Modular Playground had little need for digital logic; they were instead more analog, using the ranges set for interpolation and normalization as logical parameters (e.g., increasing the intensity of a timbre or the coherence of the Smiling Blob's messages, rather than enabling or disabling a timbre altogether). As such, the only necessary modules for control flow were focused on temporal logic. Examples include a timed gate, a sample and hold, a latch that remains high or saturated for a given interval, and an accumulator.

Utilities

To ease the development of modules, we built a series of utility modules and helper functions atop which to build further modules. These include base modules for managing parallel operations (thereby making it easier for a developer to create one module that does the same thing across multiple input-output edge pairs), managing edge-specific outputs (outputs that differ per named edge), and anonymous modules (for quickly creating a module based on a lambda/arrow/inline function); and functions for retrieving only the most recent part of a module's input history, and instantiating a module that reads from a specific OSC address.

Audio-to-Data and Data-to-Audio

Although its latency presents a challenge, the Modular Playground uses Pyo to provide audio-to-data and data-to-audio modules. These read to and from buffer tables for a given buffer size (sample window), and produce either Pyo audio streams (data-to-audio, but often with artifacts from aliasing given latency) or a buffer of data that is gradually inserted into the Playground's pipeline to be passed to the module's children (audio-to-data).

Specialized Modules

Some portions of our system were more effectively and quickly implementable in Python than in C or Max MSP, such as the n-grams algorithm that generates the Smiling Blob's messages. For these portions, we wrote specialized modules in the Modular Playground that were specific to this installation: "NGramModule" (the n-grams algorithm modulated by parameters sent over OSC), "ListNormInterpolateModule" (for linear interpolation along a list of values with jump discontinuities), and modules for converting the accelerometer's data into a usable bundle.

Extending the Playground

The process of creating a new module is also meant to abstract away as much detail as a user with less programming experience might desire. To create a new module class, one can extend any base class that extends "Module." Then, for most modules, only the constructor and one lifecycle method need to be extended:

1. The constructor should store any necessary parameters.

2. The "step" function should apply some logic to the inputs, stored in as a dictionary "{ parentEdgeName: Array<any> }" that contains each parent edge's history, and save it to the module's "history" buffer (an array for "Module"s and a dictionary of arrays indexed by edge names for "MultiOutputModule"s and "ParallelModule"s) by using the "storeStep" method. For a "ParallelModule," this can be done easily using the "ezStep" method, which applies the same operation to input-output edge pairs.

3. Other lifecycle methods that can be extended include "stop," used for cleanup when the Playground is terminating, "onAudioCallback," used for hooking into data from an audio-rate stream from Pyo, "init," used for any initial setup that occurs immediately after the *Playground*'s tree structure has been created, and "onConnect," which is called whenever the host connects the module to another module.

4. Many other helper methods are included to ease the development process, and are documented in the "module.py" file.

ii. Corpus-Based Concatenative Synthesis (CCS)

Corpus-based concatenative synthesis[218] is a method of synthesis that compares inputted snapshots of sound (or any control signal) to a large database of signals to find similar moments. It allows an inputted signal to control which part of the output dataset is played, creating a nonlinear playback of the database. This is used in this system to establish a sense of call and response between the participants and the machine, mimicking inputted singing, cañitas playing, touching, etc. with chains of sound that are slightly delayed and at times can be unexpected and chaotic.

[218] Many thanks to Nikhil Singh for lending his support and knowledge in building this system.

To do this, we built a Max MSP patch where we uploaded a series of samples to build our audio corpuses for outputting sound. Once we have our samples, the system analyzes them in order to identify pre-assigned descriptors. These descriptors consist of a series of audio features that can be identified in a signal. There can be a large set of audio features for sound description, as these are commonly used in speech recognition systems as well as for classification and taxonomy of sounds and instruments. The descriptors we are using were created at IRCAM[219] by the Analysis/Synthesis Team, and they can be selected in Max MSP through a drop-down list. For each corpus we can assign three descriptors; as a starting point we have been working with Total Energy, Inharmonicity, and Fundamental Frequency. These descriptors can be changed and calibrated to produce different results depending on the corpus that is uploaded, the types of incoming signals, and the acoustics of the space of the installation, to name a few elements that might change it. The signal features corresponding to each descriptor are analyzed in real time in the audio input coming from the Flags/Listening Membranes within the installation. Everytime sound is inputted through the Flags into the system, that signal will be analyzed and matched to moments of the corpus that have similar characteristics, outputting that sound in response. This is done by using k-nearest neighbor search.

This methodology was implemented so the system can create its own set of dynamic responses to the sounds in the installation's environment whereas they are created by the participants or by incoming outdoor sounds from *La Orejona*, the Vibrational Membrane Microphone. With the corpus-based concatenative synthesis, we are implementing a system that can output sounds beyond a predetermined and static original intent; it provides erratic and fortuitous responses.

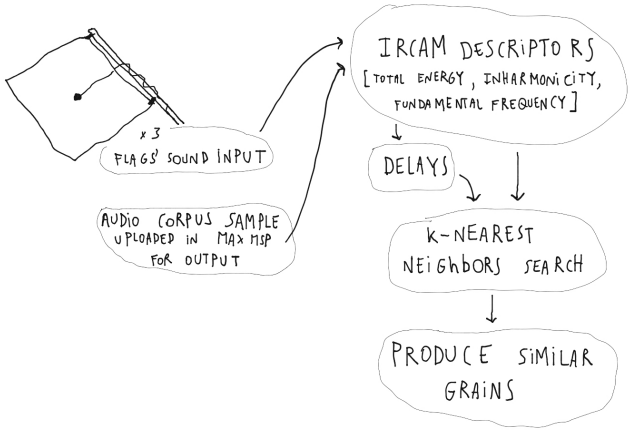

Figure 91 *Corpus Concatenative Synthesis Diagram. Nicole L'Huillier. Based on Jessie Mindel's diagram.*

[219] Geoffroy Peeters, *A large set of audio features for sound description (similarity and classification) in the CUIDADO project* (Paris: IRCAM, 2004).

iii. Patches and Processes

In this section, I provide a detailed description of the processes that are taking place in Max MSP.

CCS Control Panel

The corpus-based concatenative synthesis (CCS) control panel allows one to quickly tweak all CCS-related parameters in the main Max patch. We'll explore each one individually here. The panel can be found by double clicking on the "p CCSPanel" subpatch.

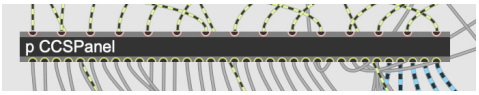

Figure 92 *CCS Control Panel.*

Samples

The system currently has five CCS instances running at any given time. To use one, the first step is to load a sample by dragging and dropping an audio file into the drop file area for the CCS instance to be used. This sample will be used as the output database for the instance that has been chosen.

Delays

Above the samples section, there are five knobs that control how delayed the audio output is for that CCS instance (relative to the input signal). The knob's values range from 0 to roughly 5 seconds.

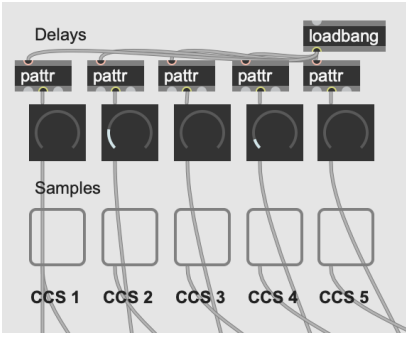

Figure 93 *CCS Delays.*

Grain Parameters

Once the CCS has found a moment in its output database that looks similar to the inputted signal, it uses granular synthesis to prolong and create movement around that moment. The grain parameters allow you to change the envelope shape of each grain played by the granular synthesizer: the columns represent CCS instances (with one column called global that changes the parameters for all instances), and the rows represent three different parameters (duration, attack, and release) for the envelope.

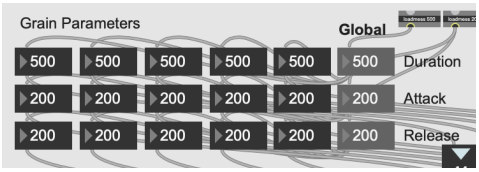

Figure 94 *Grain Parameters*

Input Sources

The main area of the CCS panel is for routing. Two to four inputs are available for each signal of the three Flags. Each input represents either a filtered version of that signal or an IRCAM descriptor for the signal.

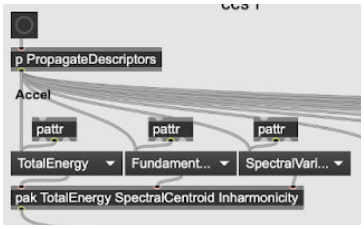

Figure 95 *Input Sources and descriptors.*

The IRCAM descriptors can be used to generate the control signals for each input using the dropdowns. Then, the bottom left outlet of the control panel ("Norm") beneath each input can be used to route that input to an output (by connecting that outlet to the left inlet of the control panel titled "Gauss Rand"). Each input can be used for multiple outputs.

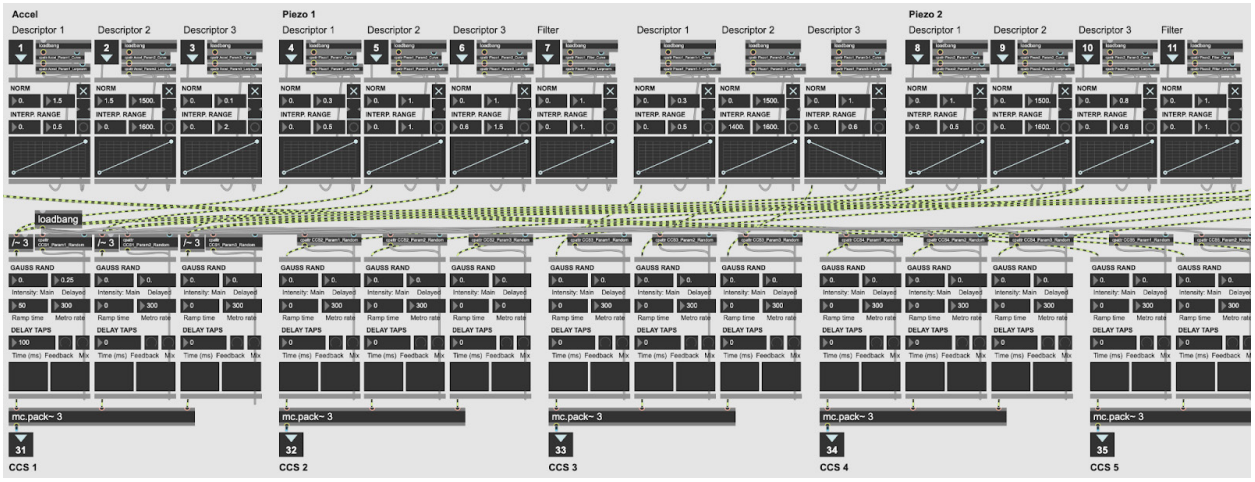

Figure 96 *Input Sources and descriptors routing and control.*

There's also a manual input with three channels which allows you to choose (in the right column) the scale for each channel and the value between 0 and that magnitude (the sliders to the left), and a constant 0-valued signal.

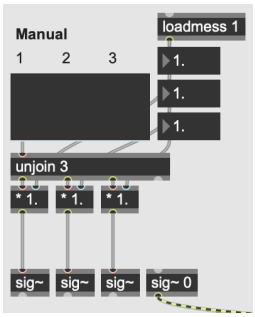

Figure 97 *Manual Input.*

Interpolation and Normalization

Under each input source is a normalization and interpolation block. The "Norm" section normalizes the input between two values (e.g., if min is 1 and max is 5, then a signal with value 2 will be normalized to (2 - 1) / (5 - 1) = 0.25). Under "Norm," the left float is the minimum value for the range, the right float is the maximum, and the toggle determines whether or not the normalization should be strict (e.g., if the

range is 1 to 5 and the inputted value is 6, normalization would yield a value larger than 1; if strict is true, then the value is clamped to 1). The normalized value can be seen in the meter just below the toggle.

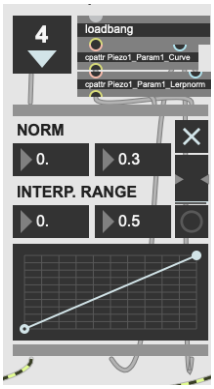

Figure 98 *Interpolation and Normalization.*

The “Interp. Range” section is for interpolating using the normalized value. The left value is the value to which 0 should map, and the right value is the value to which 1 should map. The left value can be greater than the right value if desired for an inverted mapping. Then, the function below the float inputs is for determining the interpolation function in more detail. For example, if you’d like an exponential mapping, you can simply add a convex curve. If you’d like to reset the function to a straight line from 0 to 1, you can press the button at the top left of this section.

Figure 99 *Gaussian random.*

Output Channels

Once an input signal is configured, it can be routed to any of the 15 output channels (three parameters per CCS instance). For each CCS instance, each parameter gets compared to a desired IRCAM descriptor for the output database. The three IRCAM descriptors used for the output can be set in the same way as those for the three inputs, pictured to the right. In order to connect a signal to a given output channel, it must be connected to the left inlet of the "Gauss Rand" block above it.

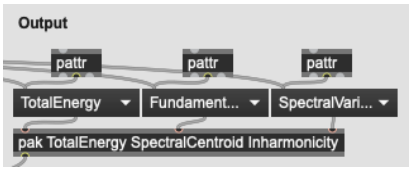

Figure 100 *Output channels.*

Gaussian Randomization

Each output channel is equipped with a little bit of chaos: an object that adds a slightly random transient to a given signal. The module acts as a combined Gaussian randomizer and delay. When used in tandem, the two effects create transients that become increasingly random with each delay tap, almost like a random walk. This is used to further augment the sense that the machine has some small degree of agency.

The "Gauss Rand" section is responsible for randomizing a Gaussian distribution. Turn up "Intensity: Main" to increase the amount of randomness that's added to the inputted signal, or "Intensity: Delayed" to do the same for each iteration of the delayed signal. "Ramp Time" creates a smooth interpolation between the inputted signal and the added randomness (to avoid clicks), and "Metro Rate" determines how often a new random value is selected (300 by default). A fast rate and fairly high intensity can create almost a strumming effect.

