UNIVERSITY OF CALIFORNIA SAN DIEGO

Resonance & Resemblance: Sound Perspectives of a Pluralistic World

A dissertation submitted in partial satisfaction of the requirements for the degree
Doctor of Philosophy

in

Music

by

Suzanne Thorpe

Committee in charge:

Professor David Borgo, Chair
Professor Amy Cimini
Professor Tom Erbe
Professor Nancy Guy
Professor Victoria Petrovich
Professor Kalindi Vora

2020

The Dissertation of Suzanne Thorpe is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

Chair

University of California San Diego

2020

TABLE OF CONTENTS

LIST OF FIGURES

ACKNOWLEDGEMENTS

I am deeply grateful to my committee, David Borgo, Amy Cimini, Tom Erbe, Nancy Guy, Victoria Petrovich and Kalindi Vora for their expertise and support. Their guidance and encouragement have helped me shape a critical and creative project that I look forward to maturing as my career progresses. I am particularly grateful to David Borgo and Amy Cimini for their detailed feedback and humor. They have both taught me that research is a personal process and have consistently cultivated my unique progression.

I have a beautiful group of loving friends without whom I could not have achieved this goal. They include Julie Evanoff, Alex Zucker, Susan Nathan, Carrie Dashow, Kjell Nordeson, Amit Sen, Stephanie Loveless, Christina Zafiris, and Irene Frank.

A special note of gratitude to my partner in all things TECHNE, Bonnie Jones. With her support and commitment our shared vision has continued to grow and for that I am impressed and grateful.

Lastly, I want to thank my family: my parents, Jack and Gail Thorpe, my brother John and sister-in-law Maria, and my nephew Shea and niece Holly. They have been relentlessly supportive as I find my way through the world, with good humor and constant encouragement. Thank you!

Chapter 2, in part, has been submitted for publication of the material as it may appear in Music Research Forum published by the University of Cincinnati College-Conservatory of Music, 2020. I, Suzanne Thorpe, was the primary investigator and author of this paper.

VITA

EDUCATION

Ph.D., University of California, San Diego: Music/Integrative Studies

M.F.A., Mills College: Electronic Music and Media

B.A., University at Buffalo, SUNY: English

A.S., Schenectady County Community College: Music Performance

Certified Instructor: Deep Listening Institute

ACADEMIC POSITIONS

2013 – Present
University of California, San Diego

- *Music, Media & Technology* - Associate-In (Current)
- *Music, Sound & Environment* - Associate-In (Summer, 2019)
- *Sound In Time* – Associate-In (Winter 2015, 2016, 2017, 2018)

2017, Fall
Bennington College, Bennington, VT – Visiting Faculty of Electronic Music

- *Logics of Ecology and Electronic Music*: Designed a curriculum that applied theories of ecology to compositional methods with the inclusion of technology
- *Feminist Theory and Electronic Music*: Designed a curriculum that explored compositional modes of female pioneers of electronic music through the lens of feminist theory

2013, Spring
Parsons School of Design: School of Art, Media and Technology NY, NY – Adjunct Faculty

- *Sound Design1*: Provided an overview of nonlinear audio production and sound culture with an emphasis on integration with other narrative formats

2010 – 2013
Marymount Manhattan College, Communications Arts Dept., NY, NY - Adjunct Faculty

- *Digital Sound Workshop*: Intro to Sound Design & Pro Tools
- *Sense & Medium*: Introduction to Digital Tools

2007 – 2008
Mills College, Center for Contemporary Music, Oakland, CA
- *Deep Listening* with Pauline Oliveros – Teaching Assistant

CONFERENCE PAPER PRESENTATIONS
- 2018 Royal Danish Academy of Fine Arts, Sounding Bodies Symposium - 'Researching Resonance'
- 2018 Graz University of Technology, Graz, Austria/17th Annual STS Conference – 'Musicking and Material Agency'
- 2018 University of Arizona, Tucson, AZ/Tucson Noise Symposium – 'Feminism & Noise' (In collaboration with Bonnie Jones)
- 2017 McGill University, IPLAI: Still Listening 'Live Performance Considerations for Pauline Oliveros' Early Electronic Music' (In collaboration with Alex Chechile)
- 2016 UC Irvine ICIT: New Expressions: Women in Music Technology 'Community Enactment of Radical Transformation with Sound and Technology'
- 2015 Northwestern University, Chicago, IL – 'Site Specific Sound, Autopoiesis and Interconnectivity'
- 2014 SUNY at Stony Brook, Stony Brook, NY – 'Reading Site Specific Sound Art as Adaptive Environmentalism'
- 2008 ARTECH, Porto, Portugal - 'Biofeedback Data and Telematics'

INVITED LECTURES/PANELS
- 2018 SARC, Queens University, Belfast - *Radical Transformation Through Sound*
- 2018 Brown University - *Listening (In) To Relational Becoming*
- 2018 Rensselaer Polytech Institute - *Listening (In) To Relational Becoming*
- 2018 UC San Diego, San Diego, CA – *Performing Live Code*
- 2017 Johns Hopkins University, Baltimore, MD - *Diversity in Electronic Music*
- 2016 Re-Sounding, Seattle WA - *Imagining Within and Beyond the Sonic Sphere*
- 2016 San Diego Art Institute, San Diego, CA – *Technology and Listening*
- 2015 Bauhaus University, Weimar, Germany – *Proprioceptive Embodiment of Space through Deep Listening*
- 2014 Caramoor Center for the Arts – *In the Garden of Sonic Delights*
- 2014 Brown University, Providence, RI – *Open Signal: Women in Electronic Music*
- 2012 Pace University, New York, NY - *Sound Design and Video*
- 2012 Cycling 74 Convention, Brooklyn Tech, Brooklyn, NY - Artist Talk
- 2011 Bard College, Music/Division of the Arts, Tivoli, NY
    - Conducted the Bard Improvisation Ensemble

    - Presented spatialization techniques
- 2011 SUNY Purchase, School of Visual Arts, Purchase, NY – *Sound & Image*
- 2010 New York University, Steinhardt School, New York, NY - *Improvisation and Electronic Music*
- 2009 Pratt Institute, Munson Williams Proctors Arts, Digital Foundations, NY Artist Talk

GRANTS, AWARDS, RESIDENCIES

- 2019 Ferral Artist-in-Residence, Beloit College
- 2018 QO2 Artist In Residence
- 2016 David Tudor Residency – Mills College, Oakland, CA
- 2016 Prattsville Arts Center
- 2016 New Music USA
- 2015 MAP Fund (Doris Duke & Andrew Mellon)
- 2014 UCIRA
- 2012 Ten Legs Teaching Artist Award
- 2012 Harvestworks New Works Residency
- 2012/2011/2010 Meet the Composer, Creative Connections
- 2008 Frog Peak Collective Award for Technical Achievement
- 2007 – 2008 Crothers & Menaglia Awards
- 2002 – 2003 Second Chance Scholarship
- 1999 Recording Industry Association of America: Gold Record - For *Deserter's Songs* by Mercury Rev, Sony/Beggars Banquet Records

PUBLICATIONS

- "Musicking Eco-logically: Towards an Environmentally Inclusive Practice" [Music Research Forum published by the University of Cincinnati College-Conservatory of Music: Forthcoming]
- "Materiality in Resonance" *Vorkus: Echoes,* University of Florida, Graduate School of Architecture [April 2019]
- "Listening In(to) Relational Becoming," The Global Composition: Sound, Ecology, and Media Culture, Darmstadt-Dieburg/Germany. Proceedings Publication, Hocschule Darmstadt, University of Applied Science [2018]
- "Applying the Enhanced Hearing Abilities of Digital Media to Understand the Relational." *Media Commons*, http://mediacommons.futureofthebook.org/ [2018]
- "Pedagogy of Flow: Sound and Bodies." *Grounds For Possible Music*, edited by Julia Eckhardt, Brussels. In collaboration with Bonnie Jones [2018]
- "*Resonance & Resemblance," Experimental Music Year Book*, http://experimentalmusicyearbook.com/, [2016]

- "One History of Female Electronic Musicians," *Sound American*, Vol. 1, Issue 2, edited by Nate Wooley, Brooklyn, NY. In collaboration with Bonnie Jones [2016]
- "Deep Listening: A Method Towards Focusing Consciousness in a Multi-Mediated Student Body," Anthology of Essays on Deep Listening, Edited by Monique Buzzarte and Tom Bickley, Deep Listening Publications [2012]

SELECTED WORKS

- **2018 *Border Fandango***
- A composition based on field recordings gathered at the San Diego/Tijuana border. Commissioned by 'Each Morning of the World' for their North American PhoNographic Mornings release
- **2017 *Resonance & Resemblance***
- A sonic meditation created for Russel Wright's quarry pool, on his estate Manitoga, in Garrison, NY. It featured four recorders players, electronics, trees, insects, birds, animals, water, wind, granite and listeners. Commissioned by the Russel Wright Foundation
- **2015 *Constituting States***
- A generative work for vocals & electronics, spatialized for 8 speaker array, commissioned by the San Diego Art Institute, for the exhibit (Con)Text.
- **2014 *Balboa Arboretum***
- A generative work featuring field recordings of trees with conduction by wind speed via an anemometer. Commissioned by the San Diego Art Institute for the exhibit Balboa Park: 100 Years
- **2013 *Listening Is As Listening Does***
- *Listening Is As Listening Does* is a composition that simulates the principles of echolocation, a system of listening that allows bats, and other animals, to navigate. Commissioned by Caramoor Center for Music and Art
- **2012 *Phloq***
- *Phloq* is a 3D sound installation composed while an Artist in Residence at Harvestworks Digital Media Center, NY, NY.
- **2011 *I Could Sit Here and Listen to You All Night Long***
- Written for solo flute, tape music & electronics
- **2011 *Twilight***
- For field recordings, electronics and group song
- **2010 *Clean Water Act***
- A participatory work for group-song and listening meditation the piece invokes folk-song formats and a Deep Listening mediation to be performed

on a body of water

- **2010 *Alpha 4 Tron***
- For Wii controllers, dancers and electronics, to be performed in an immersive environment designed in tribute to the movie Tron. Commissioned by Media Artist Katherine Behar
- **2009 *Extreme Terrains***
- For oscillators, laptop, Balkan beats, flute, trumpet and 16 channel sound system that features the physiological effects of inaudible frequencies, difference tones and psychoacoustics as main compositional tools.
- **2009 *When the Center of the Sun is 6 – 12 Degrees Below the Horizon***
- For solo flute, electronics and 16 hemispherical speakers, commissioned for the Floating Points festival at Issue Project Room, Brooklyn, NY
- **2008 *Balancing Act***
- Composed for the Lightship Frying Pan, Pier 66 Maritime, NY, NY. The installation was simultaneously activated by the ship and activated the space it was in. Commissioned by the Electronic Music Foundation
- **2008 *Subway Series: Part 1***
- A cartographic composition made up of field recordings gathered on two mass transit systems, the New York City Subway and the San Francisco BART and processed in a tuned filtering system.
- **2008 *1+1=3***
- Telepresent distance performance, written for laptop, flute, electronics, oscillator and biofeedback data. Mills College Signal Flow Festival
- **2007 *Convergente***
- Conduction via text for solo or small ensemble of any instrumentation, duration to be determined by group discussion. The score was printed and distributed by postcard.
- **2006 *Foiled***
- A tape piece for flute, electronics and hand diffusion to 8-channel sound system
- **2003 *Basement Conversations***
- For solo flute. Composed for Albany Symphony Master Class on Extended Flute Techniques

ABSTRACT OF THE DISSERTATION

Resonance & Resemblance: Sound Perspectives of a Pluralistic World

by

Suzanne Thorpe

Doctor of Philosophy in Music

University of California San Diego, 2020

Professor David Borgo, Chair

As we mature into the 21st century the world is experiencing increasing instability in environmental, geopolitical, economic and social realms. To support a more equitable and sustainable politics, feminist new materialist theorists have proposed constructs that reframe our engagement of nature, agency, political and social realms. They work to challenge nature/cultural and subject/object binaries to

emphasize a distributed, pluralistic, impactful and interconnected world. However, they have an epistemic blind spot in that their theorizing lacks a diversity of the embedded and creative animation they advocate for. The following dissertation *Resonance & Resemblance: Sound Perspectives of a Pluralistic World* attends to this need. Through an interdisciplinary methodology this dissertation discusses my proposition that the phenomenon of resonance can be, and has been, engaged to theorize a diverse field of material agency and interconnectedness. It addresses my approach to a component of my research, which was conducted through artistic research practice with the composition *Resonance & Resemblance* (2017) commissioned by the Russel Wright Historical Foundation.

This dissertation also presents work from interlocutors Maryanne Amacher (1943 -2010), Pauline Oliveros (1932 - 2016), and Jacqueline Kiyomi Gordon (b. 1982). Each of these electronic music composers have adopted resonance as a mode of creative engagement to know the materials they work with and their surrounding environment. I analyze the composite of my research through a critical framework that intersects feminist materialisms with agent-environment cognition theory. This intersection of theory progresses an intertextual reading that allows me to locate resonance as a cross-modal mode of interpersonal and intermaterial negotiations to render what I call resonant materialism, an embedded, sensual praxis that reframes issues of difference, material effect and accessibility without separation.

Chapter One: Perceived Resemblances

Catalysts

This is an {invitation to practice} the following listening meditation: sit in a grounded posture; take three deep breaths; turn your attention to the sounds around you; complete the following prompts:

Breathe in, Breathe out

Listen to your surroundings, in its entirety

Breathe in, Breathe out

Listen to or imagine an animal's sound, sing the sound to yourself

Breathe in, Breathe out

Listen to or imagine a tree's sound, sing the sound to yourself

Breathe in, Breathe out

Listen to or imagine a sound from the weather, sing the sound to yourself

Breathe in, Breathe out

Listen to a human-made sound, sing the sound to yourself

Repeat until it feels right to end

Suzanne Thorpe, 2017

If you've just completed the above listening meditation, you've possibly activated your sensibility of bird or cricket for a short while, or perhaps heard an experience of leaves, a train's whistle or airplane flying overhead. This listening meditation was part of a 50-minute sonic meditation, a composition I presented in fall of 2017. The piece was commissioned by the Russel Wright Foundation for the designer's woodland garden, Manitoga, in Garrison, NY. Titled *Resonance & Resemblance,* the work had two phases: a guided soundwalk in the woodland, followed by a sonic meditation at Manitoga's quarry pool. The sonic meditation featured four recorder performers in kayaks, within the pool, while I was onshore, playing electronics. Together we performed a sound event amid Manitoga's acoustic ecology that arose out of the environment we were in.

The kernel of inspiration that became *Resonance & Resemblance* (R&R) emerged out of a kayak trip on the Delaware River, in the Delaware Valley area of New York State in September 2010. I had reached an unusually calm basin of pooled water along the river that was surrounded by cliffs of exposed rock. I sat quietly to catch my breath after navigating a section of whitewater rapids and listened to the comparative stillness. As I admired the reflections of small sounds off of the water's surface a beaver slapped its tail as it swam nearby. The sound startled me and grabbed my attention. The detail of the beaver's tail-slap was amplified and jumped around wildly as it reflected off of the water's undulating surface and the cliff's smooth exterior. As I listened to the effect, I knew that I

wanted to create a piece that specifically focused on this effect: one that emphasized sound's activity, and its interactions with an environment's characteristics and behaviors. I wanted to create a tableau that amplified the lively, dynamic and complexly enmeshed changes of being through sound.

It took four years to find a location that had the qualities that would allow me to follow up on this idea. And in that time the kernel of thought had grown, fed by the experience of creating other sound installations. In 2007 I began a series of situated sound installations; sound works developed to intentionally engage with the behaviors and characteristics of a place. I refer to these sound installations as situated, as opposed to site-specific, to gesture towards theorist Donna Haraway's phrase "situated knowledges," and acknowledge that meaning making is the result of bodies in conversation, from their own grounded perspectives.[1] I will expand on this idea going forward, but for now I'll summarize that using the word emphasizes the specificities of place, and the situated bodily encounters of those in that place, during in a music making event.

An example of situated composition includes *Balancing Act*, which I composed for the lightship Frying Pan, berthed at Pier 66 in NYC, in 2008. It was a multichannel sound installation installed in the galley of the 130-foot steel ship.

[1] Donna Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies* 14, no. 3 (1988): 575.

The piece was performed with sound generation in real time, with musical choices determined by the sway of the ship. This was accomplished by tracking data gathered by an accelerometer which I streamed into a software called Max/msp to produce and conduct compositional choices. I also activated psychoacoustic effects by choosing wave forms that interacted with the steel walls of the ship to produce enharmonic tones. The piece proved to be a multi-sensorial experience of the ship's being. Its gentle movements and interactions with its surroundings could be heard and felt by the voicing of *Balancing Act* in tandem with sounds of rope as they strained to hold the mooring, or the moans of the gangway as it fluctuated to hold its place. *Balancing Act* focused the listener in a heightened sense of aurality that was somatically comprehensive and environmentally contingent, which led listeners to the many vociferous actors in the space.

Another significant piece I created in this series was *Listening Is As Listening Does (LIALD). LIALD* was composed for Caramoor Center for Music and the Arts' inaugural sound art exhibit, *In the Garden of Sonic Delights*, 2013. The impetus for the piece was the plight of local bats, whose population had declined due to white-nose disease, causing a marked imbalance in the ecosystem. While I listened in the open-air Spanish courtyard, a favorite spot for bats, I my attention was drawn to the slate floor, swirled concrete walls, arches and windows because of how they interacted with sound. When I walked slowly about the space, and projected sounds, my awareness of the structure's effects on what I heard

increased, and the place's structures became characters that contributed to the piece's evolution. Sound wavered and wandered around the semi-enclosure, which at times discreetly embraced voices in a corner or arch, or tossed it around. The activeness of the space, and the fact that the courtyard was home for many bats, inspired me to adopt sonar as the compositional process for the piece. Sonar is a system of navigation bats use to determine the location of objects via reflected sound. *Listening Is As Listening Does* simulated this process by listening for echoes of specific frequencies in the courtyard, that when heard, conducted compositional choices. The piece was most responsive when the courtyard was empty as more surfaces were exposed, or, as the piece listened to various regions of the courtyard, one side would be more active than another. The piece also attracted birds to seemingly duet with it, as their vocal range was in the spectrum of what the piece was listening for, which created quick little vignettes of call and response.

We (the characters of the courtyard and I) produced a fantastic spinning effect with high ranged, closely pitched frequencies. And the open roof of the courtyard seemed to embrace sounds that came from above, creating an animated, somewhat dislocated sonic happening of birdcall, airplanes, wind, visitor's conversations, lawn mowers, and an occasional symphony (from a nearby outdoor stage) within its walls. The piece's slowly evolving environmental interaction invited participants to slip into a contemplative state of listening that

illuminated processes of entanglement in the setting. The musicking experience that emerged was the product of a dynamic entanglement of many actors, not just that of a composer. The binary of composer/performer was quite blurred by the activity of animals and the materials of the space, and preconceived notions of the courtyard, and its inhabitants, as static bystanders were easily dispelled.

Creating these pieces had a combined effect that illuminated certain phenomena that I became curious about. In these sound installations, my musicking underwent a contextual metamorphosis when it was heard with other sounds in the environment. The music also emitted subtle physical changes when elements in the places were modified or shifted, such as temperature or time of day. And my attitude about who, or what, was responsible for the musicking experience transformed. I no longer believed that I was a sole author, but understood I was one of many sound actors and influencers interweaving in dynamic relationships. These experiences combined to point to a heightened awareness of material activeness and agency, and an awareness of ongoing inter-material effects that was illuminated by sound. I began to figure this effect as a materialism of sorts, a way of knowing the world as a diverse field of entangled material forces. And because the experience was amplified by materials resonating together, I began to call this a resonant materialism. I emphasize resonance because the heightened sensibility I experienced emerged out of mutually excited affectation of bodies that together bloomed into another being or

meaning. I suspected this effect might be true for others from responses to *Balancing Act* and *Listening Is As Listening Does*, and set out to inquire about the phenomena with focused intent in *Resonance & Resemblance*.

Resonance

Resonance & Resemblance was developed as a way to think through resonance's ability to engender an articulation of feminist materialist theory, which can broadly be understood as a scrutinization of nature/culture binaries and an effort to accentuate our agential and heterogeneous environment. Feminist materialist theorists purport that nature/culture and subject/object binaries perpetuate hegemonic structures of power that rely on bifurcated and hierarchical frameworks. Yet they struggle to convey a diffusion of binaries and convey a sensibility of a diverse and impactful world. I believe that thinking through feminist materialist comments with the phenomenon of resonance has the potential to supplement their efforts.