The "Delay Taps" section adds delay. The delay time can be chosen with "Time (ms)," the amount of feedback (between 0 and 0.99, so that it doesn't oversaturate) with the "Feedback" knob, and mix in the signal with "Mix" (off by default, so that no delay is audible).

CCS Patch

The main CCS patch can be found inside of the [corpus-concat bufferName] object. It takes 7 inputs:

1. (list) The parameter values, given (usually) as floats. These are generated and packed by CCSPanel's processing.
2. (list) The names (as strings) of the three IRCAM descriptors that should be used to process/generate the output database.
3. (list) The weight of each parameter (as floats). These can be used to change the importance that the engine places on one IRCAM descriptor/input signal vs. another.
4. (string) The path to the file that should be used as the audio sample for the output database.
5. (int) The duration of each grain in milliseconds.
6. (int) The attack time of each grain in milliseconds.
7. (int) The release time of each grain in milliseconds.

Using IRCAM's MuBu library, the CCS engine works by first processing the sample file (so that it can identify the value of each IRCAM descriptor at each moment for later comparison with input signals), and then using k-nearest neighbors search to find the moment in the output for a given descriptor which is most similar to the inputted signal (the control signal). [read $1 @name audio] loads the file, [mubu.process] handles the file processing with the desired descriptors, and [mubu.concat~] is the granular engine that stitches moments found by [mubu.knn] together.

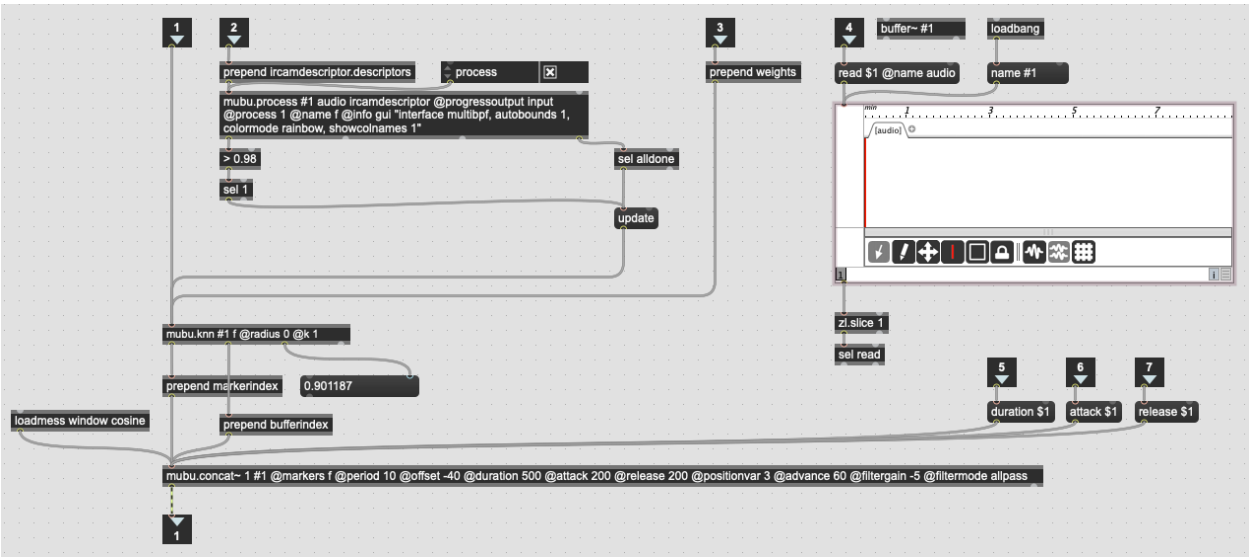

Figure 101 *CCS Patch.*

Other Max Control Panels & Routing

The main patch offers many controls apart from those used for corpus-based concatenative synthesis. Some are more temporary than not, but may still be useful in experimentation and understanding the functions and operations of the patch.

Routing

The main patch draws from two external inputs: an OSC server on port 7400 (currently run by the Modular Playground), and a set of 8 audio inputs (made accessible through [mc.adc~]) from the Motu Audio Interface. These inputs can be rerouted to any other part of the patch, or new inputs can be added. At the moment, the first three audio inputs are used to stream audio from the three Flags, and the incoming OSC bundle only contains the filename of the most recently retrieved sample from *La Orejona*, the Vibrational Membrane Microphone.

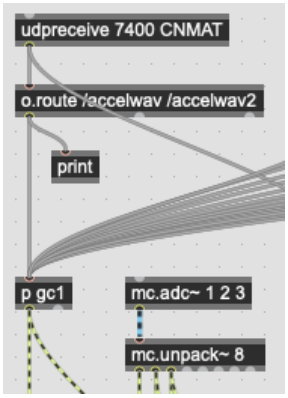

Figure 102 *Routing.*

At the bottom of the patch is an [mc.pack~] object that's responsible for routing each audio signal to an audio output. The system uses BlackHole to create virtual outputs, such that an output from Max MSP can easily be routed to Ableton Live, to the Motu's outputs, etc., when BlackHole is used as an input device in any other program. Some outlets are simply passthrough from the Motu so that the raw audio signals can be filtered in Live.

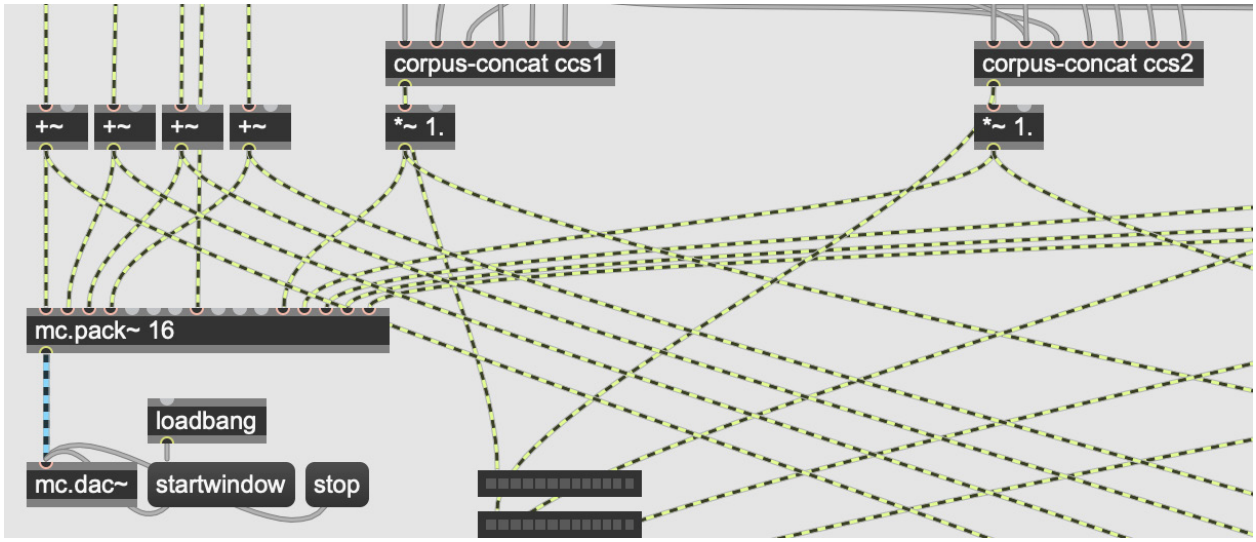

Figure 103 *Routing Inputs and Outputs.*

All data outputs are routed back through OSC over UDP sockets on port 7403 so that the Modular Playground and Live can use any information generated in Max.

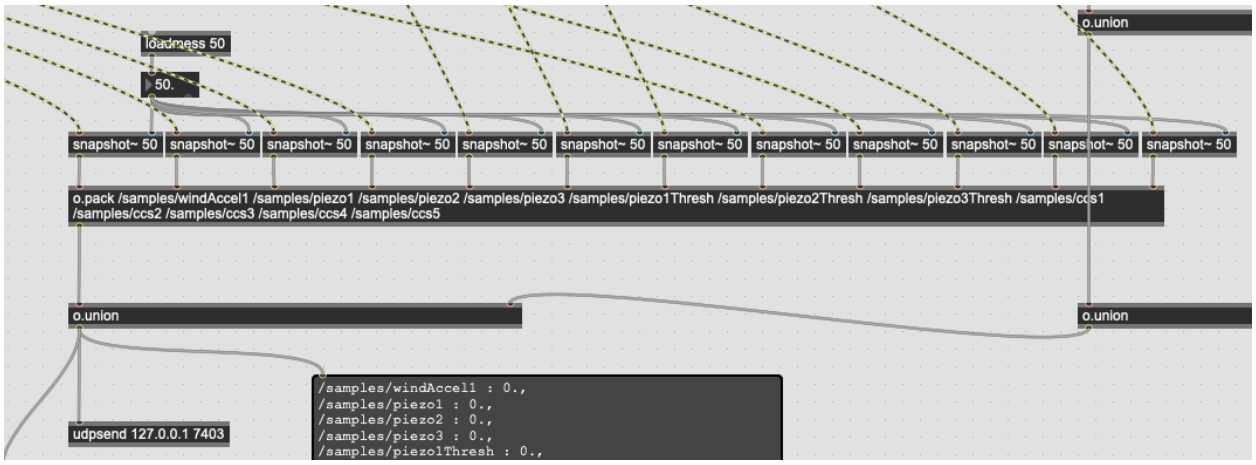

Figure 104 *Data Outputs Control.*

For all of these inputs and outputs, additional items can easily be added.

Filter Panel

Each input signal from a Flag is filtered through [filter-piezo]. The parameters for filtration can be determined using [p FilterPanel], which has five parameters, described below.

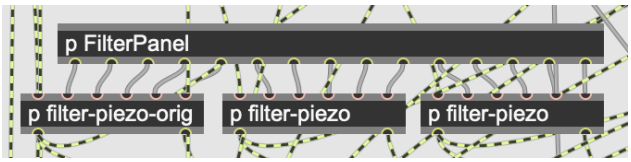

Figure 105 *Filter Panel windows.*

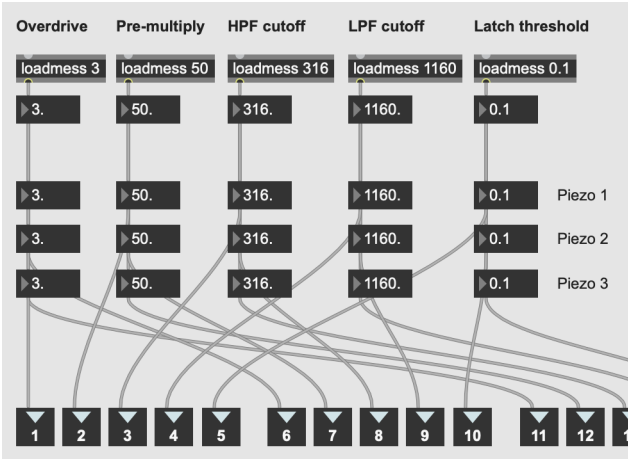

Figure 106 *Filter Panel.*

Overdrive

The signal is pre-amplified (adding a bit of saturation) to ensure that the quieter high-frequency range (which is where most voices seem to lie) will still be audible after filtration. This controls the gain of an [overdrive~] at the start of the chain.

Pre-Multiply

The signal is further amplified (without distortion) with a [~*]; this determines the constant by which to multiply the signal.

HPF Cutoff

After amplification, the system keeps higher frequencies using an [svf~] with the frequency specified as the cutoff. (This also rolls off the DC gain.)

LPF Cutoff

A low-pass filter is then used to roll off any high-end noise, with the parameter determining the filter's cutoff frequency.

Latch Threshold

[max-latch~] acts somewhat as a sample and hold. If the threshold passed in for this parameter is crossed, then the system will output a 1 in its second outlet for 500 ms. By default, this threshold is 0.1.

PIPO Input Analysis

Each of the three inputs (Flags) is analyzed to retrieve three IRCAM descriptors per input. The desired IRCAM descriptors are set in CCSPanel. Analysis occurs in an object called [pipo-analyze-input], which takes one parameter: the OSC/o. address into which to bundle all of the information produced by the analysis. It then outputs three signals (one per descriptor) and an o. bundle containing that information (to be sent to the Modular Playground).

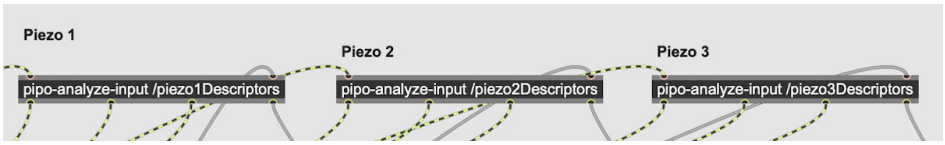

Figure 107 *Pipo Inputs.*

UI Panel

This panel is mostly temporary, but is a good place to add any other parameters which should be sent to the Modular Playground; it's already connected to the required infrastructure for sending data over OSC. At the moment, it sends five parameters to the Modular Playground: the minimum value of *La Orejona* (/ui/accelMin), the maximum of *La Orejona* (/ui/accelMax), a list of values that determine the MIDI mapping for the sub-bass (which is currently not used) (/ui/subMidiRangeKeyPoints), and the minimum

and maximum weight of the knitting text corpus (which is currently not used) (/ui/minKnitWeight and /uiMaxKnitWeight).

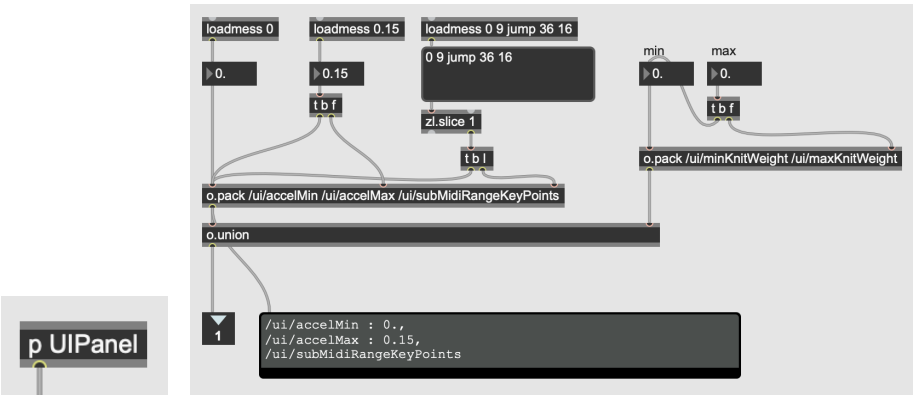

Figure 108 *UI Panel.*

I'll briefly discuss the syntax for the list in /ui/subMidiRangeKeyPoints (the other parameters are simpler). The list dictates a series of key points that define a desired function. So, if a value between 0 and 1 (a normalized value) is inputted, then the list determines the y values for that function. A list can contain numerical values and the word "jump." If there is no "jump" between two numbers, then a smooth gradient/line will be generated between those values. If there is a "jump" between two numbers, then the value will jump between the first and second numbers in that pair rather than moving smoothly between them (think of a jump discontinuity in a function).