Resonance as a phenomenon is defined as the activation of like frequencies in a vibrating system, which results in their amplification.[2] It is germanely contextualized in that its potential rests on the specificities of a body, which points to a body's aspects or characteristics. Resonance doesn't disclose a

[2] Panos Photinos, *Musical Sound, Instruments, and Equipment* (IOP Publishing, 2017), 12, https://doi.org/10.1088/978-1-6817-4680-7.

body's entirety but divulges some of its qualities as they exist in the moment. Sympathetic resonances are generated when a sonic impulse from one body activates close or identical frequencies in other forms.[3] When multiple bodies resonate together, we hear resonance's capacity to cross forms, to dynamically coalesce or commingle. In resonance a shared sensibility can simultaneously arise in a multiplicity of bodies, akin to a shared perspective. This perspective arises without denying the entirety of a being, and its individual distinctions. In fact, this perspective exists, in resonance, because of bodies' particular lived experiences, and does so without separation from its totality.

Going forward this dissertation builds a case for resonant materialism: a feminist-informed, relationally derived, and experientially transpired account of the world as pluralistic and impactful, as well as distributed and interconnected. It is an interdisciplinary inquiry from the embedded practice of music-making that highlights multiplicity and simultaneity. From this province I propose resonance as a sensual praxis to think through feminist materialist concerns about who and what matters, how we know our material environment, and how we can imagine equitable narrations of the world. Through a creative, resonant-focused event of my own making, *Resonance & Resemblance*, and the work of electronic music composers Maryanne Amacher, Jacquline Kiyomi Gordon, and Pauline Oliveros, I argue that resonance blurs subject/object and nature/cultural binaries. With the

[3] Photinos, *Musical Sound,* 14.

support of feminist materialisms, agent-environment cognition and Native American studies, I also propose that resonance is uniquely suited phenomenon through which to know our heterogeneously entangled world because of its own embedded existence: it's being is but a perspective of its contextualized entirety.

Interspersed within this dissertation are what I call {Invitations to Practice}. These are invitations for you, the reader, to participate in this project as a member of a coalition of contributors to this body of knowledge. It is also an effort to perform concepts I argue going forward that trouble human/nonhuman and nature/cultural binaries in the interdisciplinary fashion that I believe this project requires. I hope you'll take time to perform one or all of the scores offered.

{Invitation to Practice}

Paper
Choose a vowel to hum
Sing your vowel 3 times and notice how it engages with you, and your surroundings
Hold a sheet of paper in front of your mouth
Focus your attention on the sheet of paper and sing your vowel again
Play … try new vowels, sing softly and loudly, move the paper close and far
Continue for a few cycles
Now think about paper … do you know paper differently?

Creative Practice as Methodology

From a feminist perspective that knowledge is process as well as a coordination of information, my methodology emphasizes location, relationships, subjective experience, and coalitions. As a composer and researcher, I find myself in the position of both insider/expert as well as outsider/observer in that I participated in and observed the effects of my work. According to ethnomusicologist Timothy Rice, this is not atypical of a contemporary researcher, and in fact has benefits in its ability to create coordinates between the subjective knowledge in regard to the influence of meanings and intentions and objectivist methods of observation.[4]

I engaged my expertise to perform a portion of my inquiry through creative practice. In so doing, I consulted Hazel Smith and Roger Dean's *Practice-led Research, Research-led Practice in the Creative Arts*, which provides an overview of emerging concepts and approaches to practice-based research.[5] The phrase creative practice-based research emerged in the 1970s, mainly in the U.K. and Australia, when artists recognized a potential to develop their practice in the framework of higher education. Academic institutions applied specific parameters and metrics to what they deemed research, and adopted these terms and methods

[4] Timothy Rice, "Toward a Mediation of Field Methods and Field Experience Ethnomusicology," in *Shadows in the Field: New Perspectives for Fieldwork in Ethnomusicology*, ed. Gregory F. Barz and Timothy J. Cooley, 2nd edition (New York: Oxford University Press, 2008), 46.
[5] Hazel Smith and Roger Dean, eds., *Practice-Led Research, Research-Led Practice in the Creative Arts*, 1 edition (Edinburgh: Edinburgh University Press, 2009).

to refer to, and qualify, investigative work conducted in a creative mode. A few variants have emerged since, including practice-*as* research, practice-*led* research and practice-*based* research. For author and Professor Robin Nelson, practice-as research is a method of inquiry in which creative practice plays a key role, and record of the practice is submitted as evidence in documentation.[6] Practice-led research, on the other hand, is research engaged to discover new modes of production in creative practice. Smith and Dean situate practice-led research alongside the term research-led practice to indicate an iterative cycle of discovery for creative process and production. More recently, Linda Candy and Ernest Edmonds, in their article *Practice-Based Research in the Creative Arts: Foundations and Futures from the Front Lines* succinctly defined practice-based research (PBR) as "an original investigation undertaken in order to gain new knowledge, partly by means of practice and the outcomes of that practice."[7] They characterize the production of an object or knowledge as a specific characteristic of PBR. I correlate my research with Candy and Edmond's description of PBR, who cite examples including the Ph.D. research of Dave Burraston, which investigated formal systems with the adaptation of cellular automata to generate music, and Jen Seevinck's Ph.D. research, which addressed emergent complexity theory in computer-based interactive art.[8]

---

[6] Robin Nelson, *Practice as Research in the Arts: Principles, Protocols, Pedagogies, Resistances* (Palgrave Macmillan UK, 2013).
[7] Linda Candy and Ernest Edmonds, "Practice-Based Research in the Creative Arts: Foundations and Futures from the Front Line," *Leonardo* 51, no. 1 (February 2018): 63.
[8] Candy and Edmonds, *Practice-Based Research*, 68.

Carole Gray detailed strategies and methodologies for the practice-led researcher in her article "*Inquiry through Practice: Developing Appropriate Research Strategies"* that identify workable constructs for the creative-based researcher.[9] Following her process, I have contextualized the critical theory aspects of my research in relation to historic and contemporary discourse. The method I adopt to encompass my ontological and epistemological framework is an amalgam of perspectives, incorporating a hybrid of "methodologies involving a synthesis of many diverse research methods and techniques."[10] To the traditional researcher, this may seem unmanageable in an effort to qualify or quantify, but Gray points to what she terms a naturalistic form of inquiry adopted by ceramic artist Katie Bunnell that offers structure to apply. Specifically, Bunnell's methods acknowledge complexity, real experience, tacit knowledge, emergent methodologies, special criteria for trustworthiness and idiographic interpretation.[11] The practitioner-researcher *is* the subjectivity, a fact that is handled through reflexive acknowledgment. The knowledge generated is context bound and may involve personal construction. The research project may not be replicable, but it must be accessible and communicable through documentation.

Forms of reporting include the creative work itself and written text. Methods traditionally used by artists, such as sketch books or journals, have been

[9] Carole Gray. 1996. "Inquiry through Practice: Developing Appropriate Research Strategies." In *No Guru, No Method? Discussions on Art and Design Research* 1 -28*,* University of Art & Design, UIAH, Helsinki, Finland.
[10] Gray, *Inquiry through Practice*, 12.
[11] Ibid. 16

repurposed as a research method for documenting and recording process and discovery. In addition to creative practice, my methodology is grounded in the feminist perspective that knowledge is process as well as a coordination of information. Following is a review of critical texts I situate my work with, and critical theory I draw from.

Differences and Similarities in Literature

There is a common narrative that the evolution of Western reason is detached from the senses. However, in his text *Reason and Resonance: A History of Modern Aurality* Veit Erlmann brings attention to aurality's role in the maturation of modern thought with a focus on resonance.[12] His text parses and parleys the complex relationship between historical frameworks of hearing and metaphysics, and how they recursively informed notions of subject-hood. Erlmann initiated his point with a reexamination of philosopher Rene Descarte's metaphysics, to whom our current attachment to ontological dualisms is typically ascribed. Descartes rejected the concept that everything is matter, and instead proposed two separate substances: thinking substance and extended substance. The second is modifiable matter, innately quantifiable, without value or internal qualities, and subject to control. If a thing presented interior or sensual qualities, such as smell or taste, they were deemed unreliable, unstable sensations that Descarte

[12] Veit Erlmann, *Reason and Resonance: A History of Modern Aurality* (New York: Zone Books, 2014).

attributed to human thought.[13] His configuration emptied matter of vitality and uncoupled the corporeal experience of a thing's properties from the thing. This framework established a dualism that set the stage for Euclidean geometry, and modernity's frameworks of detachment that inform techno industrialism. Erlmann destabilizes this narrative with a focus on Descartes' lesser known interest in aurality. He proposes that Descarte's *Meditations on First Philosophy* be "decoded sonically," an act which reveals an "uneasy truce between cogito and audio, a precarious entente between entendre, hearing, and entendre, understanding."[14] With this declaration Erlmann points to the possibility that Descarte may have reasoned through sound and hearing. Erlmann holds that if one can *hear* the text sonically, one can understand how Descartes began a "lifelong (and never completed) quest for 'reasoning,' the joining together of reason and resonance in a new concept of personhood."[15] He also suggests that our assumptions about Descarte's adhesion to discretion isn't what it seems through his *Compendium of Music* (1618), an early text often dismissed as insignificant. Amidst comments that relinquish the nature of aural pleasure to physicists, Descartes contradicts himself by framing the voice as a sensual manner of reason. Cumulatively, Erlmann uncovers convincing evidence in Descarte's treatment of sound that suggests his stance on modifiable mechanisms vs. thought weren't as firm as we believe.

---

[13] Diana Coole, "The Inertia of Matter and the Generativity of Flesh." in *New Materialisms: Ontology, Agency, and Politics* ed. Diana Coole and Samantha Frost (Duke University Press, 2010) 95.
[14] Erlmann, *Reason and Resonance*, 31.
[15] Ibid. 31.

From Descartes Erlmann progresses through an exhaustive list of otologists, philosophers, physicists and musicians (Claude-Nicolas Le Cat, Denis Diderot, Samuel Sommerring, Wilhelm Heinse) to trace an aural metaphysics that emerges out of an oscillation between reason and resonance. He traces cohesions and contradictions of vitalist-informed medicine, physics and metaphysics that feature the ear as "clearly our most exact sense" that, through various interpretations, led to theories of autonomy in music and sound.[16] For example he framed romantic-era physicists and philosophers Johann Ritter, Johannes Muller, and Jan Purkinje as autoresonant listeners. They attempted to understand the physics of hearing and the perception of sound with extreme experiments on themselves that featured techniques such as electric shock via galvanization and metallurgy. Their experiments produced self-induced mental and physical ailments, as well as speculations about the mechanics of hearing and the effects of sound that became an invitation to "empiricism of the subjective element" in philosophical circles of the time.[17]

Erlmann also traced auto-affection to Herman Helmholtz's theories on resonance. In his text *On the Sensations of Tone* Helmholtz displayed a tendency to think of the acoustic world as "prater nos," or existing outside of ourselves.[18] For Helmholtz sound had its own idiosyncratic behaviors: "mechanical effects in

[16] Ibid. 156.
[17] Ibid. 207.
[18] Ibid. 220

nature, altogether independent of the human ear and its sensations, and also altogether independent of merely theoretical considerations."[19] Though this points to an ability to acknowledge the existence of a world outside of human experience, Helmholtz employed the notion to reify his own significance. He separated the phenomenon of sound from hearing, and the lack of continuum substantiated notions of detached self. The summary of Erlmann's in depth research demonstrates that modern concepts of subjecthood have direct connections to historical understandings of aurality and resonance, from which I assume a continued inquiry into the relationship between stances on hearing, listening and resonance, and how we situate self.

Another figure who dreamed of, and wrote about, resonance as way to know ourselves was electronic musician, composer and inventor Daphne Oram (1925 - 2003). Her book *An Individual Note: Of Music, Sound and Electronics* (1972) is a primer of sorts for the would-be electronic musician in which she frames resonance as "an emergence into being of something beyond the original." [20] It is both technically precise and playfully imaginary as it introduces the reader to concepts of basic circuitry and tonal harmony and illustrates how one articulates the other. The topic and content are intensely technical and reflects the rigor of Oram's knowledge. But she intentionally situates the text outside of the realm of

[19] Hermann von Helmholtz, *On the Sensations of Tone as a Physiological Basis for the Theory of Music* (Longmans, Green, and Company, 1895), 36.
[20] Daphne Oram, *Daphne Oram: An Individual Note of Music, Sound and Electronics*, ed. Matt Price (London: Anomie Academic, 2016), 12.

"sober academic textbooks."[21] Instead she frames her writing as an "amusement," a move that seemingly liberates her to reason from outside the bounds of empiricism in her field that are typically considered to be reason.[22] She breaks down the word amusement to focus on the word muse, contained in amusement. This suggests that her writing functions as an inspiration to explore the "intriguing interrelationships between electronics and music, to see whether we can break open watertight compartments and glance anew-from various aspects and in various states of mind."[23] With this statement Oram insinuates a need to diverge from the restrictions of empiricism in order to access prisms of perspective that allow for a "strange world where composers will be mingling with capacitors, computers will be controlling crotchets and, maybe, memory, music and magnetism will lead us towards meta- physics."[24] Oram's situating enables her to position electronics and music as germanely creative in a life-engendering sense, a view that invites her to ponder resonance and its relationship to life. "Are we forever developing our regions of resonance so that our individual consciousness will rise into being?" "In this way does the tumult of existence resolve itself into a final personal waveshape, the embodiment of all one's own interpretations of the art of living?"[25]

[21] Oram, *An Individual Note*, 1.
[22] Ibid. 1.
[23] Ibid. 1.
[24] Ibid. 1.
[25] Ibd. 32.

From Oram's text I take up a playful musing about resonance's emergent possibilities. I answer Oram's summons to perform a mischievous, interdisciplinary derive in and out of resonance's empirical, sonic and metaphysical possibilities and imagine new ways of being through resoance. In addition, I put myself in dialog with her and other women of that area, including Pauline Oliveros, Maryanne Amacher, Eliane Radigue, and Wendy Carlos Williams among others. They were part of a cohort of 1970s electronic music figures who, in contrast to Erlmann's cast of male philosophers and physicists, fluently reasoned through resonance in the field of electronic music.

[Sonic Materialism]

Salome Voegelin's S*onic Possible Worlds: Hearing the Continuum of Sound* and Christoph Cox's *Sonic Flux: Sound, Art and Metaphysics* are recent proposals for vibrant materialism in sound. They are in part driven by a need to move beyond semiotic and text driven forms of musical analysis which fall short in their ability to analyze proposals brought forth in contemporary sound art. Thinking of sound and music as dynamic relational forces in time and space allows us to broaden our musicking practice and expand how we study and apply our knowledge of sound and its effects in the world. Considering sounds' materiality engenders a way to theorize its role in constructing, or deconstructing subjectivity, and co-constructing the world around us.

Voegelin argues that sonic materialism makes context and contingency more available by providing a generative continuum that leads to what she calls phenomenological possibilisms. A phenomenological possibilism, which she derives from an intersection of Saul Kripke's modal philosophy and Merleau-Ponty's phenomenology, is "where possible worlds and life-worlds meet in the generative practice of listening."[26] Inhabiting the world on the continuum of sound creates a "sonic sensibility," and Vogelin theorizes that in this sonic sensibility we access a thing's materiality.[27] This creates an opportunity to know a thing's agency through the act of listening. "The sonic sensibility allows us to reference the material as action, as thing thinging, rather than as object, and understands the inhabited reciprocity of its reality."[28]

For Voegelin focusing on music's materiality frees music from "disciplinary hermeticism and semantic limitations and allow us to hear a contemporary relevance."[29] She adopts a definition of "generative listening" to frame it as listening relationally, or listening to elements of sound in music as they relate to each other, in their ongoing formations, as opposed to how the music, overall, relates to a discipline.[30] She sees this as a way to render a post-humanist musical discourse from which a critical response can be rendered out of sound's

[26] Salomé Voegelin, *Sonic Possible Worlds* (New York: Bloomsbury Academic, 2014), 57.
[27] Voegelin, *Sonic Possible Worlds*, 51.
[28] Ibid. 95.
[29] Ibid. 126.
[30] Ibid. 130.

experiential properties, free of their discipline and rational music narratives. Voegelin sees her phenomenological possibilism as a non-ontology "which does not insist on precedence and provenance," but rather, "grants unrestricted access to sonic variations of objects and subjects that have gone beyond the idea of a referential reality into the truth of their own generating."[31]

Much like Voegelin, Christoph Cox builds a case for a sonic materialism that is capable of making legible the "powerful, signifying materiality that characterizes so much experimental work with sound," in his text *Sonic Flux: Sound, Art and Metaphysics*. He argues for a theory that vigorously rejects representation and narrative and turns to a thread of metaphysics he believes aids in negating nature/cultural, human/nonhuman dualisms that representation upholds. His interlocutors include Schopenhauer, and his advocacy for art as a place where one can escape the consciousness of one's own observant stance, a "pure, will-less, painless, timeless subject of knowledge."[32] Schopenhauer holds that music *is* the world, in process, not an ideation, and that we can know this through direct perception of its effects.

From Schopenhauer, Cox continues to build his platform with the work of Nietzsche, who advances Schopenhauer's will-less-ness to will-to-power, the pre-

[31] Ibid. 90.
[32] Christoph Cox, *Sonic Flux: Sound, Art, and Metaphysics*, First edition (Chicago ; London: University of Chicago Press, 2018), 20.

formed energy that he believes is germane to all being. Cox also folds in frameworks initiated by Deleuze and Guitarri, who he believes enable a different ontological conception of sound to emerge, one that inhabits sounds temporal qualities "for sounds support an ontology of events and becomings."[33] Cox's theory of sonic force settles into what he calls a sonic flux, which he believes is an audible aspect of Nietzsche and Schoepenhauer's non-subjective life force. A sonic flux is a "distinct stratum within this becoming," a sonorous continuous energy of existence distinguished from the individual bodies through which it flows.[34]

Like Voegelin, Cox argues that sounds can be heard as distinct and independent from their causes. But unlike Voegelin, he makes a greater effort to account for sound's chronology through Deleuze's notion of effects. For Deleuze, effects are historical demarcations that aren't reducible to their unique instantiations, despite their invariants. Cox proposes an account of sound as events and becomings, as well as their effects. But he stresses that sonic flux must remain anonymous because he believes it is a way to emphasize its present, relational, complex becomings. He also believes this method encompasses potentials of emergent complexity, where a whole is greater than the sum of its parts, and its nonlinear qualities.

[33] Cox, *Sonic Flux,* 33.
[34] Ibid. 31.

Listening is also a building block in the realization of Cox's sonic materialism. He refers to Jonathan Sterne's tympanic turn and Roland Barthes' three types of listening to illuminate that the mechanical processes of listening cannot be easily separated from the meaning-making process. Cox reasons that if we believe that all things perceive or sense (even if we ascribe said perception as will-to-power) listening cannot be a purely human event. Following this thought, he proposes that in listening there is access to a sensibility of non-binary intermaterial being that is integral to a vibratory ontology, or sonic materialism.

Like Cox and Voegelin, I understand sound to be part of a body of ongoing, relationally derived events that can experientially afford listeners a nonbinary bound epistemology and ontology. However, I choose to focus on the phenomenon of resonance to think through materialism because it is the result of a confluence of bodies and is dependent on the unique characteristics and histories of those bodies that engenders its presence. Contrary to Cox and Voegelin's insistence on anonymity, this move allows us to be with the simultaneity of sound's existence as a body with historic and contemporary contingencies and bodily attributes. This simultaneity of existence seems important in the face of repeated attempts to mute sound's multiple facets of being and present it as autonomous. A materiality that strips sound of its social and cultural constitution runs the risk of rendering a concept of generativity that is historically weightless and magically liberated from that which makes up itself. Alternatively, the

stickiness of resonance, it's need for specificity and possibility of multiplicity promotes an embrace of a full-bodied presence that acknowledges historical and contemporary contingency.

Again, similar to Cox and Voegelin, I believe that resonant materialism can be made legible through an interdisciplinary filter that privileges the experiential, listening, and theories of meaning-making that can account for relational becoming. I believe this framework affords us a way to read the work of artists working outside the traditional semiotics of tonal music, which in turn gives us insight into a proposition posited by a growing number of sound artists: that the nonhuman world is diverse and existentially significant. However, I see this proposition as analogous to the work of feminist materialists and instead turn to them as interlocutors. This move provides a varied body of dialoguers and their experiential perspectives. As critical theorist N. Katherine Hayles' extensive work has taught us, bodies and their context have a significant effect on cognition, and that which informs our information-making matters.[35] Or perhaps, more directly, as science philosopher Sandra Harding observed: "Western culture's favored beliefs mirror in sometimes clear and sometimes distorting ways not the world as it is or as we might want it to be, but the social projects of their historically identifiable

[35] For an extensive critique on the history of cybernetics and their impact on contemporary frameworks of cognition, artificial intelligence and the virtual world, see N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*, 1 edition (Chicago, Ill: University of Chicago Press, 1999).

creators."[36] And so I'd like to see where a different set of thinkers, doers and parameters might take us.

[New Materialism]

A host of contemporary theorists have initiated a project set out to illuminate a lively, agential and existentially significant materiality that they call new materialism. These theorists, who include Karen Barad, Jane Bennett, Rosie Braidotti, Diane Coole, Manuel DeLanda, Samantha Frost, and Elizabeth Grosz, among others, have radically reevaluated objectivity and materiality to render new concepts of material cause and effect in a manner that challenges our current understanding of corporality. Their approach to an account of materiality is often interdisciplinary as they triangulate thought between metaphysics, science and the arts. In addition, they collectively trouble binary thinking, which they find to be restrictive and damaging to the socio, political and eco spheres.