Granular Crossfade

Samples from *La Orejona* don't come in quickly enough. In order to combat this issue, we use a granular synthesizer that prolongs each sample it receives until the next one is ready. At the top left of the patch is an octopus-like configuration of parameters that control the granular synthesis engine implemented for the crossfade.

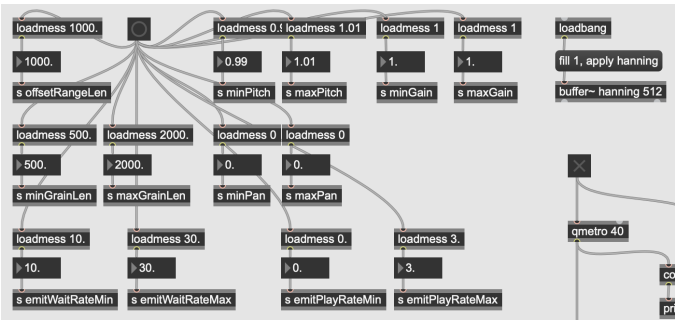

Figure 109 *Granular Crossfade.*

Offset Range Length

Imagine a playhead scrubbing along the length of an audio file. As the playhead continues to move linearly, the engine selects samples from the audio file that are at or around that index in time. The size of the range centered around the playhead from which the engine can choose samples (which it plays as grains) is called the offset range length and is given in milliseconds (the default is one second).

Grain Length

The length (duration in milliseconds) of each grain that the engine emits. This is randomizable by setting minGrainLen (the minimum length) and maxGrainLen (the maximum) to different values.

Pitch Variation

The engine can slightly randomly detune/repitch each grain. Both the minimum and maximum are written as decimals representing percentages. A value of 1 means no repitching; the range [0, 1) yields lower pitches, and anything above 1 yields a higher pitch.

Gain Variation

Operates in the same way as pitch variation, but for gain.

Pan Variation

Operates in the same way as pitch variation, but for panning (below 1 is left, above 1 is right).

Emit Rates (and their variation)

The emit rate is the rate at which new grains are selected and played. There are two emit rates that you can customize: the rate when the engine is linearly playing a sample it received (play mode), and the rate when the engine is waiting for a new sample to come in (wait mode). During play mode, the engine isn't reliant on grains being emitted to play back the sample in full, so any grains that it emits will be played on top of the sample (possibly a moment just before or just after the current index). This can be handy for making the transition between *play* mode and *wait* mode a bit smoother, but that depends on one's tastes. In contrast, in wait mode, only the granular synthesizer is active, so a higher emit rate is necessary. The minimum and maximum rates can be set independently for each mode: emitWaitRateMin and emitWaitRateMax for wait mode, and emitPlayRateMin and emitPlayRateMax for play mode.

Silence / Mute

It is possible to fill the granular crossfade engine with an empty buffer (so that it stops playing for that moment), by clicking on the [silent.wav] message.

c. Sound Design and Corpuses

Membranas provides a characteristic sonic environment constructed by the sounds that come from *La Orejona* and the audio corpuses uploaded to the Corpus-based concatenative synthesis (CCS) database.

The first element, the sounds coming from *La Orejona*, set the foundations of the installation's soundscape. As an organizing principle, there is a constant drone, which corresponds to the full sonic spectrum of *La Orejona*. This vibrational membrane microphone has a constant layer of noise that is diffused in the structure through the suspended black tube. This noise comes from the low resolution sound from *La Orejona* as well as from its constant motion; however subtle its movements, the membrane is never in absolute stillness. Both of these elements contribute to its constant, diffuse, droney sound. This bass sound is also modulated by the installation—as the sound bounces inside the tube, it is filtered by the tube's elongated resonant chamber and infused with shiny and bouncy reverberations. Another element to consider is the way that this tube crosses the installation from one point to another, meaning that the sound is also spatialized through it, and because the tube is suspended, this sound is less contained than it would be in a fixed tube, allowing it to become more central in the installation space. This drone is the most consistent sonic element of the installation. It is sporadically accompanied by other sounds coming directly from *La Orejona*, as the wind and other vibrations interact with the membrane microphone. These

incoming sounds can bring other frequencies into the installation space, but are still very low-resolution and textured sounds, which are always coupled with the constant drone and diffused through the same speaker organ. Finally, there is another layer that also comes from *La Orejona*, corresponding to its low frequency section, which is diffused through the subwoofer organ. This sound is a loud, low-frequency rumble enhanced with a deep, thunder-like roar coming from the vibration and sound of the subwoofer's external membranes.

In addition to the sounds coming from *La Orejona*, the CCS used for the machine's responses completes the installations' sounds. For these, a series of audio corpuses were selected and implemented in the system so the machine could have a base material from which to draw its responses. As described in the previous section, the CCS was implemented with the intention of providing a way for the machine to generate responses in relation to the input sound signals. These responses are not always the same and are hard to predict, since the logic behind them is organized by a series of audio descriptors that are themselves hard to predict and control. This means that the machine responses are indeterminate, even if the audio corpuses are predetermined. One important thing to note is that because the CCS system is hard to predict, the process of constructing the corpus database was in itself a very involved process of trial and error. At first, I had an idea of what corpuses to use, and once they were loaded into the system, they yielded very boring results. The implementation made it hard to predict the right corpus, as a combination of factors (calibration parameters, the input signals, the descriptors being used, and the audio corpus itself) also made it hard to predict the results. Once we started to get a better sense of the calibrations, however, we were able to begin testing different corpuses and playing with the system to explore possible results.

The initial and main intention behind the corpuses was that these sounds come from *Surlogical* sonic events based on winds. This was a way to invite the wind into the machine both as an entity and as an instrument. Initially, the corpuses were constructed with short samples of Andean flutes and whistles.[220] However, these did not work well, as the outputs were very linear and not interesting. It made sense, then, to include longer and more varied corpuses. I then made an audio track with many samples, but still the results remained basic and monotonous, since the initial track was not very dynamic. This made us realize that even if we couldn't fully predict the outcomes, and even if we tried to construct corpuses with different sounds, the descriptors that are analyzing the corpuses were more complex than that. So we ended up testing recordings from old performances and flute ensembles I had been part of. This yielded

[220] I recorded these myself with my own collection of flutes and cañitas and a small collection of whistle resonators made by my dear friend and collaborator, Chilean archeologist, ceramist restorer, and musician Francisca Gili.

interesting outputs. The sounds in these corpuses, in contrast to the previous ones, were varied in terms of dynamics and consisted of complex and saturated interwoven flutes, such as the ones previously described in this dissertation when referring to the *flauta colectiva*.[221] In addition to this corpus, I created a series of long corpuses with different wind sounds that I had recorded through the process of prototyping the membrane microphones for this work, wind recordings that I had done some years ago in the Atacama Desert in Chile, and a set of "imagined, remembered, or simulated" winds produced by human voices imitating the sound of the wind.

An interesting part of this process is that in spite of having predetermined corpuses, the sounds that are output are strangely hard to identify in the original corpus. So for me it was important to have a conceptual and sonic intention behind the sounds given to the machine. Even so, the results were barely within my control. Also, the machine as it produces the outputs modulates the sounds and gives them "electronic" characteristics; weird, glitchy elements appear that make the sound the installation's own. Somehow the machine took the initial corpuses, which were purely acoustic and environmental, and output sounds that kept some interesting timbral and textural elements from the corpus but balanced them with other peculiar elements. This set of corpuses and operations is what gives *Membranas* its unique sound. At the moment, the sounds are interesting and unpredictable, but still there is not an enormous amount of variation. It would be fascinating to explore further ways of making this system even more autonomous—for example, by enabling the possibility of a dynamic corpus. This would be a way of providing an initial intent, but allowing the sound to change and evolve away from my initial conceptual and aesthetic intention. I will discuss this further in the Future Work section in the Outro.[222]

[221] The *flauta colectiva* translates to *collective flute*. This is a concept proposed by Chilean ethnomusicologist José Perés de Arce. For a complete discussion on this concept, please refer to page 112 of this document.
José Pérez de Arce A., "La Flauta Colectiva: El uso social de flautas de tubo cerrado en los andes sur," in *Música y sonidos en el mundo andino: flautas de Pan, zampoñas, antaras, sikus y ayarachis,* ed. Carlos Sánchez Huaringa. (Lima: Fondo Editorial de la Universidad Nacional Mayor de San Marcos, 2018). p. 51-116.
[222] Please refer to page 214 of this document.

Outro

Figure 110 *QR code for audio Outro, Conspirando, Esccuchando y Cuchicheando. 0'58". I recommend listening with headphones. The file can also be accessed at this link: http://nicolelhuillier.com/outro/ (Accessed: 04-13-2022*)

a. Conspirando, Escuchando Y Cuchicheando

The teller of tales | La Contadora[223]

When I'm walking, everything | Cuando camino se levantan

on earth gets up | todas las cosas de la tierra

and stops me and whispers to me, | y me paran y cuchichean,

and what they tell me is their story. | y es su historia lo que cuentan.

[223] Gabriela Mistral, "La Contadora / The Teller of Tales," in *Selected Poems of Gabriela Mistral: Translated by Ursula K. Le Guin*, trans. Ursula K. Le Guin. (Albuquerque: University of New Mexico Press, 2003) p. 387-391.

Membranas is envisioned as a continuous experiment for resonant call and response encounters. With this in mind, up to this moment, it has been presented in two different settings: as an installation demo and as a performance. Both have taken place in the Opera of the Future research lab, in the MIT Media Lab, the space where *Membranas* was created.

i. Installation/Demo

For the installation demo, *Membranas* was presented to the Media Lab's members, who visited on April 12th, 2022 for an open house. This proved to be the perfect occasion to finalize and set up the installation. It required calibrating the system (sounds and interaction) in detail and finishing the implementation of the mediation elements (such as speakers that invite participants to engage in specific actions). This event also provided the opportunity to test out the system for many hours of continuous operation and to observe the interactions with and responses from many participants. Most importantly, during this performance, I had the chance to observe how different people engaged with *Membranas*. One of the key things that I noticed in this setting was that people relied on my explanation before engaging with the piece. This may have been due to the type of event, where things are usually explained to the visitors. Another thing that I really appreciated about this experience is that after a few hours of communicating what *Membranas* was and how it worked, I got to a point where the iteration helped me polish the explanation so I could do it in a concise yet complete way. It helped me to identify and highlight the key elements of the installation, instead of trying to monitor and explain every single detail and stream in the system. Thanks to this experience, I better understand *Membranas*.

As people engaged with the installation, one thing that proved to be extremely helpful was the "Instruction Choir," the four speakers that provide guidelines for certain elements of the installation. This mediation tool worked perfectly and signaled to the participants that there were specific things to do or pay attention to. Also, as the speakers that diffuse the sonic instructions are placed in strategically protagonistic places, even if they are not playing, people got close to them out of curiosity in case there was a soft sound they were missing. This way, they became focal points that caught people's attention and highlighted certain elements that would otherwise have gone unnoticed. I also realized that people are really into playing cañitas. I thought they would have been less inclined to do so, considering the context, and that these instruments are less common in Massachusetts than in the South. But visitors were curious and many asked for a small demonstration of how to play the cañitas properly. This also showed me that once you show people how to do something, they most likely will engage in it. A similar thing occurred when I told (and showed) the visitors that they could change their bodily positions and explore the

structure in order to find sounds and listen differently to the speakers placed in the tubes and the transducers installed across the structure. It was great to observe people kneeling down, touching things, or moving around the structure in order to listen differently, to engage with the different pockets of sounds while moving their bodies. Some people did not need to be told to engage in these actions; just by seeing others doing so, they became curious and copied the actions to unveil the secrets of the system.

As for people's engagement with the work, the experience was varied. Some just gave a quick look, maybe asked a few technical questions about the system, and then continued their Lab tour. Others devoted more time to listening carefully to some elements and taking pictures of the different components. Finally, there was a third group that was really taken by the work and spent time with the installation, in order to explore its multiple parts, as well as playing cañitas, coming back to me for more questions, asking me to play with the machine, or even to talk further about how the idea came about, and to go deeper into the structural themes, references, and theories behind the work. While this may sound obvious, it evidenced to me that, as with many other works, there will be people with different engagement levels, time, interests, and emotions. The work then has to accommodate a diverse crowd, by having elements that can communicate at different scales. For example, always having a way of communicating an immediate and simple message is important, as are elements that can provide deeper layers for more prolonged experiences. For this occasion, I was present and able to rapidly communicate a brief introductory message. Eventually, this could be done by a short wall text, and/or audio message that greets the visitors. One thing that I would like to do for a future installation that provides wall space for intervening, is to create a mural with audiovisual elements that accompanies the installation. As a map of sorts, it could contain images, small videos, and tiny speakers with snippets of sound to tell the story of *Membranas*, highlight how the elements are vinculated, and schematically and very simply provide information to support the navigation of the piece and its experience.

This installation demo was a wonderful opportunity to test things out, finalize details, and gain perspective from the system and the visitors' behaviors. However, it is important to consider that the participants who engaged with *Membranas* on this occasion were drawn from a specific group that was there in a professional capacity, and the majority belonged to a similar socioeconomic and age group. So the observations and knowledge that I can infer from this moment, even if very helpful, are still partial and limited. Despite these constraints, it was a very insightful and enriching experience.

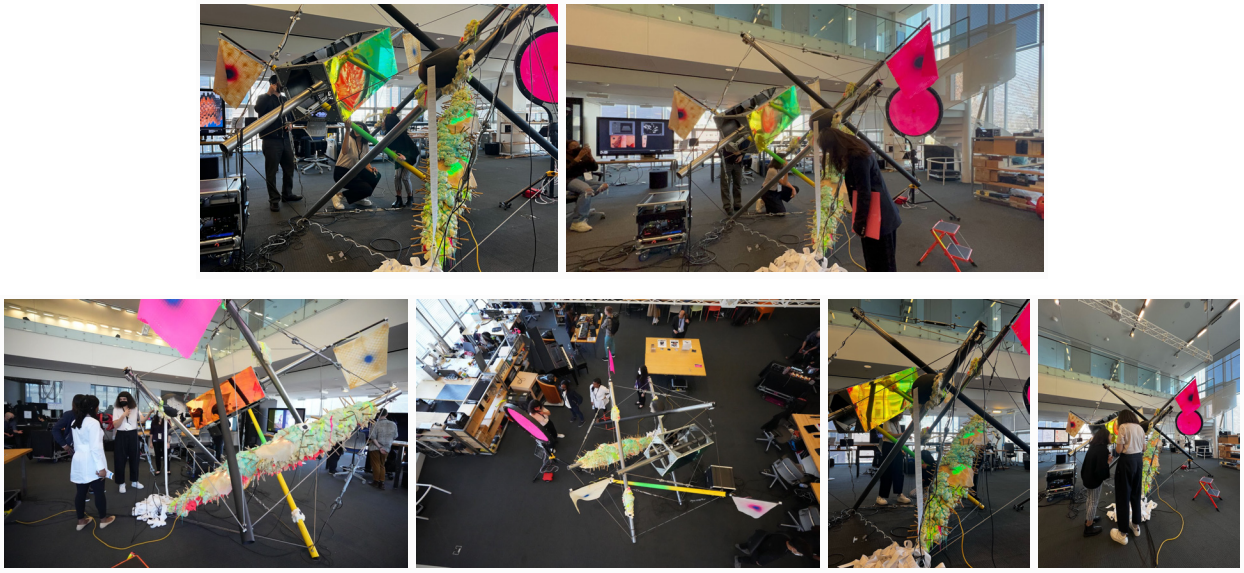

Figure 111 *Pictures during the installation demo at the MIT Media Lab open house, 2022. Photos: (Up) Kimaya Lecamwasam. (Bottom left and center left) David Silverman Photography/DSPics.com. (Bottom center right and right) Kimaya Lecamwasam.*

ii. Performance/Activation

As a complement to the previous experience, I used the opportunity of having finalized the work for *Membranas* to organize a small-scale performance in a more controlled environment and get insights from this different setting. The performance was framed as the first "collective activation" of *Membranas*, which was an invitation extended to a group of about 20 friends and colleagues, not all of whom knew each other. This was an intimate group that gathered in the Opera of the Future space at 6:30pm on April 13, 2022. As people gathered, before the performance started, we had an informal, convivial moment waiting for all the guests to arrive. Once everybody was there, I initiated the performance by standing on a chair away from *Membranas* and reading a text to greet the participants and invite them to join me in the activation. This text was constructed from some elements of the introduction of this dissertation, in addition to some simple explanations and guidelines. This was an invitation to fuzz and activate the system in a collective way. The message was communicated with a solemn and serious emphasis to highlight the significance of this moment for me and *Membranas*, yet with a celebratory, friendly, and affectionate tone. After I read the text, we cheered and I played a cañita in order to show the participants how to do so, then I walked over *La Orejona*, which was placed right next to the *Membranas* structure, and proceeded to initiate the activation.

Since *La Orejona* was indoors for this opportunity, there was no wind to make it oscillate. This kept things simple and allowed me to show all of the components to the participants. Since this was the first activation, it made sense to me to have everything together in one place; on future occasions, the elements can be distributed and move away from one another. In order to activate *La Orejona*, I started blowing wind into it with a handheld fan made out of iridescent/holographic paper. Since the sound takes a few seconds to be transmitted to the structure, it seemed as if the air I was blowing into it was being accumulated and slowly awakening the machine. As it started to make loud rumbles through the subwoofers, I continued to strongly blow wind into *La Orejona*. Then I started singing/making sounds with my voice, and then proceeded to gently touch *La Orejona* before activating it with less gentle percussive hits. At this moment, I suddenly heard the sound of the cañitas. The participants had taken the initiative to join me by playing cañitas and slowly getting close to the structure, timidly activating it with the sound of their flutes. As I joined them with a cañita, and all of us moved close to the structure, *Membranas* responded with force. *Membranas* was activated. We (humans and machine) continued to play in response to each other. It worked! We all engaged in a nonverbal dialogue.

When I invited the participants to come to the first performance/activation, I imagined that it would last around 10 or 15 minutes. It ended up being 45 minutes of emergent continuous sonic engagement. Towards the end of the activation, I realized that I had not planned how to finish the performance, how to signal an end. But organically, things started to quiet down, so I read aloud one of the text scores from the Smiling Blob. I think this shifted people's attention and prompted some of them to lay down and read in silence or softly whisper to each other as they shared some of the texts, while others continued to listen, lay down on the tubes, or play cañitas. At some point, it felt like everything started to quiet down and you could just hear some very faint rumbles from *Membranas* as it quieted down. At that moment, I turned the volume down from the subwoofer amplifier, and the sound progressively softened. This was the end. We all joyfully clapped and celebrated. I was very moved, as I finally got to properly *withness* what *Membranas* was. Somehow, it ended up being what I always dreamed it would be.

During the activation, I even got to incorporate certain things that I learned from the demo installation that took place the day before. One of the key elements that I learned from that experience was to physically engage in actions so the others could follow. So I made sure to carry out these actions during the performance. To do so, I integrated physical "demonstrations" in order to unveil some of the more obscure layers contained in *Membranas*. As an example, I showed the participants how to take cañitas from the Cañitas Vessel, and then how to use them for making sounds, for communicating. This worked very well, since when I had fully entered the call and response, people just followed along without me

needing to tell them to join me. They simply went ahead and took cañitas and made sounds with them. They joined in a very beautiful and unscripted way/moment.

Similarly, during the performance, once the call and response had been running for a while, I started engaging with different elements of the installation, such as putting my head in contact with the elements with transducers, or touching the flags, or feeling the tubes with my hands and body. Then as I moved through the elements, people followed and curiously continued to activate the elements or allow themselves to be activated by them. I loved what emerged at that moment. When the participants got comfortable in the nonverbal exchange, things that I did not anticipate started happening, and it was very moving for me. For example, I saw people group around *La Orejona* and start singing and playing flutes directly to it. I saw people laying down around the printed text scores from the Smiling Blob, and quietly reading texts and cutting them with their hands to take home with them the ones that resonated the most, as a souvenir, as a reminder. I saw people hugging tubes that don't even make sound. Some people stayed for long periods inside the subwoofer box. They mentioned later that this was very powerful and made them resonate—they were mesmerized by the low-frequency drone and became entranced by it. This last interaction was something that I haven't even imagined before.

In addition to me guiding people through my performance and physical movements, Luna (my almost 2-year-old daughter) accidentally did an incredible labor of breaking the ice and intuitively giving confidence to the others. She was completely taken by the performance and was the first to start yelling at *La Orejona*, the first being careless with the structure and just exploring it as if it was a playground, even the first who took the printed texts and distributed the printed paper scroll across the room. I think that her confident and bizarre actions gave the other participants a sense of playfulness and release that might not have happened otherwise.

It is important to mention that this group of participants are also people that I trust and care for. They all knew me in advance and this provided a sense of familiarity, trust, and affection within the room. I am sure that this first activation of *Membranas*—and its success—was highly conditioned by that familiarity. But it makes me wonder whether it was only pre-existent trust and affection that made this shared experience into a meaningful one, or if the experience itself brought up a sense of deeper cohesion among this group. I think it is a mix of both things, and I am sure that on future occasions, the performances/collective activations of *Membranas* will spawn similar yet unique situations. It feels to me like a concert, where sometimes things really crack and make sense and other times, some mysterious element is missing. I intuit that what matters the most is the willingness of the participants to be part of

this experience, and the way that I invite them to engage with the machine, the wind, me, and each other in this emergent encounter.

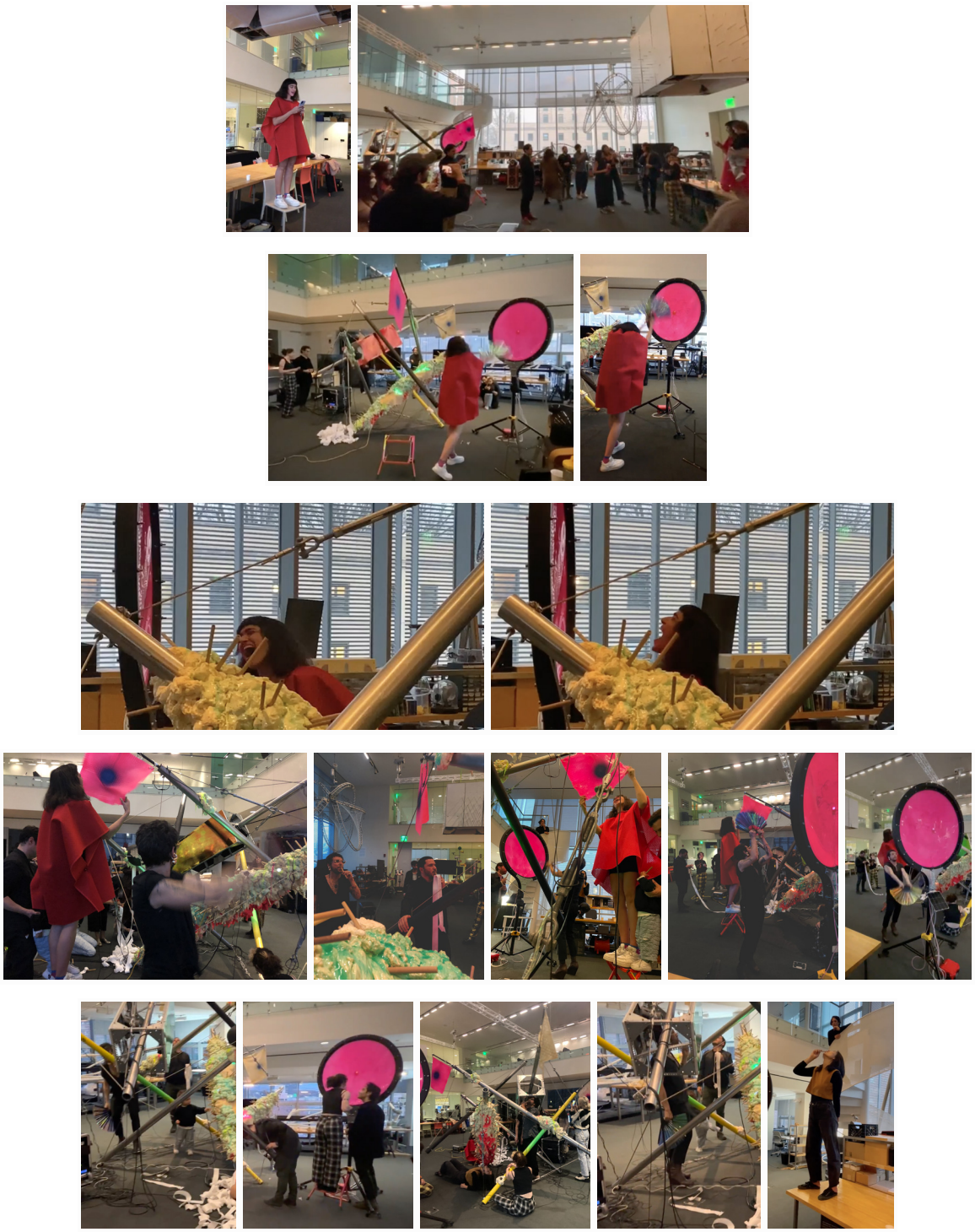

Figure 112 *Membranas first collective activation, April 13, 2022. Photos and film stills from participants.*

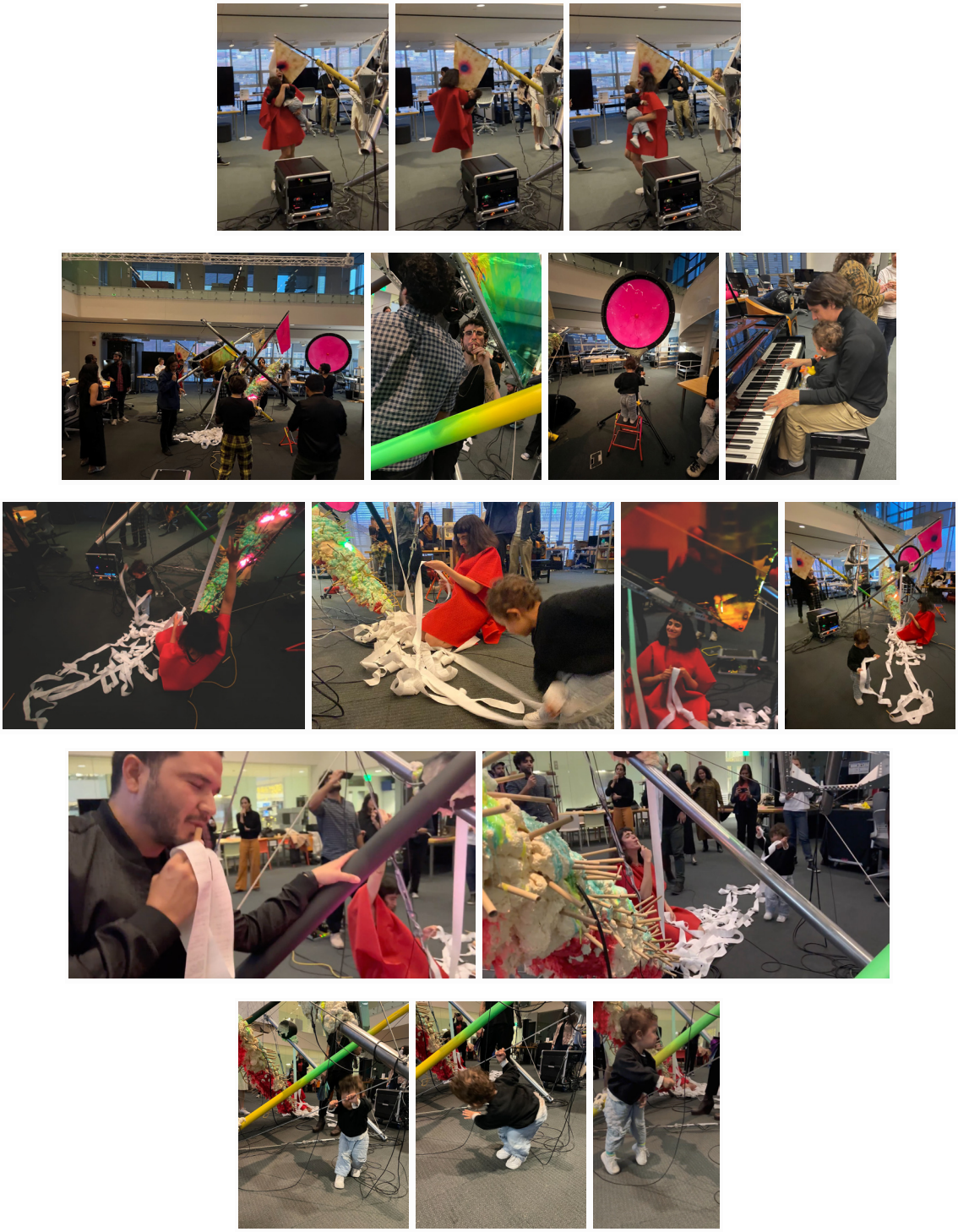

Figure 113 *Membranas first collective activation, April 13, 2022. Photos and film stills from participants.*