For new materialists, what is typically held as lifeless and inert is reframed as fluctuating and viably productive by focusing on the vibratory aspect of being. Shifting our understanding of materiality from staid and ineffective to vibrant and impactful also provides a de facto platform from which to recognize matter as relationally constitutive. Relationally constitutive means that what a thing is, is in

[36] Sandra Harding, "From the Woman Question in Science to the Science Question in Feminism," in *Knowledge: Critical Concepts*, ed. Nico Stehr and Reiner Grundmann (Routledge, 2005), 327--342.

part, composed by and contextualized by what is around it, and any thing has the same impactful capability. A platform of new materialism is formed with the understanding that, at any given moment, it is an intensity of forces (or lack thereof) that enable a thing to be itself, and any object or being is in continuously shifting circumstances in an environment that increase or decrease. The combination of these factors creates affordances, which refers to what is available to a thing or individual. This modulating thingness, which is situationally attained, points to the many interactions that make what is, and its temporariness.

Recomposing our understanding of matter from separate and still to contingently active, and foregrounding its significance, is what new materialists hold as necessary to achieve a "plausible account of coexistence and its conditions in the twenty-first century."[37] When they engage western philosophy they turn to those that "affirm matter's imminent vitality," through the work of Nietzsche, Deleuze, Spinoza, and Bergson, among others.[38] In its interdisciplinary inquiry, support for thing-equality, advocacy for nonbinary divisors, and recognition of individual and collective action, it embodies feminist principles that work to eradicate ideologies of domination by challenging epistemologies and ontologies that perpetuate capitalist, imperialist and colonialist structures. The theorists that influenced me, and this project, most significantly are Rosie Braidotti and Jane Bennett.

[37] Coole and Frost, *New Materialisms*, 2.
[38] Ibid. 2.

In *The Posthuman* Rosie Braidotti argues for a non-unitary subjectivity that encompasses "an enlarged sense of inter-connection between self and others, including the non-human, or earth others, by removing the obstacle of self-centered individualism."[39] She does this through a theory of vitality that creates an "affirmative bond that locates the subject in the flow of relations with multiple others."[40] She also takes great care to identify a vital activeness in structures that we typically read as immaterial, such as political, technically virtual and social spheres. She identifies these arenas as having such an impact on the earth, and all of its inhabitants, as to necessitate their consideration as material. I see this as an invitation to acknowledge the full body of a thing's being, including its social and political entanglements. This is opposed to Cox and Voegelin's efforts to single out physical presence as singularly significant and simultaneously socially anonymous.[41] For Braidotti, formless potencies compose her notion of what she terms zoe a nonhuman yet affirmative life-force that is her rendition of vital materialism. Zoe emerges out of theories of becoming from Spinoza, read through Deleuze, though one can imagine a nod toward its Greek meaning for life which expands beyond the bios. For Braidotti zoe enables an understanding of nature-cultural that resists dualisms commonly applied to nature and culture. This construct renders a subject as an ongoing emergence from the relational and nature-cultural that she uses as a springboard to explore becoming-animal,

[39] Rosi Braidotti, *The Posthuman*, 1 edition (Cambridge, UK ; Malden, MA, USA: Polity, 2013), 49.
[40] Braidotti, *Posthuman,* 50.
[41] Cox, *Sonic Flux*, 31, 33, 34; Voegelin, *Sonic Possible Worlds,* 90, 123, 126.

becoming-earth, and becoming-machine. For Braidotti, we know each other and our earth others in a flowing subjectivity when we assume a presence that arises out of emergent, nature-cultural relations. As I will demonstrate going forward, resonance also has the capacity to combine nature/cultural domains.

In her text *Vibrant Matter: A Political Ecology of Things* Bennett constructs what she calls a thing theory, a vital materialism that illuminates an active force present in all things. She argues that if all things have a vital force, then all things can be considered, to some degree, actants. Bennett engages monotheist philosophers Spinoza, Deleuze & Guattari, and Bergson, to support her work, and juxtaposes research in the natural sciences with the arts to illustrate her point. She creates vivid tableaus of garbage, electrical grids, food consumption and worm habitats to portray a world full of vibrant materiality that actively influence our human shapes, formations and choices. With these poetic descriptions her goal is to render an ontological field "without any unequivocal demarcations between human, animal, vegetable, or mineral. All forces and flows (materials) are or can become lively, affective, and signaling."[42] This quote comprehensively articulates the experiential inspirations that led me to work through resonance. In my sound art pieces, environments and their components were clearly impactful, a fact that became more legible in the music-making experience. Specifically, though,

[42] Jane Bennett, *Vibrant Matter: A Political Ecology of Things*, unknown edition (Durham: Duke University Press Books, 2010), 117.

because my work focuses on resonant features, I propose that this environmental agentialness was distinctly available in through the phenomena of resonance.

An aspect of Bennett's work that is compatible to mine includes her motivation. With *Vibrant Matter* Bennett sets out to develop a horizontal politics capable of breaking the binds of binaries and their resulting hierarchies that feed current self-centered politics and economics. In her thing-theory she presents an opportunity to ascend equations of property plus consumption that equal prosperity to instead assume a thoughtful engagement with things that renders a heterogeneous ontological field and a sustainably oriented public. My project is also concerned with habits of modernity that discount the nonhuman world. Contemporary consciousness seems to be siloed from the interconnected and impactful aspects of our environment and its inhabitants, a quality that has fueled current political, economic, cultural and environmental crises. However, new materialism has a few epistemic blind spots to which theorizing through resonance attends.

A goal of new materialists is to initiate a restorative approach to theorizing that "creatively" affirms a new ontology, "a project that is in turn consistent with the productive, inventive capacities they ascribe to materiality itself."[43] However, they confess to a problematic paradox that occurs when thinking about matter: "as soon

[43] Coole and Frost, *New Materialisms*, 8.

as we do so, we seem to distance ourselves from it."[44] Or, as N. Katherine Hayles has noted "words never make things happen by themselves-or rather, that the only things they can make happen are other abstractions."[45] Instead we need to theorize in a manner consistent with the productive, inventive capacities we're attempting to ascribe to materiality, which is why I turned to the creative space to work through a theory of resonance.

Theorizing through creative practice also opens up an opportunity to engage composers as interlocutors who I believed proposed similar theories through their work. This includes the work and techniques of Maryanne Amacher, Pauline Oliveros and Jacqueline Kiyomi Gordon, a consortium of female composers I propose saliently articulated an idea of resonant materialism. With their work I diverge from the standard offering of philosophers typically referenced in new materialist theory, such as Spinoza, Delueze, or Nitzsche whose repeated presence runs the risk of reifying the very constructs new materialism tries to escape. Instead, I bring together a quorum of perspectives from the embedded province of music making. I theorize along with artists committed to working with the dynamic qualities of sound, which are always in motion, environmentally entangled and relationally derived.

[44] Ibid. 1.
[45] Hayles, *How We Became Posthuman,* 83.

The idea of perspective is significant to this project, and I turn to Donna Haraway to support my adaption of the concept. In particular I refer to Haraway's *A Cyborg Manifesto, Science, Technology and Socialist-Feminism in the Late Twentieth Century*. This text is a proposition to reimagine how we imagine ourselves, science and the emerging technoworld. It is an "effort to build an ironic political myth faithful to feminism, socialism, and materialism."[46] In other words, it is an invitation to question existing narratives of womanhood, personhood, politics, science and the environment to enable resistance to essentialist definitions that reify capitalist and patriarchal structures. Haraway reworks constructs such as nature and culture so that they can not be used against each other as polarizing fields, arriving at what she terms naturecultures to signal the mind is an idea that is itself made up of matter. She further troubles binaries by encouraging an embrace of multiplicities of identities. She also welcomes the variables and tensions that multiple perspectives bring about as possible points of inquiry made available through their conflict.

In *A Cyborg Manifesto* Haraway reintroduces her concept of partial knowledges, a proposal she developed in her essay "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective." Partial, or situated knowledges form the basis for depolarization and a feminist critique of science. Haraway proposes that situated knowledge diverges from the

[46] Donna J. Haraway and Bruce and Elizabeth Dunlevie Professor Cary Wolfe, *Manifestly Haraway*, 1 edition (Minneapolis: Univ Of Minnesota Press, 2016), 9.

unobtainable goal of objectivity by embracing the fact that knowledge claims are partial. They are partial in that they originate from a knower, and *their grounded perspective*, *but have the ability to develop into fuller forms of knowledge when in conversation with other knowers* (italics mine). Useful knowledge emerges from instantiations of conversations between knowers, and their partial perspectives. Partial perspectives form the basis for a possible feminist objectivity that knows itself to be a collective of dialogic partners as well as retrospectively reflexive to acknowledge changing circumstances. Perspective counters absolutes, dualisms and essentialist claims in a grounded consortium of experience.

Haraway leans on the visual as a place that can access the nonbinary and perform an embodied objectivity: "Vision can be good for avoiding binary oppositions. I would like to insist on the embodied nature of all vision and so reclaim the sensory system that has been used to signify a leap out of the marked body and into a conquering gaze from nowhere."[47] But I take inspiration from her (albeit brief) reference to resonance as place to access the feminist objective of perspective: "Feminist accountability requires a knowledge tuned to resonance, not to dichotomy."[48] From this, I nurture the idea that resonance has the capacity to allow for a heterogeneous field of interactions that can simultaneously hold similarities and difference, and notice their creative capacities. When resonance

[47] Donna Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies* 14, no. 3 (1988): 575.
[48] Haraway, 588.

comes into being it can't help but acknowledge the details of all involved. It requires situated specificities, but not uniformity, nor full disclosure. Rather it is an articulation of shared aspects amidst the multiplicities of things being, and a fuller form that emerges from convergences of grounded perspective.