Figure 114 *Membranas first collective activation, April 13, 2022. Photos and film stills from participants.*

iii. Observations of the Experiences

After the performance/activation, I had the chance to gather feedback from the participants. This feedback has been very helpful as it helped me define some of the main takeaways of the experience:

1. One of the most meaningful and consistent comments was that there was a shared sense of cohesion and connection among the participants, even though most of them did not know each other previously, and they were not socializing with words. This connection formed through a non-verbal shared experience of playing cañitas and exploring the installation. Some participants said that the experience touched them deeply and even felt "spiritual."

2. Another consistent comment was that the structure was a successful participant and mediator of the experience as it felt "sincere" and "organic" in its unpredictability; as most of the experience depends on this factor, this observation was a key indicator that the activation achieved its goals.

3. Something that surprised me and made me understand *Membranas* in another way was that people mentioned that there was a "beautiful collapse of space," that the room was "transformed." This comment came to me from people who know the space very well, and were very moved to have felt that they were in a different place, and that the experience had transformed such a familiar environment into something new for a moment. This makes me reflect on the potentials of such a collective musical experience in terms of the spatial dynamics that it can open up and modulate. It highlights for me what a powerful spatial force sound can be. It also makes me think

about future performances/activations that could take this effect even more into consideration and push it even further.

4. Most participants mentioned that having different sensory modalities and details to discover was both intriguing and stimulating. This encouraged them to explore and be playful with the structure. People were touching things in case they had any secret vibrations, and some of them even showed me ways of interacting with the structure that I had not previously considered.

I also would like to add some personal takeaways and reflections after both experiences:

1. I learned that mediation is key, and that it is necessary to invite participation in the correct way so people can engage and open up. Having "guides" for the experience is essential, so participants can engage with confidence.

2. Both experiences showed me how important it is to always have a way of communicating an immediate and simple message. Even if there might be many other layers of information and possible dialogue, providing one direct idea is fundamental. This can be done verbally, physically, or with the help of mediation elements.

3. I personally believe that the "performance" experience was much more powerful than the installation. In any next iteration, even if it is an installation setting, I think it has to be organized with a public program for different performances/activations. I would like to do this myself but also to work with local artists who can be invited to host and guide different performances/activations/encounters.

4. One beautiful thing that I had the chance to experience is the importance of having kids in the room. As I observed my daughter Luna interacting with the structure as if it was her playground, she intuitively broke the ice and made space for adults in the room behave in a less shy and judgmental way, as if they were in a playground too.

5. I believe that both showings were very valuable and contributed a lot to the process of calibrating and testing the installation. But I definitely need to do many more activations in order to better understand the system and its possibilities. Also, as this is a system that will change depending on the space it is in, every iteration will require detailed attention and care.

b. Impact and Contributions

This work and research have provided a significant set of learnings that enable the exploration of membranal territories and activate relational encounters that are in tune with the *Surlogical*. Concretely, the installation *Membranas* provided a platform for exploring resonance and articulating more-than-human call and response encounters. This work functions as a continuous experiment and open system. This framing provides flexibility, as *Membranas* presents the possibility for variation and iteration. This is key, as it can grow, change, adapt, and be activated in multiple forms. While many of the contributions of this work will remain personal and speculative until it can be shared with a wider audience, the experiences of the collective performance/activation justify my faith in the possibilities of *Membranas* to foster meaningful encounters. I firmly trust that experiments like this one are fundamental for stimulating our imagination and the ways we relate to each other and the world we are part of, in ways that can readjust our ethical compasses and relational languages.

Concrete contributions made by this work include the creation of a spatial structure for exploring resonance and stimulating more-than-human call and response improvisatory encounters, embodied in a system that offers the possibility of scalability, iterations, variations, and the exploration of other possibilities, even without the need to alter the physical structure. Another contribution is the creation of a distributed and spatial improvisational machinic agent. The system also contributes *La Orejona*, a vibrational membrane microphone that consists of a soft, flexible accelerometer membrane that is water-resistant, solar powered, and can be placed outdoors and in remote places to transmit sounds from a distance. Beyond its artistic and musical functions in the scope of *Membranas*, this is a technology that can be used for other unexplored applications.

This dissertation also contributes to the development of transdisciplinary work and artistic research that provides insight into the exploration of relevant social, environmental, and cultural ideas. *La Membrana* is a theoretical work with enormous potential as an organizational and empowering conceptual apparatus, and the *Surlogical* can function as an alternative paradigm for resonant emergent encounters and ways of socializing through sound and music. Altogether, this is a body of work that contributes to the fields of sound studies, music, art, and technology, and can be exhibited and published in different forms and contexts.

c. Future work

Throughout this dissertation, I have mentioned elements that I would like to incorporate into future showings and performances of *Membranas*. The main element that I would like to add is a second vibrational membrane microphone. In the different instances where I have tested *Membranas* it has been useful to have *La Orejona* near the structure. It creates a direct link to make the system understandable and transparent, and it was also very enriching to have it there during the performance/activation as it provides extra layers and nuances for relational, sonic, and performative opportunities. In its current configuration, *La Orejona* is on another floor than the rest of the installation when it is outside, and there is no way to suggest their connection. This creates a dislocation between the elements that sometimes makes one forget about *La Orejona*. I would eventually love for there to be many *Orejonas* that create a distributed system across a building and its outdoor surroundings. One opportunity to explore with *La Orejona* is that it has wheels and is fully wireless, so it can move around. In this way, it can fluidly go from inside to outside and vice versa, providing other possible dynamics for future collective activations/performances.

Making a new *Orejona* could also be an opportunity to explore sustainable materials for the sensor. At the moment the silicone works wonderfully and presents the perfect qualities for *La Orejona*, but I wonder what other possibilities could emerge from other materials that are more sustainable. What if *La Orejona* could become a more organic entity that decomposes in time and eventually dissolves into the ground or vanishes with the wind? What if its sound was also affected by it being organic matter? For example, *La Orejona* could eventually be made of kombucha or out of membranes made from algae or mushrooms. Maybe its elasticity (and thus its sound) would change as it is watered, fed, and cared for every day; for example, maybe when it is more elastic it is a sign that it is healthy. These are only speculations for now, but they are interesting ideas to keep in mind for future experiments to come.

In addition to making a second *Orejona*, I would like to create an audiovisual mural with a map of the installation and its parts. This element would also evidentiate the relations and distances between the elements in an organized way, so they make sense and are easily communicated. This could take many shapes, but I initially imagine a graphic mural (ideally painted in the room) that has distributedly encrusted a few small screens for visual elements (such as a video of *La Orejona* or a brief video of a cañitas tutorial) as well as speakers for short sound messages. This would be a diagram for *Membranas*, some sort of constellation of the system. If this does not make sense for the exhibition space or the desired focus at the moment, it would be ideal to have people who can mediate the encounter and guide the participants through the interaction and key elements of the work.

Another aspect that I would like to explore in the future is the possibility for the installation to be more energetically sustainable. At the moment the only element that is self-sufficient in terms of energy is *La Orejona*, which has a solar panel. I eventually would love for *Membranas* to work in a sustainable way. Even if it does not operate fully on wind and solar energy, at least I would like to find a way to make it hybrid and cover the elements that don't require a high watt/hour consumption. If there are elements that still need electricity coming from the grid, I would like to signal the cables connected to the electric outlet with a bright color gradient. These would be like arms or roots that would signal that the system extends to these connections and is not fully contained within the exhibition space. Similarly, I would like to explore other possibilities with the materials for the structure. If *Membranas* were to be built again from scratch, I would like to use locally sourced, refurbished/found elements for the structure and the organs. Now that I have a better idea of the structural loads that the structure requires and a better sense of how the structure resists compression by extra weight from the speakers, and how it responds to external vibrations, I would dare to make it out of lighter elements of different formal and material characteristics. I would even dare to make it larger if it made sense to do so.

In terms of the system, I believe that there are interesting questions to explore in relation to the responses of the machine and its improvisational autonomy through the exploration of a dynamic audio corpus. At the moment the system contains a set of predetermined audio corpuses that compose the database for the machine to draw sounds from in order to produce the responses. A dynamic corpus would enable the machine to expand and evolve from my initial conceptual and aesthetic intentions. As I have mentioned previously in this dissertation, this system—as any machine—contains, represents, and is limited by my initial ideas, capacities, and biases. As a result, the original system ended up being simple and sloppy, yet effective. A dynamic corpus could be a way to find even more complex, interesting, and intricate ways for the machine to emerge in time and possibly change through the iterations, a way for the system to "learn" from every "practice," as I have and will continue doing.

One possibility could be for the system to register moments during the interactions and incorporate different sounds from the room. This would mean that every interaction could bring to the system specific sounds from the wind and the people of that place. Somehow, the machine would be listening to these elements and adapting in relation to them. So this doesn't only become a game of mimicry, I think it will be important to add other elements to the mix. Participants could eventually be invited to give sounds to the system, whether made with their voices or by other means. These sounds could be incorporated into the corpus database and create new corpuses after every performance/activation. Maybe one of the

objectives of the performance could be to give new sets of sounds and sonic intentions to the machine so it can generate other outputs during the installation moments and performances that follow. To implement this idea, I would start by testing how long a corpus can be in the current system. If it is possible to have a very long corpus with diverse sections, a simple way to run some tests would be to stitch the different sounds provided to the machine and replace the corpuses after the interaction. This way each interaction would be like a "seed" that grows in time and that allows for participants and other creators to contribute. I am sure there are more interesting, automated ways to do this by incorporating elements of machine learning and AI, which would be a next step to explore. This operation would be framed as a *Surlogical* experiment based in autopoiesis[224] as a structural model for the system. The dynamic corpus could be another element that opens up the system to fluid exchanges with their environment and dynamically negotiates its definition through synergic potential and improvisatory encounters.

One of the main objectives of *Membranas* is to explore exchange strategies for humans to be aware and attentive to more-than-human entities in order to create a better understanding of our interconnectedness with *otherness.* Specifically by means of collective emergence through resonant encounters, by means of more-than-human musical social arrangements. As I see it, this has been partially achieved and there are many potential avenues for future exploration. I think that due to the constraints on deploying the installation up to this moment, the experience of the wind, outdoors sounds, vibrations, and other *outer* forces has been limited. Their action in awakening the system has been less relevant and present than it was initially conceived to be. They are meant to be key elements of the system as spontaneous "initiators" of the interaction. This has drastically diminished the scope of the piece, as it has placed the focus on the relationship between the humans and the machine, narrowing the system to more "controllable" possibilities within the room. In spite of this narrower scope, the shift of focus towards the entities in the room has been interesting, since it has allowed me to open up deeper questions about the agency of the machine, its relationship to humans, and more intricate possibilities to come.

Important aspects of future work are to redress the focus of the art work and provide space for the *outer* entities to be constantly modifying and altering the system, and redefining the experience in the room as their temporalities, energies, and noises are manifested. Now that *Membranas* is ready, I think it is the moment to explore its full potential and possibilities through further iterations and the inclusion of

[224] In 1980, Maturana and Varela proposed the concept of an autopoietic system to describe a network of interrelated, component-producing processes, wherein the components in interaction generate the same network that produced them. Please refer to the discussion on Song 4: Sistemas on page 125 of this document.
Reference: Maturana, Humberto R., et al. *Autopoiesis and Cognition: The Realization of the Living*. Reidel, 1980.

elements that will enable a complete experience, such as the creation of a second vibrational membrane microphone.

In future explorations, I would also like to engage with more-than-human entities in a more direct way. One big question that was present every day during this process, and that still remains open, is the very notion of improvisation as "dialogue." Even if in this piece I fuzz certain lines and engage in a response to otherness, this otherness is not in dialogue with me or the other participants—it is still a unilateral thing. In *Membranas* I tried to break this problem open by having three different networked entities. Since the wind and the other outer entities can never respond to the events happening in the room, the machine was a way to create a link and enable a collective emergence where the wind is a signal that disrupts linearity in the system and opens it up, and the machine is the one that is there to respond in a dynamic way. As I see it, there are three main parts, one that is only a call (outer entities/signals), one that only responds (the machine), and one that can either call or respond (the humans). In future work, I would like to find ways that these relations can be rearranged differently and change dynamically.

In spite of my many efforts to create something that makes a shift from exclusively anthropocentric perspectives, the installation and experience remains one curated for humans, which aims to stimulate ideas within human perception and conception. I wonder if there would be other ways of creating a truly meaningful dialogue with the more-than-human. I always imagined in a poetic way that voices singing or cañitas being blown are means of contributing energy to the wind, ways of stirring up the wind or of making the air move, and I wonder how this work could contribute in other ways to the wind—not necessarily as a force, but in a genuine dialogue. I think this last point is a truly important and interesting question to which I have no concrete answer at the moment. I intuit that interspecies dialogue could be a place to begin further explorations. I have delved into these questions by listening and responding to *other* signals but not in a way that has allowed the *other* to engage with or respond to mine.

In relation to expanding my membranal explorations beyond this dissertation, in the short term, I am already planning to create a series of continuous membranes that diffuse sounds. These membranes will shape a long flag that falls on the floor as folds as a blanket full of intimate sounds, voices, and textures that can be perceived when in proximity to and contact with it. In addition, I will also create a choir of sonic kites made of elastic membranes that sing songs to the wind. Though these membranes have different intentions behind them than the *Membranas* installation, they are based in the theories of *La Membrana* and present ways of opening different types of questions.

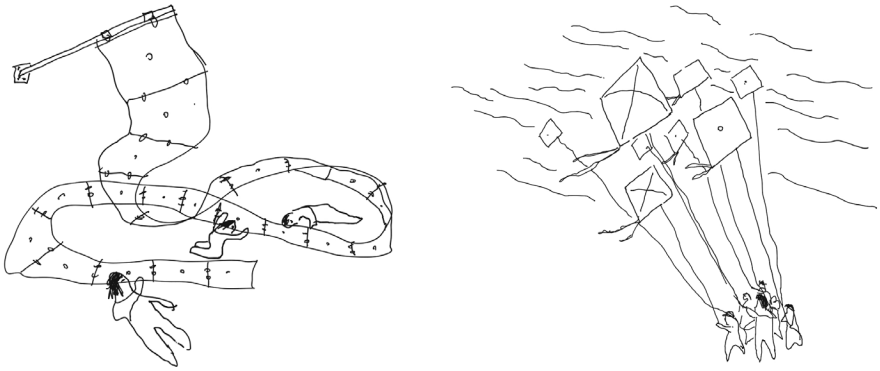

Figure 115 *(Left) Continuous Membrane Flag sketch. (Right) Choir of Sonic Membranal Kites sketch.*

It is very important to mention that this art work and research have been for me part of an ongoing process that is just beginning. This dissertation is both the culmination of something and the start of a thread. As a result, besides concrete elements that can be added to the installation in the future, and other possible membranal explorations, I would like to mention a few things that are longer-term ideas and possibly more impactful on a personal level. For me, this thesis unveiled a series of emergent elements that could have enormous transformational potential as they mature and grow outside of this dissertation. Continuing to navigate the world of the *Surlogical* is one of these elements. I hope I can intersect with many other communities, thinkers, and creators from different geographies in future collaborations to continue reflecting on this topic and its possibilities. Similarly, this dissertation unveiled for me the universe of *La Membrana*. I live in *La Membrana* now and this is where I will operate from now on, whatever that means and wherever it takes me.

I am ready for the oscillations.

I am ready to vibrate, resonate, and transduce.

I am ready to fuzz.

~

References

Intro

Abrams, David. 1996. *The Spell of the Sensuous: Perception and Language in a More-than-Human World*. New York: Pantheon Books.

Lewis, George. 2005. "Improvised Music after 1950: Afrological and Eurological Perspectives," in *Audio Culture: Readings in Modern Music*. Edited by Cox, Christoph, Warner, Daniel. New York;London: Continuum, 272–284.

Eshun, Kodwo. 1998. *More Brilliant Than The Sun: Adventures In Sonic Fiction*. London: Quartet Books.

Ettinger, Bracha. 2006. *The Matrixial Borderspace*. Minneapolis: University of Minnesota Press.

Irigaray, Luce. 1993. *An Ethics of Sexual Difference.* Ithaca: Cornell University Press.

Morton, Timothy. 2013. *Hyperobjects: Philosophy and Ecology after the End of the World*. Minneapolis; London: University of Minnesota Press.

Barad, Karen. 2003. "Posthuman Performativity, Toward an Understanding of How Matter Comes to Matter," in *Signs*, Vol. 28, No. 3. Chicago: University of Chicago Press.

Barad, Karen. 2007 (2nd edition). *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham; London: Duke University Press.

Viveiros de Castro, Eduardo. 2014. *Cannibal Metaphysics: For a Post Structural Anthropology*. Minneapolis: Univocal Publishing.

De la Cadena, Marisol. 2015. *Earth beings: ecologies of practice across Andean worlds*. Durham: Duke University Press.

Descola, Philippe. 2013. *Beyond nature and culture.* Translation by Lloyd, Janet. Chicago: University of Chicago Press.

Stengers, Isabelle. 2012. "Reclaiming Animism," in *eflux Journal #36*. (Accessed: 10-9-2018) https://www.eflux.com/journal/36/61245/reclaiminganimism/

Malone, Nicholas, Ovenden, Kathryn. 2017. "Natureculture," in *The International Encyclopedia of Primatology*. Edited by Fuentes, Agustín. Chichester: John Wiley & Sons, Inc., 848.

Haraway, Donna. 2003. *The Companion Species Manifesto: Dogs, People, and Significant Otherness*. Chicago: Prickly Paradigm Press.

Kohn, Eduardo. 2013. *How Forests Think, Toward an Anthropology beyond the Human*. Berkeley; Los Angeles: University of California Press.

Ferreira da Silva, Denise. 2016. "On Difference without Separability," in *Incerteza Viva: 32a Bienal de São Paulo, exhibition catalogue*. Edited by Volz, Jochen, Rebouças, Julia. São Paulo: Fundação Bienal de São Paulo, 65.

Ferreira da Silva, Denise. 2021. Tangible Possibility lecture, ICA Miami. (Accessed: 04-10-2022). https://www.youtube.com/watch?v=79UWUHtCW6g

Song 1: Resonant Layers

De Andrade, Oswald. 1928. "Manifesto Antropófago," in *Revista de Antropofagia,* 1: 3-7.

Neves Marques, Pedro. 2015. *The Forest & The School" / "Where to Sit at the Dinner Table?* Berlin: Archive Books.

Viveiros de Castro, Eduardo. 2014. *Cannibal Metaphysics: For a Post Structural Anthropology*. Minneapolis: Univocal Publishing.

Tuck, Eve, Yang, K. Wayne. 2012. "Decolonization is not a metaphor," in *Decolonization: Indigeneity, Education & Society*, 1(1). Open Journal Systems, 40.

Oliveros, Pauline. 1971. *Sonic Meditations*. Baltimore: Smith Publications, 26.

Oliveros, Pauline. 2000. "Quantum Listening: From Practice to Theory (To Practice Practice)," in *Music Works* #75.

Oliveros, Pauline. 2008. "Quantum improvisation: The cybernetic presence". In *Sound Unbound: Sampling Digital Music and Culture*. Edited by Miller, Paul D.. Cambridge: MIT Press.

https://doi.org/10.7551/mitpress/7723.003.0012
Haraway, Donna. 1991. “A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century,” in *Simians, Cyborgs and Women: The Reinvention of Nature*. New York: Routledge, 149-181.
Lewis, George. 2021. “Why Do We Want Our Computers to Improvise?” Presentation, part of Media Lab Perspectives Series hosted by Professor Tod Machover, April 29, 2021 (Accessed: 03-26-2022) https://www.media.mit.edu/videos/ml-perspectives-2021-04-29/?autoplay=true
Lewis, George. 2018. “Why Do We Want Our Computers to Improvise?” in *The Oxford Handbook of Algorithmic Music*. Edited by Dean, Roger T., McLean, Alex. Oxford: Oxford University Press, 129.
Tomlinson, Gary. 2018. A million years of music: The emergence of human modernity. New York: Zone Books.
Montero, Valentina. 2020. “Entre Frankenstein y el hada de la Cenicienta. Arte y tecnología desde América Latina.” In *Tecnología, política y algoritmos en América Latina*. Edites by Tello, Andrés Maximiliano. Viña del Mar: CENALTES ediciones, 97-110.
Smith, V. 2011. *Juan Downey: The Invisible Architect*. New York; Cambridge: Bronx Museum of the Arts; MIT List Visual Arts Center.
Downey, Walker. 2017. *Crossing Canals: Maryanne Amacher’s Cybernetic Impulse*. Unpublished manuscript.
Amacher, Maryanne. 2021. “Adjacencies,” in *Maryanne Amacher: Selected Writing and Interviews*. Edited by Cimini, Amy, Dietz, Bill. Brooklyn, NY: Blank Forms Editions, 39.
Lewis, George. 2005. “Improvised Music after 1950: Afrological and Eurological Perspectives,” in *Audio Culture: Readings in Modern Music*. Edited by Cox, Christoph, Warner, Daniel. New York;London: Continuum, 272–284.
Kanngieser, AM. 2022. “On not knowing (for that which cannot be imagined)” Keynote with Jack Halberstam, part of *This is not anarchy this is chaos, Transmediale Symposium*. (Accessed: 03-26-2022) https://transmediale.de/events/keynote
Kanngieser, A.,Todd, Z. 2020. “From environmental case study to environmental Kin study.” *History and Theory* 59(3), 385-393.
Robinson, Dylan. 2020. *Hungry Listening, Resonant Theory for Indigenous Sound Studies*. Minneapolis; London: University of Minnesota Press.
Thompson, Marie. 2017. “Whiteness and the Ontological Turn in Sound Studies," in *Parallax: Sounding/Thinking*, 23:3. United Kingdom: Routledge, 266-282. DOI: 10.1080/13534645.2017.1339967
Kanngieser, A, Todd, Z. 2021. “Listening as Relation, an Invocation” Lecture-performance. Part of *Critical Modes of Listening*, *CTM Festival, Transformation Discourse Series*, along with a presentation by Maier, Carla J., yamomo, mêLe. (Accessed: 03-25-2022) https://www.youtube.com/watch?v=kGe0DYMroEg
Valdés, Catalina. 2019. Curatorial text for the exhibition “El Tercer Paisaje,” Museo Nacional de Bellas Artes, 14 Bienal de Artes Mediales (BAM), Santiago, Chile.
Ibañez, AnaRosa. 2019. Curatorial text for opening performance of exhibition “El Tercer Paisaje,” Museo Nacional de Bellas Artes, 14 Bienal de Artes Mediales (BAM), Santiago, Chile. (Accessed: 04-13-2022) https://www.anarosadechile.com/serpiente-ch
Lanzamiento fanzine "Serpiente Delirante". 2022. Umbral, 15 Bienal de Artes Mediales de Santiago. Retrieved 04-13-2022, from https://15.bienaldeartesmediales.cl/calendario/lanzamiento-fanzine-serpiente-delirante/
Escobar, Arturo. 2018. *Designs for the pluriverse: radical interdependence, autonomy, and the making of worlds*. Durham; London: Duke University Press.
Urbonas, Nomeda, Urbonas, Gediminas. 2021. Amphibians songs sleeve text. On Amphibians songs vinyl. Cambridge: Swamp Records.
Dominguez, Patricia, L’Huillier, Nicole. 2021. Leche Holográfica. Commissioned by the Inter-American Development Bank for the exhibition “On the Way to Healing.” (Accessed: 04-13-2022) https://tinyurl.com/mr2f3mz7

Song 2: La Membrana, An Apparatus for Tunning In

Ettinger, Bracha. 2006. *The Matrixial Borderspace*. Minneapolis: University of Minnesota Press.

Irigaray, Luce. 1993. *An Ethics of Sexual Difference.* Ithaca: Cornell University Press.
Green, Mitchell. 2017. "Speech Acts," in *The Stanford Encyclopedia of Philosophy.* Edited by Zalta, Edward N.
Butler, Judith. 2006. *Gender Trouble, Feminism and the Subversion of Identity.* New York; London: Routledge.
Barad, Karen. 2003. "Posthuman Performativity, Toward an Understanding of How Matter Comes to Matter," in *Signs*, Vol. 28, No. 3. Chicago: University of Chicago Press.
Latour, Bruno. 2007. *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford: Oxford University Press.
Deleuze, Gilles, Guattari, Felix. 2016 (16th edition). *A Thousand Plateaus, Capitalism and Schizophrenia.* Translation by: Brian Massumi. Minneapolis: University of Minnesota Press.
Barad, Karen. 2007 (2nd edition). *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham; London: Duke University Press.
Viveiros de Castro, Eduardo. 2014. *Cannibal Metaphysics: For a Post Structural Anthropology*. Minneapolis: Univocal Publishing.
Laycock, Joseph. 2012. "We Are Spirits of Another Sort: Ontological Rebellion and Religious Dimensions of the Otherkin Community," in *Nova Religio: The Journal of Alternative and Emergent Religions*. Vol. 15, No. 3. Berkeley: University of California Press, 65-90.
Zapf, Hubert. 2016. *Handbook of Ecocriticism and Cultural Ecology*. Germany; Boston: De Gruyter GmbH.
Haraway, Donna. 1991. "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century," in Simians, Cyborgs and Women: The Reinvention of Nature. New York: Routledge, 149-181.
Ferrando, Francesca. 2018. "Transhumanism/Posthumanism," in *Posthuman Glossary*. Edited by Braidotti, Rosi, Hlavajova, Maria. London: Bloomsbury, 438-439.
De la Cadena, Marisol. 2015. *Earth beings: ecologies of practice across Andean worlds*. Durham: Duke University Press.
Rocha, Jara, Snelting, Femke. 2021. "Kingdom Dysphoria workshop," in *the Biofriction summer program*. Hosted by Hangar, Barcelona, Spain. (Accessed: 03-29-2022) https://pad.constantvzw.org/p/kingdom_dysphoria
Haraway, Donna. 2003. *The Companion Species Manifesto: Dogs, People, and Significant Otherness*. Chicago: Prickly Paradigm Press.
Haraway, Donna J. 2016. "Sympoiesis: Symbiogenesis and the Lively Arts of Staying with the Trouble," in *Staying with the Trouble, Making Kin in the Chthulucene*. Durham; London: Duke University Press, 58.
Descola, Philippe. 2013. *Beyond nature and culture.* Translation by Lloyd, Janet. Chicago: University of Chicago Press.
Stengers, Isabelle. 2012. "Reclaiming Animism," in *eflux Journal #36*. (Accessed: 10-9-2018) https://www.eflux.com/journal/36/61245/reclaiminganimism/
Kohn, Eduardo. 2013. *How Forests Think, Toward an Anthropology beyond the Human*. Berkeley; Los Angeles: University of California Press, 16.
Malone, Nicholas, Ovenden, Kathryn. 2017. "Natureculture," in *The International Encyclopedia of Primatology*. Edited by Fuentes, Agustín. Chichester: John Wiley & Sons, Inc., 848.
Haraway, Donna. 2003. *The Companion Species Manifesto: Dogs, People, and Significant Otherness*. Chicago: Prickly Paradigm Press.
Berenguer, José, Pimentel G., Gonzalo. 2017. "Introduction to the study of internodal spaces and their contribution to the history, nature and dynamics of human occupations in arid zones," in *Estudios Atacameños, Arqueología y Antropología Surandinas* Nº 56. Antofagasta: Universidad Católica del Norte, 12-20.
De la Cadena, Marisol, Blaser, Mario (editors). 2018. *A World of Many Worlds*. Durham; London: Duke University Press, 17.
Foucault, Michel. 1980. "The Confession of the flesh," in *Power/Knowledge: Selected Interviews and Other Writings*. Edited by Gordon, C. New York, NY: Pantheon, 194–228.
Ferreira da Silva, Denise. 2016. "On Difference without Separability," in *Incerteza Viva: 32a Bienal de São Paulo,*