[Perspectives of Cognition]

Haraway argues for a grounded knowing through our unique experience as bodies, one that recognizes the encounter of variables and what emerges from those points of specificity. To encompass this full-bodied thinking, I engage agent-environment cognition to present another perspective of how we may interact with the world in resonance. If we believe that thinking is a mind-*in*-body experience, as opposed to a body-*then*-mind experience, then an active, co-constructed world becomes legible. Specifically, I engage ecological and enactive modes of cognition theory which counter the narrative that knowing is a brain-centric event built on a contingency model of thinking that consists of cognitivist sensing to thinking to acting. Instead, ecological and enactive models of cognition figure mind *in* body, and knowing arises out of environmental engagement, a process that isn't necessarily performed linearly. An ecological approach to cognition emphasizes active, contextualized adaptation that engages an environment in itself as part of knowledge formation.[49] Enactive cognition also proposes that how and what we

[49] Eric F. Clarke, *Ways of Listening: An Ecological Approach to the Perception of Musical Meaning: An Ecological Approach to the Perception of Musical Meaning, (*New York: Oxford University Press,

know is relationally brought forth. It emphasizes a being's mode of enjoining with the environment and sensorimotor patterns of perception and action.[50] Enactive cognition is a term first introduced by Francisco Varela, Evan Thompson, Evelyn and Rosch in their text *The Embodied Mind: Cognitive Science and Human Experience* (1991). However, I reference Evan Thompson's *Mind in Life: Biology, Phenomenology and the Science of the Mind* to better understand aspects of enaction that include emergence, autopoiesis, and sensorimotor subjectivity.

Of significant relevance to this project is Lambros Malafouris's anthropological investigation into the dialogic and recursive relationship between humans and things. His text *How Things Shape the Mind: A Theory of Material Engagement* investigates this relationship with the support of agent-environment cognition. He depicts how our world of things shape cognition from an archaeological and enactive mind perspective. He explores how mind, body, things and culture have historically co-constituted each other to arrive at what he calls material engagement theory, a "synergistic process by which, out of brains, bodies and things, mind emerges."[51]

I also reference Eric F. Clarke's *Ways of Listening: An Ecological Approach to the Perception of Musical Meaning* and Wayne Bowman's essay "Cognition and

---

2005) 17.

[50] Evan Thompson, *Mind in Life*. (Cambridge, MA: BELKNAP, 2010), 23.

[51] Lambros Malafouris, *How Things Shape the Mind* (MIT Press, 2013), 17.

the Body: Perspectives from Music Education" to address how sound, musicking, mind and body shape each other through action-perception theories of cognition. Clarke approaches an ecological analysis of music through the lens of James Gibson's ecological model of cognition, which presumes that structure is inherent in the environment, not constructed by the mind, and there for the information we need to act is available in the environment through its affordances, or availability. For Clarke, resonance is "a perceiving organism's active, exploratory engagement with its environment."[52] He arrives at this conclusion by correlating Gibson's theory of environmental co-construction, which Gibson frames as a type of resonance, with how sound interacts with us. Specifically, sound, in resonance, communicates "properties of the object in itself" to a listener, creating affordances for action and meaning.[53] This perspective is productive for me as I speculate on how we might know an element's properties through resonance, though I don't focus on musical instruments per se. Clarke also presents his framework through traditional western modes of music, and their notation, from which I deviate. Of particular interest to me is Clarke's move to address the schism between concepts of autonomy and ecology, a problematic crossroads for many of my interlocutors. Clarke's restoration of the body through ecological theories of perception in listening, environmental mutualism and application of the concept of affordances inspired

[52] Eric Clarke, *Ways of Listening: An Ecological Approach to the Perception of Musical Meaning* (Oxford University Press, 2005), 19.
[53] Clarke, 18.

me to imagine resonance's ability to recognize simultaneous multiplicities for an embedded, listening and music making body.

Bowman's essay interweaves tenants of enactive theory with key terms of phenomenology from Merleau-Ponty to figure musicking as a primary place of knowledge production. And, similar to Clarke, Bowman spends considerable effort locating the body in knowing, and knowing in music-making: "Music is a valuable cognitive resource not because of what it teaches us about the disembodied metaphysical realm of feeling, but what it shows us about the profoundly embodied and socioculturally-situated character of all human knowing and being."[54] He proposes that music's being requires bodily motion, which then shapes and informs many ways of embodied being. This proposition supports my concept that resonance can be a place of knowing many beings in the material world when situated within bodily interactions, and Bowman also recognizes the socio-cultural constitution music making contributes.

To continue a feminist practice that situates many perspectives I also engage Native Science to think through relational world making. I do this in part to provide a counterpoint to the European-based perspectives I've engaged so far. In addition, I situate Native Science in this section along with agent-environment cognition theories because of their shared emphasis on complexity and

[54] Wayne Bowman, "Cognition and the Body: Perspectives from Music Education," in *Knowing Bodies, Moving Minds*, ed. Liora Bresler, vol. 3 (Dordrecht: Springer Netherlands, 2004), 4.

environmentally contextualized and embedded knowing. According to Tewa author and professor Gregory Cajete Native science is concerned with a search for reality and knowledge much like Western science. However, Native Science begins its inquiry from different assumptions of how the world is, which allows it to ask different questions, and include broader methods of inquiry. As Cajete writes in his text *Native Science: Natural Laws of Interdependence*, the Native American paradigm sees the world as a constant flow of interrelationships knowable through embodied perception of its patterns, cycles and spirit, with spirit and energy waves being synonymous. Every "thing" is animate and has spirit (energy), and mathematics are but one method used to understand "basic relationships, patterns and cycles in the world that need to be understood."[55] Native Science also, significantly, qualifies epistemological aspects of relationships with natures specifically as resonance.

Cajente presents Native Science as a rigorous, embodied, process-oriented mode of inquiry that involves "insight, immersion, creation and reflection," and includes art, music, and dance as both texts and sites of process.[56] This recognition of the creative space as site of inquiry supports my move to conduct a research project of my own in a music-focused event. Native Science also shares goals with new materialists in that Native Science believes that the "mechanistic,

[55] Gregory Cajete, *Native Science: Natural Laws of Interdependence*, 1st edition (Santa Fe, N.M: Clear Light Publishers, 2016), 65.
[56] Cajete, 14.

Cartesian model reveals itself as wholly inadequate and inappropriate for founding the kinds of institutions that are inclusive and multidimensional enough to sustain us in the twenty-first century and beyond."[57] In their resistance to binaries and their embrace of the arts, Native Science denotes activeness and constructiveness in forms modernity reads as immaterial, such as storytelling, music making or social dynamics. This construct is a full-bodied knowing that doesn't attempt to extract particles of knowledge as we've seen in Cox and Voegelin's texts, but instead encompasses the entirety of a being's being. Going forward I will situate Native Science's methods of knowing along with feminist materialisms and agent-environment cognition to further support my critical inquiry. It presents a compelling argument for creative practice as a place to theorize through and confuses what is empirically considered to be material and immaterial.

Listening

A significant portion of my research into resonance is grounded in listening, a practice and method I developed during in-depth study with composer and Deep Listening founder Pauline Oliveros. Oliveros grew up in Houston, Texas where she learned the piano from her mother, who was a piano instructor, and later took up French horn and accordion. She completed her MFA in Composition at San Francisco State in 1957 and went on to co-found the San Francisco Tape Center in 1962. At the Tape Center, she vigorously adopted electronics in her composition

[57] Ibid. 55.

and performance practice and devised groundbreaking techniques in the electronic music field. She later founded the Deep Listening Institute in 1985. Deep Listening cultivates a conscious awareness of the sonic environment through auditory, oral, somatic and imaginary strategies. It strengthens our ability to be voluntarily attentive to sound through body work, sonic and listening meditations, interactive performance, dreams, memory and listening to listening itself. Deep Listening locates an individual's experience of sound in context with their environment, in its entirety. For Oliveros listening deeply is the experience of sound as a focal point in "the whole space/time continuum," where we encounter "vastness and complexities as much as possible."[58]

I studied with and worked alongside Oliveros from 2006 until her passing in 2016 and became a Deep Listening instructor in 2012. As I worked with Oliveros, listening became a foundational tenet of my research, composition, and performance methods. Going forward, I draw from my experience as a student and collaborator of Oliveros,' and I relay my knowledge through our recounted conversations, emails and performances. I also draw from significant texts by her, which include *Deep Listening: A Composer's Sound Practice,* which is a handbook for Deep Listening and *Software for People,* which is a compendium of essays Oliveros published in various outlets from 1963 – 1980.

[58] Pauline Oliveros, *Deep Listening: A Composer's Sound Practice* (New York, NY: iUniverse, Inc., 2005), xxiii.

Methods

My methods emphasize specificities of experience in relationship to that of others, and coalitions of knowledge. I also bring to bear the notion of "reflexivity in retrospect" to maintain a continuous and open-ended process in regards to the research and knowledge produced, and changes that arise as researchers revisit data and new researchers reanalyze work.[59] I situate my work with the work of other artists, to frame my point of view as a partial knowledge that expands into a larger body of information. Artists I dialog with are composers and electronic musicians Pauline Oliveros (1932 - 2016), Maryanne Amacher (1938 - 2009) and Jacquline Kiyomi Gordon (b.1982).

Data collected for this study includes a survey and interview, observations, field notes, and artifacts in the form of field recordings, photos and video documentation. The survey was a quantitative self-report survey administered to participants of *Resonance & Resemblance,* the piece I created to research the effects of resonance. For interviews I engaged guidelines established for qualitative analysis from Interpretative Phenomenological Analysis as outlined by Flowers, Larkin and Reid. This research method emphasizes an interviewee's perception of themselves and their environment, and how individuals understand

[59] Andrea Doucet and Natasha S. Mauthner, "Feminist Methodologies and Epistemology," in *21st Century Sociology*, by Clifton Bryant and Dennis Peck (2455 Teller Road, Thousand Oaks California 91320 United States: SAGE Publications, Inc., 2007), 42.

their experience. This method allowed me to correlate my location and interpretation with pre-existing concerns.[60] The interview was semi-structured in that it centered around themes of my inquiry, yet maintained flexibility to accommodate the specificities of each participant.

Chapter Outline

Chapter two, 'Eco-logical Musicking: A Method for an Environmentally Inclusive Practice,' details *Resonance & Resemblance*, the performance-based inquiry I constructed to contemplate resonance and its possible effects. In chapter two, I detail the methodology I adopted to create *Resonance & Resemblance,* which include ecocentric philosophy as read through environmental philosopher Arne Næss and scholar Gregory Cajete's account of Native Science. I also describe the methods I engaged, which were adaptations of creative improvisation as defined by George Lewis and Derek Bailey, and listening practices primarily derived from Pauline Oliveros. I address how each of these methods support an awareness of multiplicity and simultaneity. These are qualities needed to highlight the generative complexity and interconnectedness of a pluralistic environment. When these methods are engaged in a music-making event they embody distributed and nonhierarchical means through which to experience a diverse and

[60] Katie Reid, Paul Flowers, and Michael Larkin, "Exploring Lived Experience," *The Psychologist* 18, no. 1 (2005): 4.

entangled world. In addition, I expand on the various components of *Resonance & Resemblance* to illustrate how each reinforce the objective of the inquiry.