exhibition catalogue. Edited by Volz, Jochen, Rebouças, Julia. São Paulo: Fundação Bienal de São Paulo, 65.
Ferreira da Silva, Denise. 2021. Tangible Possibility lecture, ICA Miami. (Accessed: 04-10-2022). https://www.youtube.com/watch?v=79UWUHtCW6g
Rossing, Thomas D., Fletcher, Neville H. 2011 (2nd edition). *Principles of vibration and sound*. New York: Springer.
Pettman, Dominic. 2017. *Sonic Intimacy: Voice, Species, Technics (Or, How To Listen To The World)*. Palo Alto: Stanford University Press.
Derrida, Jacques. 2005. *On Touching—Jean-Luc Nancy*. Stanford: Stanford University Press.
Alloa, Emmanuel. 2015. "Getting in Touch: Aristotelian Diagnostics," in *Carnal Hermeneutics, Perspectives in Continental Philosophy*. Edited by Kearney, Richard, Treanor, Brian. New York: Fordham University Press, 205.
Eidsheim, Nina. 2015. *Sensing Sound: Singing and Listening as Vibrational Practice.* Durham; London: Duke University Press.
Trower, Shelley. 2012. *Senses of Vibration: A History of the Pleasure and Pain of Sound.* New York: Continuum.
Sterne, Jonathan. 2003. *The Audible Past: Cultural Origins of Sound Reproduction*. Durham: Duke University Press,
Kapchan, Deborah. 2015. "Body," in *Keywords in Sound*. Edited by Novak, David, Sakakeeny, Matt. Durham; London: Duke University Press, 42.
Von Helmholtz, Hermann. 1995. "The Conservation of Force," in *Hermann von Helmholtz: Science and Culture, Popular and Philosophical Essays*. Edited by Cahan, David. Chicago: University of Chicago Press, 96-126.
Von Helmholtz, Hermann. 1954. *On the Sensation of Tone as a Physiological Basis for the Theory of Music*. New York: Dover Publications.
Erlmann, Veit. 2014. *Reason and Resonance: A History of Modern Aurality*. New York: Zone Books, 9-10.
Feld, Steven. 1982. *Sound and sentiment: birds, weeping, poetics, and song in Kaluli expression.* Philadelphia: University of Pennsylvania Press.
Feld, Steven. 2015. "Acoustemology," in *Keywords in Sound*. Edited by Novak, David, Sakakeeny, Matt. Durham; London: Duke University Press, 12-21.
Feld, Steven. "Acoustemologies," in *Sensing the Unseen Seminar, The Elusive: Listening*. MIT, 2010. Podcast (Accessed: 04-10-2022) http://web.mit.edu/unseen/podcasts/elusive/1.1_elusive_Feld.mp3
Weinel, Jonathan. 2018. *Inner sound: altered states of consciousness in electronic music and audio-visual media.* New York: Oxford University Press, 22.
Ahmed, Sara. 2006. *Queer Phenomenology: Orientations, Objects, Others.* Durham; London: Duke University Press, 9.
Ebeling, Siegfried. 1926. *Space as Membrane (Der Raum als Membran)*. Dessau: C Duennhaupt.
Ferreira da Silva, Denise. 2020. *Corpus Infinitum* Lecture at Brown University (Accessed: 04-10-2022) https://events.brown.edu/cogut/event/183599-denise-ferreira-da-silva-corpus-infinitum

Possible Bodies (Rocha, Jara, Snelting, Femke (Editors)). 2022. *Volumetric Regimes: Material Cultures of Quanfied Presence*. To be published by Open Humanities Press. The contents of this book-in-the-making can be accessed on this wiki site: https://possiblebodies.constantvzw.org/book (Accessed: 04-10-2022)
Zylinska, Joanna. 2014. *Minimal Ethics for the Anthropocene*. Ann Arbor: Open Humanities Press, 139-142. (Accessed: 04-10-2022) http://dx.doi.org/10.3998/ohp.12917741.0001.001
Ferreira da Silva, Denise. 2021. *Tangible Possibility.* Lecture at ICA Miami. (Accessed: 04-10-2022). https://www.youtube.com/watch?v=79UWUHtCW6g
Haraway, Donna. 1988. "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," in *Feminist Studies* 14, no. 3, 575–99.

Song 3: Membranas, A Platform To Practice

Kohn, Eduardo. 2013. *How Forests Think, Toward an Anthropology beyond the Human*. Berkeley; Los Angeles:

University of California Press, 16.
Cusicanqui, Silvia Rivera. 2020. *Ch'ixinakax utxiwa: On Practices and Discourses of Decolonization*. Translation by Geidel, Molly. Cambridge; Medford: Polity Press, 56.
De Andrade, Oswald. 1928. "Manifesto Antropófago," in *Revista de Antropofagia,* 1: 3-7.
Lewis, George. 2005. "Improvised Music after 1950: Afrological and Eurological Perspectives," in *Audio Culture: Readings in Modern Music*. Edited by Cox, Christoph, Warner, Daniel. New York;London: Continuum, 272–284.
Anzaldúa, Gloria. 1987. *Borderlands: The New Mestiza = La Frontera*. San Francisco: Spinsters/Aunt Lute.
Marambio, Camila. 2011. "Mestiza," entry for "An Incomplete Glossary of Latin America," in *United States of Latin America*. Edited by Hoffman, Jens. Berlin: Sternberg Press, 100-101.
Pérez de Arce A, José. 2018. "La Flauta Colectiva: El uso social de flautas de tubo cerrado en los andes sur," in *Música y sonidos en el mundo andino: flautas de Pan, zampoñas, antaras, sikus y ayarachis.* Edited by Sánchez Huaringa, Carlos. Lima: Fondo Editorial de la Universidad Nacional Mayor de San Marcos, 51-116.
Pérez de Arce, José, Pita, Mairemi, Ukumari, Ozzo. 2021. "Eclipse, sonido y ancestralidad." Lecture for *Festival de Arte Sonoro Tsonami*.
De la Cadena, Marisol. 2015. *Earth beings: ecologies of practice across Andean worlds*. Durham: Duke University Press.
Mercado, Claudio, Rondón, Víctor. 2003. *Con Mi Humilde Devoción, Bailes Chinos en Chile Central*. Santiago: Museo Chileno de Arte Precolombino, 6.
Mercado Muñoz, Claudio. 2004. "The Sereno and the Transmission of Music among the Atacama People," in *Studien zur musikarchaologie IV. Music archaeological sources: finds, oral transmission, written evidence*. Edited by Hickmann, Ellen, Eichmann, Ricardo. Germany, 291.
Marambio, Camila, Vicuña, Cecilia. 2019. *Slow Down Fast, A Toda Raja*. Berlin: Errant Bodies Press, 85.
Han, Byung-Chul. 2020. *The Disappearance of Rituals: A Topology of the Present*. Translated by Steuer, Daniel. Cambridge; Medford: Polity Press, 8.
Fisher, Mark. 2009. *Capitalist Realism: Is There No Alternative?* Winchester; Washington: Zero Books.
Infrasonica, Wave 3, Sonic Realisms, 2021. (Accessed: 04-10-2022) https://infrasonica.org/en/sonic-realism-wave-3/editor-s-note-3
Shaw, Christine. 2019. "The Work of Wind" lecture in the discursive gathering *Futurity Island: Amphibian Pedagogies and Submerged Perspectives*. MIT Program in Art, Culture, and Technology (ACT).
Simmons, Kirsten. 2017. "Settler Atmospherics," in *Cultural Anthropology* (Accessed: 05-17-2020) https://culanth.org/fieldsights/settler-atmospherics
Ettinger, Bracha. 2006. *The Matrixial Borderspace*. Minneapolis: University of Minnesota Press.
Irigaray, Luce. 1993. *An Ethics of Sexual Difference.* Ithaca: Cornell University Press.

Song 4: Sistemas

Maturana, Humberto R., et al. 1980. *Autopoiesis and Cognition: The Realization of the Living*. Reidel.
Haraway, Donna J. 2016. "Sympoiesis: Symbiogenesis and the Lively Arts of Staying with the Trouble," in *Staying with the Trouble, Making Kin in the Chthulucene*. Durham; London: Duke University Press, 58.
Barad, Karen. 2003. "Posthuman Performativity, Toward an Understanding of How Matter Comes to Matter," in *Signs*, Vol. 28, No. 3. Chicago: University of Chicago Press.
Oreilly, Rob, et al. 2009. "Sonic nirvana: Using mems accelerometers as acoustic pickups in musical instruments." in *Analog Dialogue*, vol. 43, no. 02.
Barad, Karen. 2018. "On Touching: The Alterity Within". As part of the conference-festival *Hold Me Now—Feel and Touch in an Unreal World.* Organized by the Gerrit Rietveld Academie at Stedelijk Museum Amsterdam, March 21-24, 2018. Curated by Jack Halberstam. (Accessed: 05-17-2020) https://www.youtube.com/watch?v=u7LvXswjEBY
De Andrade, Oswald. 1928. "Manifesto Antropófago," in *Revista de Antropofagia,* 1: 3-7.

Peeters, Geoffroy. 2004. *A large set of audio features for sound description (similarity and classification) in the CUIDADO project*. Paris: IRCAM.

Pérez de Arce A, José. 2018. “La Flauta Colectiva: El uso social de flautas de tubo cerrado en los andes sur,” in *Música y sonidos en el mundo andino: flautas de Pan, zampoñas, antaras, sikus y ayarachis.* Edited by Sánchez Huaringa, Carlos. Lima: Fondo Editorial de la Universidad Nacional Mayor de San Marcos, 51-116.

Outro

Mistral, Gabriela. 2003. “La Contadora / The Teller of Tales," in *Selected Poems of Gabriela Mistral: Translated by Ursula K. Le Guin*.Translated by Le Guin, Ursula K. Albuquerque: University of New Mexico Press, 387-391.

Maturana, Humberto R., et al. 1980. *Autopoiesis and Cognition: The Realization of the Living*. Reidel.

Appendix

i. Transductions and Surlógicas vol. I

In conversation with José Pérez de Arce

The following conversation was posted on Infrasonica, Wave 3, Sonic Realisms, 2021.[225]

> The multidisciplinary artist and researcher Nicole L'Huillier explores ideas associated with sound and musical composition in a non-colonial register. L'Huillier proposes a political grimoire where conceptual frameworks open portals for conversations about the relationship of sound with Indigenous Deep Time and the paradoxes of coloniality emerging from the creation of contaminated sounds. As a resonant companion for her conversation with the musical archaeologist José Pérez de Arce, the improvisational collaboration with Pérez de Arce, Francisca Gili, Claudio Mercado Muñoz and AnaRosa Ibañez invites the listener to consider a logic emanating from the global South.[226]

NL: I'm interested in sound as something that activates collective, hybrid, and resonant processes. Where humans and other entities dialogue, they open non-lineal sonorous spaces and explore the potentiality of sound outside of the musical. I'm also interested in sound as an extended temporality and access to other dimensions through trance. What can we learn from paying attention to sound as another space of wisdom and beauty outside of the Western canon? What does it mean for you to think from a southern logic, a *Surlógica*? What elements of sound dialogues from the South can help us to structure this concept?

JPA: From my experience as a music archaeologist, I believe there are two *surlógicas.* One that existed before Columbus, in which everything followed a self-coherent, self-powered logic in continuous ecological change according to its own parameters, like everything in nature; and

[225] I am very grateful for the resonant and caring exchanges with the Infrasonica amigxs that opened up this dialogue, as well as for their labor in translation, and for José Pérez de Arce, Francisca Gili, Claudio Mercado, and AnaRosa Ibañez for responding my call. The conversations occurred digitally during the year 2020 via Zoom.
Please refer to the Infrasonica site for the full interview, sound component, and bios of each of the participants: https://infrasonica.org/en/sonic-realism-wave-3/transducciones-en (Accessed: 04-10-2022)

[226] Please refer to the Infrasonica site for listening to the sound component of this note.

another that emerged afterward, when things collided that had never collided before, and which produced a power imbalance that tried to push this primordial logic towards disappearance. Today we are witnessing the agony of this madness, the emergence of those balances of a new *surlógica*. Instead of fighting for survival, the heritage of this vernacular logic finds its balance, its mixture, its *ch'ixi*, its coexistence, its transformation and sublimation. Sound has always formulated this dialogue-encounter, from the birds and the winds, from motors and inventions, from guitars and flutes. This sound transit is less violent than the transit of the logics of power that have taxed a logic of "for reason or force" as a political lock to our thinking. Sounds circulate more freely, they move through parties, drunkenness, encounters, oftentimes meeting oblivious to that logic of power. That is, precisely, its power.

NL: Transduction is a concept of the *comings and goings,* of the signal that is transformed when crossing/combining media to remain valid. This concept can help us to build a discourse from the South with the complexities and contradictions that involve understanding ourselves amidst processes that oscillate between the modern and the ancient. Like being *mestizo* and living between places and realities, always in transduction, in transformation and in constant transit. How do we position ourselves as *mestizos* in respectful and anticolonial dialogue with ancestral knowledge and pre-Hispanic technologies? Do you think the concept of transduction can help us navigate our state of living between places and temporalities? In today's times of cultural transformation and redefinitions, can transductions teach us to recalibrate our alliances with otherness? Perhaps it can permit us to reinforce networks that have broken with dichotomies and categorizations of modernity?

JPA: Transduction, I would say, is a new dress for what has always been spoken about. First, it was mestizaje that tried to view globalization with the dissolution of ours in modernity, and later the reaction of *champurria,* of *ch'ixi,* of *kiltro,* of *chimuchina,* that mix without mixing, that pile up without classifying, that add and distribute through unimaginable modes, that accumulate contradictions as the norm. Everything depends on how you understand transduction. If it encompasses all these contradictions, it's a new dress for many things; if you understand it only as coming and going, it is a new dress for what has always occurred; but transduction has wanted only to be seen as a coming, not as a going.

NL: Do you think sound is an element of mediation between the material and immaterial world? I'd like you to tell me a bit more about your processes of trance and altered states of conscience

through repetition and the saturation of the frequency spectrum. Could we learn from those models to imagine transformative shapes/forms of polyphonic coexistence and dialogues for a more hybrid, dynamic and collective future?

JPA: The “altered state” could be seen as the “natural state” with which we reverse the problem. That's how many shamans view it and how I see it when I play with my grandchildren (before they become adults). That inversion also alters your question; maybe sound helps us penetrate in strokes of that reality what we've lost “from sight” (how absurd) and it returns us to connect with the primordial, before we were humans, even before we were living beings. But as we are complex, my perception of this state is very personal, non-transferable, and at the same time it's the best expression of the current me, an individual connected to the universe. At the end of the day, for us, urban, disconnected, self-absorbed, “the altered states of consciousness” often confront us with the abysmal reality in which they are part of a whole, and for us, that abysmal wonder is enough. That double “function” of that state is the most real: on the one hand, it universalizes, or, better said, diversifies that experience towards the rest of existence. On the other hand, it empowers the center-me as the only possible transductor.

NL: From transduction, *mestizaje* and the logics of the South, do you have any final thoughts on our improvisation?

JPA: I think our improvisation[227] is part of a process that is occurring in society, which allows for new forms of communication to come and go. Not from the logical platform (coming and going of news or speeches), but coming and going instantly, through intuitions that are faster and more accurate than logic.

[227] José Pérez de Arce is referring to an improvisation session along with Claudio Mercado, Francisca Gili, and AnaRosa Ibañez. This session was done during the peak of covid in 2020 via Zoom. This was a way of finding us in resonance at a distance. Although it was not the same as being together in person, it was a fulfilling exercise of resonant togetherness at a distance. The glitches due to our lousy Wi-Fi connections added interesting and weird elements. Interestingly, in this case latency was not a major issue since, as it is in many attempts of digital music encounters, our musical system is not based on a set time signature, allowing space for asynchronicities as part of the system. We called this a “transductive improvisation”.

ii. Transductions and Surlógicas vol. II

In conversation with Claudio Mercado

As a continuation of the previous conversation, the following conversation was posted on Infrasonica, Wave 3, Sonic Realisms, 2021.[228] A few small errors in the translated text were corrected for this dissertation; please visit the website to see the original translation

> The following conversation proposes the concept of transduction[229] as an axis to confront Western notions of music and sound, exploring Southernlogics[230] as modes of sonic socialization through an improvisational ritual of a system of call and response. The objective is to think about listening and sonic relationships from transduction proposing a fluid scene, where sound as a form of energy is transformed to exist in distinct planes and dimensions to construct its own meaning in dynamism. This idea opposes the notion of translation, which implicates a colonial process that fragments the signal's essence, losing part of the content and weakening the message as new meaning is imposed.[231]

Claudio Mercado and I talk about wind, cañitas, breathing, American sounds, his experiences in the Bailes Chinos,[232] his intimate relationship with the flute, sound as cultural resistance,

---

[228] I am very grateful for the resonant and caring exchanges with the Infrasonica amigxs that opened up this dialogue. Also for their labor in translating and sharing this conversation. The conversations occurred digitally during the year 2020 via Zoom. Please refer to the Infrasonica site for the full interview and sound component: https://infrasonica.org/en/sonic-realism-wave-3/interview-claudio-mercado-nicole-lhuiller (Accessed: 04-10-2022)

[229] "In the received account, sound is a form of energy transmitted through a medium. Often, that energy moves across or between media—from an antenna to a receiver, from an amplifier to an ear, from the lightness of air to the thickness of water. With such crossings, sound is transduced. The word comes from Latin transducere, "to lead across, to transfer," out of trans, "across, to or on the farther side of, beyond, over" + ducere, "to lead." A loudspeaker is a transducer. A microphone is a transducer. A telephone is a transducer. During the twentieth century, the human ear came itself to be described as a transducer." Stefan Helmreich, "Transduction," in *Keywords in Sound*, edited by David Novak and Matt Sakakeeny. (Durham: Duke University Press, 2015) p. 222-231

[230] Translator's note: Southernlogics comes from surlógica, which challenges the global status quo of Northern hegemony.

[231] Translator's note: Understanding this, the decision to translate this interview into English was made in conjunction with all parties.

[232] *Chino* is a quechua word that means "server." "The Bailes Chinos are brotherhoods of musicians/dancers from central Chile. They express the faith of farmers and fishermen that gather in religious festivals celebrated in small villages and coves where they congregate dances of neighboring towns. The oldest musical antecedents of the Bailes Chinos go back to the 'Aconcagua Volcanic Complex,' a culture that inhabited the central area of Chile between 900 and 1400 AD. During the Colony and early Republican Period, chronicalists and travelers left testimony of these celebrations. They have survived by unifying the social, cultural and religious lives of the region's farming and fishing villages. The Bailes Chinos are inserted within the framework of the American popular ritual, with Indigenous contributions like instrumental music, dance, musical instruments and the direct relation with the supernatural through special states of consciousness. They also present Hispanic elements, like prayers, the song of ensign, the Holy Scriptures, images, ritual calendar and other aspects of Christianity." Further reading: Claudio

Southernlogic possibilities, altered states, vibration and transduction in a conversation that originally took place over Zoom before being transcribed and edited for brevity.

NL: The winds are from the Americas, wind instruments prevail throughout the continent. Why do you think that is? Why has the flute spread through this territory? Are there correlations between the instruments and their choreographies with the bodies of wind that inhabit and travel here?

CM: You know, it's in the plants, it's so simple...and the wind...is observation. Nature whistles with the cañas.[233] It's full of plants that are there, they're cracked and you breathe through them and they sound. There's an acoustic matter that develops amid nature, with nature. The flute is a cut reed, remember that documentary about those old men over in Bolivia that cut the reeds and go to the wind atop the mountain, it isn't them who breathe, it's the wind, so there's a clear relationship. Breath...breathe in and breathe out and if you don't, you die. This nature is that simple. And that this instrument relies on the breath one gives to live is an interesting metaphor. You deliver your vitality through breath, that question vibrates and produces that sound. The most beautiful of that type of flute is the complete relationship that it requires with someone else. Piii paaa piii paaa (imitating the flute's sound). And that has to do with breath, if the most wonderful thing about that is breathing, because you need a partner that breathes together with you, who alternates and continues breathing. You play in perpetuity, the sound never cuts because two people are playing, each with their breath, rather, each one giving their life. Deep down, the flute gives back to you something incredible that cleans your mind and heart with hyperventilation, oxygenation, with movement, with sound, with vibration, with everything that it produces. The general vibrations of the body and space are activated. When you properly play a flute, or sing properly and afterwards remain quiet, you hear differently. That's what Chino flutes do also, they open your sound swarm jjjjjjjjjhhhhhhhhhhhhh (imitating the flute's sound) they completely open your sound and mental spectrum.

NL: One sort of calibrates itself in those vibrations with the others, like it resonates between bodies, like a type of vibrational tuning.

Mercado y Víctor Rondón, *Con Mi Humilde Devoción, Bailes Chinos en Chile Central* (Santiago: Museo Chileno de Arte Precolombino, 2003) p. 6.

[233] Translates as reeds

CM: Exactly, and that happens when the Baile Chino begins, suddenly it warms up and suddenly a moment arrives in which the thing jjjjjjjhhhh (imitating the flute's sound) sets and goes wild. The sound of the flute ultimately has a knowledge, it's a learning of the vibration that was born from the human's encounter with this piece of stick over many years. Before that relationship, there was no learning and once you stop doing it, it's extinguished. That sound that leaves in that moment has been preceded by thousands of sounds that have been played in central Chile, that's its brilliance. In Pachacamita they have been playing for at least 500, 600 years, 700 years perhaps. That sound has memory because it's alive, independent jjjjjhhhh (imitating the flute's sound), and then it extinguishes, supposedly? I don't think it ever extinguishes, it remains in some plane of the universe.

NL: Like the energy that is transduced and doesn't turn off.

CM: Of course, something like that! It's an apprenticeship that is from the same flute and those same gestures. Those gestures have also been repeated for 700 years and have a force, they have a power. We know that in the shamanic knowledge of America, the importance of positioning is essential, of the gestures, of the repetitive dances of the Chinos are knowledge that is directly transmitted through gestures and sound, rather, through the doing of the ritual. Furthermore, the festivals have happened in the same places for hundreds of years, and those places are accustomed to receiving that force, that energy, that retribution, and that petition once a year.

NL: There is an important theme there, this sound that teaches you and that communicates in that collective sonic cloud, in that polyphony… I love something that I've heard you say several times, that the ritual of the Bailes Chinos is a cultural resistance, so the Torn[234] Sound in one way is a sound that has carried that cultural resistance for centuries.

CM: Yes, well, because we are in central Chile, which was the part where the Westernization was felt most rapidly, the natives that were there were killed, uprooted, or sent far away, and those who stayed were mixed with the recent arrivals, they now constitute the Chilean peasants. The Bailes Chinos either got mixed up in the Catholic thing or they disappeared. Who knows what those festivals were like before. That's one of my dreams; that when I go up, when I am *chineando*[235] on the ridge of Pachacamita, I'll see from above the entire valley and the Aconcagua

[234] The sound of the Chino flutes is called "rajado/torn." It is a particular, dissonant sound with multiple harmonics.
[235] Translator's note: This refers to the verb form of practicing the ritual dance of the Bailes Chinos.

river, laters, I'll transduce and go back in time 600 years, climbing the same ridge *chineando* with those ancestors 600 years before.

NL: Through that sound and that trance, you travel through dimensions of reality, which have to do with the altered states of consciousness that have been an important part of your interest in this. I understand that from there you began *chineando,* trying to understand and break down what trance is.

CM: *Claro po*,[236] because I assumed that something happened there with those flutes that are played that way, they have to produce something. So I spent a year asking those old men. I went to those festivals, I went to Cai Cai, there I met the Caicainos and they told me, "Yes, one gets drunk, yes, one feels strange…" The perception of one as a human changes in relation to the world. Sound does that and speaking about that is very difficult because there are no words, it's ineffable to describe that. So one of those old men, Armando, told me, "*ya pucha dejate de preguntar tonteras y chinea po*!"[237] and he gave me a drink, and I *chinié*, and from that moment I became a Chino-addict.

NL: It's the difference of having translated what you observed from transducing through the experience.

CM: Exactly, and it's obvious. If you are an anthropologist, like myself, what you do is ethnography, from there to understand the relationship between music and the states of consciousness is absurd.

NL: Personally, I'm interested in sound as something where humans and other entities dialogue, opening nonlinear sound spaces and exploring the potentiality of sound outside of the musical, extending temporalities and access to other dimensions through trance. What can we learn by paying attention to the noise and other spaces of wisdom and beauty outside of the Western canon? What does it mean for you to think from a logic of the South, what would a Southernlogic be from your life experience?

[236] This translates to exactly.
[237] Translation: "Alright, stop asking dumb questions and *chinea* already!"

CM: It would have to be more campestral, a more communitary and solidary logic; that is how Southernlogic must be. As far as sound, well, in sound we learn to distinguish each place's territorial sound. How many times in history or geography class did the book say, "the mountains are beautiful, the central valley has this and that thing, it has that flora, that geographical feature, those rivers, it has those mountain ranges." But they have a sound, a specific sound, and that sound has a local meaning. It's the same as the sound frameworks of the Bailes Chinos. Each Baile Chino belongs to a village. That village has a sound, that dance sounds a certain way and one knows without looking that that dance is from Loncura. There are local frameworks. The *sikus* are there, the *puncullas* are there, the *tarcas* are there, the *pifilcas* are there, the *kultrunes* are there, the *copla* songs are there; there are so many American sounds.[238] All of the Mapuche songs that are precise and full of meaning are there, and there are songs for every moment and situation. I mean, the sound and the voice as vehicles of history, of the presentation of many things that were sung. There is a whole knowledge and density of acoustic information in America.

NL: It's a relationship with the flute.

CM: Absolutely.

NL: The flute is alive.

CM: It's absolutely alive. And suddenly I don't what I'm doing and it doesn't sound and it doesn't sound and it doesn't sound and it just doesn't sound...because something is happening in the relationship, or something is happening to it, or it took a lot of sun, or drank a lot of water, or isn't comfortable, or has a bit of fluff inside, or a splinter, any *weaita*[239] and it doesn't sound. And you go desperate and don't sound, and that is when you pull out other sounds.

It's alive, it's much more alive than the Western (flute), that energy that you throw into it returns three-fold. I've had my flute for twenty-eight years.

The sound swarm it produces is incredible, a swarm in which one flies, and you leave your body, as if seeing it from above. It's that collective energy that it produces, the ritual of emotion that is produced, the encounter with friends, drinking wine from the early morning, being happy telling jokes, telling stories, we met each other years ago and we see each other there with the old people

[238] Translator's Note: These are examples of instruments commonly found throughout Indigenous communities of the Americas.

[239] Translator's note: *weaita* is a Chilean word for a small thing.

from the different towns. It's a beautiful thing; the affection for others and the madness of the flutes.