In chapter three, 'Listening Outward to Resonant Perspective,' I introduce composer and electronic musician Maryanne Amacher. I discuss aspects of her practice that informed one of her most significant compositions *Living Sound, Patent Pending (Traveling Musicians Being Prepared).* I provide an analysis of Amacher's work that led to my hypothesis that she fluently proposed that resonance offered an opportunity to experience material perspective and interconnectedness. In this chapter, I situate Amacher's work with Oliveros' to illustrate a possible mode of listening I call listening outward. I propose that in listening outward we have access to material perspective, a partial knowledge of what a thing may be. Based on this groundwork, I continue to focus on significant elements in *Resonance & Resemblance* that I posit contributed significantly to the piece's ability to emphasize resonance.

In chapter four, 'Resemblance Through Resonance,' I present an interview with Los Angeles based sound artist Jacquline Kiyomi Gordon. I analyze her engagement with material and sound through the lens of agent-environment cognition. I trace a history of this form of theory with emphasis on the work of Lambros Malafouris and Wayne Bowman. From their work, I hypothesize that resonance works with the body to co-construct an embedded and embodied intermaterial knowledge and perspective. I also situate agent-environment cognition with Native Science to speculate about the ability of metaphor to

contribute to material perspectives, and trouble our concept of materiality, or what we think is constructive. With this juxtaposition, I include considerations and affirmations of mind as matter, and the material significance of social, cultural and political forces.

Chapter Two

Eco-logical Musicking: A Method for an Environmentally Inclusive Practice

Figure 2.1: *Resonance & Resemblance* performers at Manitoga's quarry pool, September 30, 2017

In June of 2014, I was invited by a colleague to tour American industrial designer Russel Wright's (1904 – 1976) home and restoration project known as Manitoga, a striking parcel of woodland in Garrison, New York, just north of New York City. My colleague informed me that the Executive Director of the site, Allison Cross, had recently initiated an artist residency program, and thought I should propose a piece. When I arrived, Allison met me in the driveway to direct me up

the path that led to the house. As Allison has recalled to me frequently, when I saw the quarry pool and the house perched above, I immediately turned to her, and said, “I know exactly what I’m going to do here.” In an instant I knew this was the place where I would work with the ideas that the slap of a beaver’s tail had inspired. I had tucked my experience on the Delaware River inside me for four years, and when I felt the incredibly alive acoustic space and character of pond, tall granite walls, and forest, I quickly knew I could think through my original sense of inspiration in this environment. But before I proceed to the details of *Resonance & Resemblance*, let me share a bit about Russel Wright, and why this site was ideal for my creative inquiry.

Russel Wright was an American craftsman, renown industrial designer, and naturalist best known for creating a distinct line of commercially produced tableware in the mid-20th century. His designs also included furniture, architecture and landscape, and in each sphere of production Wright emphasized the natural environment. He was committed to nature, perhaps inspired by his upbringing on a farm in Ohio by Quaker parents. His devotion was expressed in his work in the “simplicity and natural materials and forms” of his designs.[61] He also applied a philosophy of ecology to his work in that he saw his designs as an ecosystem: Each piece had unique attributes that informed each other, as well as unifying characteristics that noted its ties to its collection, as well as the environment

[61] Ian McHarg, “A Temple to Ecological Design” in *Russel Wright: In His Own Words*, (New York: Universe Publishing, 2001) 104.

overall. He carried his ecologically minded design philosophy over to Manitoga, a 79 - acre restoration project that is considered to be a temple to ecological design by landscape designers, architects, and curators around the world. Wright purchased the property in 1942 when it was thought to be destroyed by the lumber and quarry businesses that had mined there. But Wright made it his life's work to restore the ravaged site. He named it Manitoga, Algonquin for 'place of great spirit,' after the Lenape, a tribal identity belonging to the larger Algonquin Native American people who originally inhabited the land.[62] Over 40 years, he nurtured the woodland into the dramatic living illustration of native trees, ferns, mosses and wildflowers that it is now.

However, Wright wasn't familiar with the region and recognized that the restoration required an education of his own. After he purchased the property, he spent some 12 years learning its "plants, rocks, soils, water, climate, and creatures," before he began the slow restoration process.[63] As he acquainted himself with the land, he noted the behaviors, effects and dramas of its inhabitants. His eyes found the "great sculptural boulder formations, cliffs, small ravines, large areas of ferns, and some giant trees," and when he climbed trees, he "discovered great vistas of the river."[64]

---

[62] Robert S. Grumet, *Manhattan to Minisink: American Indian Place Names of Greater New York and Vicinity* (University of Oklahoma Press, 2013), 7.
[63] McHarg, *A Temple*, 105.
[64] Russel Wright, "Philosophy of the House" in *Russel Wright: In His Own Words*, (New York: Universe Publishing, 2001) 67.

E. C. Eckel, photo.

King's quarry, near Garrisons N. Y.
(granite, intrusive in the pre-Cambrian)

Figure 2.2: What was once known as King's quarry, and is now known as Manitoga

In the restoration, Wright contended with what appeared to most to be a cavernous wound in the earth (see figure 2.2), a gaping cavity left behind by the extraction of granite. But Wright saw a resplendent cynosure: "it is impossible to say what is the most beautiful part of this bit of the hill, but its most distinctive characteristic is the rock, the gray granite of the quarry pit itself, and the surrounding boulders. The curving of the cliff walls is so noble that we must be careful of everything we do."[65] This is where he chose to build his home and studio, on an area "where man met nature via a chasm between the natural formations of a cliff and the man-made edges of the quarry."[66] With these structures, he intentionally blurred divisions between outside and inside through a

[65] Wright, *Philosophy of the House,* 69.
[66] Ibid., 67.

number of strategies. In the construction of the house he used rock and lumber found on the site and covered the roof with vines native to the region. Other design choices included south facing walls of glass that visually extend the inside to the outside quarry (and vice versa), flagstone flooring that extends from inside the house to the outside terrace, a fireplace in a granite wall that connects to the cliffs below, and an uncut cedar trunk that supports the main roof from inside the kitchen area. Carlton Lee, Senior Vice President of the New York Botanical Garden observed that to be in the house “is to be in the landscape, to experience snowfall and rain, morning sun, driving leaves ... the ever-changing vitality of the seasons."[67]

Figure 2.3: Russle Wright’s Dragon Rock House

[67] Ibid., 69.

The quarry evolved into a lush centerpiece when Wright diverted a mountain stream to fall over a cliff and fill the quarry. This made the quarry a pool. He also encouraged the regrowth of eastern hemlocks that circled the quarry's perimeter that matured into a sky-reaching halo. And below the hemlocks Wright fostered native ferns and mosses, all of which combined to create a habitat for a vibrant and active ecosystem to re-emerge.

To draw attention to what he saw as the grandeur of the site, Wright delineated a 2-mile pathway system out of trails already articulated by local wildlife. Each derive-like path is meant to be walked at a particular time of day or season, such as the Morning Trail which travels east, into the rising sun, or the Winter Trail, which features local evergreens. Each trail also features little dramas, such as views of the Hudson River framed by branches, tree-encircled areas with soft moss flooring, and a delicate handful of birch trees dubbed the Martha Graham Girls for their collective and graceful sway. On the highest point of the shortest path you can "step out on the crown of a sheer granite cliff which drops straight down to the water of the pool thirty feet below."[68]

[68] Russel Wright, "Designing with Nature" in *Russel Wright: In His Own Words*, (New York: Universe Publishing, 2001) 126.

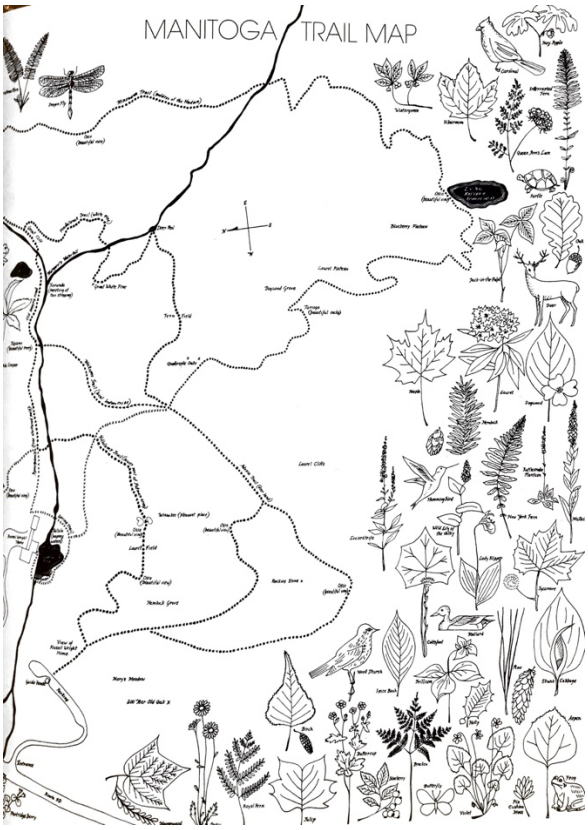

Figure 2.4: A map of Manitoga's trails for guests

Wright observed and (co)operated with the environment's behaviors to gently direct our attention to look at, listen with, and feel the environment. He created opportunities for visitors to engage with the environment's complex and changing dynamics, and notably how they intertwine. His restoration situates human visitors as just one factor in a lively and active ecosphere. In addition, Wright's affinity with the land, his recognition of its history and deep knowledge of its characteristics and behaviors, his ability to work *with* the environment as opposed to controlling it, reflected the eco-logical approach I wanted to adopt. The combined effect of Manitoga was an invitation for what *R&R* was becoming.

A Performing Inquiry

Resonance & Resemblance was a sonic meditation that featured two phases: a 25-minute guided soundwalk through chosen paths in a woodland garden known as Manitoga, and a subsequent 25-minute musicking meditation focused on a quarry pool in the woodland. The second phase had four musicians in kayaks on the quarry pool, performing a fixed improvisation on recorders, and I was on shore performing electronics. Listening participants were seated, or slowly moved about the quarry, as they engaged with the meditation.

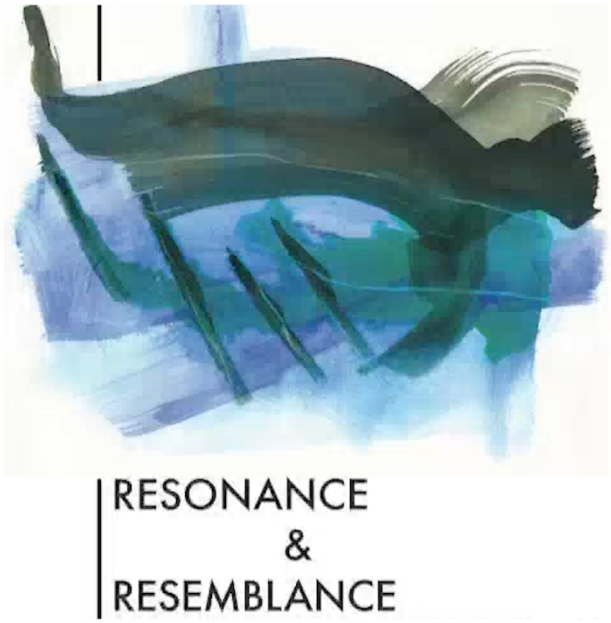

Figure 2.5: The program cover for *Resonance & Resemblance* by Alexis Negron**.** View and listen to a sample here: https://www.suzannethorpe.com/resonance-resemblance

R&R was also a critical inquiry. With it, I thought through possibilities in resonance, and the phenomenon's ability to contribute to a sensibility of an active and heterogeneous world and its interconnectedness, as well as its potential to diffuse binaries and hierarchies. To do this, I developed a method that interwove disciplines that figure authorship as a community of contributors and their real-time dynamics. These methods rest on a methodology informed by ecocentric philosophy. Going forward I will detail what philosophies of ecocentrism informed my methodology, which specific methods I adopted and why, as I developed an approach I have come to term 'eco-logical musicking.'

Eco-logical Musicking: A Method for Environmental Inclusiveness

I define eco-logical musicking as a mode of music making that works to de-centralize the human by skewing normative hierarchies and transmitting an awareness of multiplicities of agency. It is musicking that arises out of situated entanglements of environmental elements, human and non, through its emphasis on process and relational dynamics. To develop this approach, I've drawn from theories of ecocentric philosophy that emphasize interconnected generative complexity. I actuate these theories with the adaptation of music making strategies established by the improvising community as well as composer Pauline Oliveros, each of whom address understandings of community, complexity and interrelatedness in their work.

The term eco-logical musicking signals traditions established by improviser and scholar George Lewis (Lewis, 2008) and musicologist Christopher Small (Small, 1998). I use the term 'musicking' to invoke Small's development of the word. Small framed the phrase "musicking" to shift the word 'music' from a noun to a verb. This move directs our attention to the dynamic process of music making, as opposed to the fixed object of music. The semantic transformation also proposes that meaning in music arises out of its creation. According to Small, musicking includes the composer, performer, and listener, which he frames as an ecosystem in and of itself: "musicking is an activity in which all those present are involved and for whose nature and quality, success or failure, everyone present bears some responsibility."[69] Small mainly focused on human participants to discuss the term, therefore I coupled the phrase with the expression "eco-logical" to encourage a materially expanded concept of musicking.

The term "eco-logical" references a precedent set by George Lewis, who crafted the phrases "Afrological" and "Eurological" to indicate different practices of improvisation. Each phrase points to "musical belief systems and behavior [that] exemplify particular kinds of musical logic" that inform a type of improvising.[70] The phrases situate modes of improvisation in a social and cultural location; an

[69] Christopher Small, *Musicking: The Meanings of Performing and Listening* (Wesleyan University Press, 1998), 9.
[70] George Lewis, "Improvised Music after 1950: Afrological and Eurological Perspectives," in *Audio Culture: Readings in Modern Music*, ed. Christoph Cox and Daniel Warner, (A&C Black, 2004), 274.

Afrological form of improvisation draws upon the African American experience, while a Eurological improvisation embodies a Eurocentric experience. Adopting Lewis' model, I introduce the term "eco-logical musicking" to point to music-making informed by understandings of ecology. Specifically, I refer to frameworks of ecology that understand an ecosystem (biotic or abiotic) to be a dynamic, generative, interconnected system of many parts. An ecology is defined within a parameter that indicates its own totality and recognizes the interrelatedness of its components. It also has the ability to display emergent properties, the combined effect of individual agents to produce a whole greater than the sum of its parts. Going forward I describe the frameworks I engaged specifically, and how they worked to support *Resonance & Resemblance*.

Logics of Ecology

Ecocentrism interprets the world as a holistic interrelated whole. It starts from the basic understanding that all species have intrinsic value, which is an earth-centered value system. Environmental ethicist Holmes Rolston III points to anthropocentrism—a human-centered value system—as problematic and argues that anthropocentrism hinders biodiversity and conservation by reinforcing human exceptionalism.[71] Ecocentrism, on the other hand, works to negate this by

[71] Helen Kopnina et al., "Anthropocentrism: More than Just a Misunderstood Problem," *Journal of Agricultural and Environmental Ethics* 31, no. 1 (February 2018): 110.

decentralizing human primacy. It favors a non-hierarchical position that includes all environmental participants, and emphasizes interconnectedness to support equality and sustainability.[72] The ecocentric philosophies I have adopted, which include frameworks from Aldo Leopold, Arne Næss and Native Science, understand that an environment—encompassing all its inhabitants—is an emergent, diverse, interrelated body that arises relationally. They also interweave a world view, or cosmology, into their eco-philosophies. Arne Næss, who initiated Deep Ecology, frames this as a central intuition or 'ultimate premise," which is the first level of consideration in the Deep Ecology rubric that Næss devised.[73] Native Science sees the integration of cosmology in eco-philosophy as the only way to generate the eco-consciousness needed to engender an effective conceptual framework. For my purposes, I frame adaptation of a worldview into my compositional process as similar to companion planting. Companion planting is an approach to gardening where particular plants are situated together to collectively cultivate their mutually beneficial needs. To create a framework for R&R I adopted the worldview of ecocentrism as a companion to cultivate musicking strategies of mutual benefit. The worldview I cultivated is derived from a coalition of ecocentric philosophies that expand definitions of community and challenge binaries and hierarchies.

[72] Patrick Curry, *Ecological Ethics: An Introduction* (Malden, MA: Polity Press, 2006), 44.
[73] Arne Næss, "The Deep Ecological Movement: Some Philosophical Aspects" in *Environmental Ethics: An Anthology,* ed. Andrew Light and Rolston Holmes (Malden, MA: Blackwell Publishing, 2012), 262.

My understanding of environment as expanded community and complex system is partly informed by American author, scientist, and environmentalist Aldo Leopold (1887-1948). In contrast with the backdrop of increasing industrialization, expanding capitalism, and faster modes of media distribution, Leopold was a rural inhabitant and a strong advocate for environmental ethics in early- to mid-twentieth century America. From the setting of his farm in Baraboo, Wisconsin, he wrote the influential *A Sand County Almanac*, a landmark collection of essays that expressed his views on conservationism, ethics, and public policy in relation to the environment. The text was composed to advance the idea that human ethics should also encompass the natural world in which we live and its struggle for existence. The essay that most strongly moved this goal forward is "The Land Ethic," in which Leopold observed that an ethic evolves around the premise that "the individual is a member of a community of interdependent parts."[74] By extension, he reasoned that a land ethic "simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively, the land."[75] In this statement we see a burgeoning concept of ecocentrism emerge, one that recognizes an ecosystem as an interdependent, heterogeneous community, of which the human is simply one part.

[74] Aldo Leopold, "The Land Ethic" in *Environmental Ethics: An Anthology,* ed. Andrew Light and Holmes Rolston (Malden, MA: Blackwell Publishing, 2012), 39.
[75] Leopold, "The Land Ethic," 40.

I also draw from Deep Ecology, which indirectly advanced Leopold's definitions of an environmentally inclusive community. Deep Ecology was conceived by Norwegian environmental philosopher Arne Næss in 1972, against the backdrop of the seminal United Nations Conference on the Human Environment in Stockholm, Sweden. In response to increasing destruction of the environment caused by industrialization and capitalism, Næss expanded Leopold's initiative to evolve society from consumption-oriented ethics to a biotic-inclusive value system. To achieve this, Næss built a relational decision-making framework to apply to environmental issues that has four levels: an ultimate premise (or cosmology), the deep ecology principles, normative hypothesis (what is the normative narrative of a particular problem) and the specifics of the situation. The ultimate premise Næss worked from is a cosmology of unity, one that presumes the universe is constituted by dynamic, interdependent entities and their relationships.[76] Though Næss's invocation of holism and unity could be interpreted as an insinuation of, or promise for, an unobtainable sense of completion or perfection, his intention was to point towards a gestalt view of whole. A deep approach to ecology features humans as one component of a totality that is an ongoing field of creation. For Næss this dissolved notions of a world composed of discrete units and dissuaded humans from thinking of themselves as separate from nature. Deep Ecology instead understands the world as intersecting and

[76] Warwick Fox, "Deep Ecology: A New Philosophy of our Time?" in *Environmental Ethics: An Anthology,* ed. Andrew Light and Holmes Rolston (Malden, MA: Blackwell Publishing, 2012), 253.

interdependent, with no “firm ontological divide in the field of existence.”[77] Deep Ecology sees an ecology as an “enveloping community, a place in space, a process in time, [and] a set of vital relationships.”[78]

Native Science also fosters an eco-philosophy that is an expression of evolutionary interrelationships of people with nature. It too emerged out of a cosmology that knows itself as a unitary whole in which everything is interdependent and moved by creative energy. In Native Science there is no other, because the other is you. For example, Navajo philosophy is a lived practice of cultural forms that embodies the connectivity between people and the spirits of nature, animals, plants, minerals and other natural phenomena. People understand themselves in a multidimensional, relational contextualization with all other aspects of the world. According to Native Science an eco-philosophy must uphold an “interactive relationship between cosmology, philosophy, values and action.”[79] It understands an environmentally inclusive sense of community as a pathway to knowledge of relationships. In addition, what is particularly relevant about Native Science is that it refers to knowledge of relationships with nature

[77] Arne Næss, “The Deep Ecological Movement: Some Philosophical Aspects” in *Environmental Ethics: An Anthology,* ed. Andrew Light and Rolston Holmes (Malden, MA: Blackwell Publishing, 2012), 262.
[78] Holmes Rolston, “Value in Nature and the Nature of Value” in *Environmental Ethics: An Anthology,* ed. Andrew Light and Holmes Rolston (Malden, MA: Blackwell Publishing, 2012), 145.
[79] Gregory Cajete, *Native Science: Natural Laws of Interdependence*, 1st edition (Santa Fe, N.M: Clear Light Publishers, 2016), 62.

specifically as resonance. In Native Science resonance is a mode of relating to the natural world.

These ecocentric philosophies became the cosmology, or methodology for R&R: the companion plant that would help nurture a flexible and inclusive structure. Like Deep Ecology and Native Science, my intention with R&R was to invite participants to consider the other as themselves, and diffuse sensibilities of separation that support divisive binaries and problematic hierarchies. To achieve this, I needed to work *with* an environment, to focus on its process and explore how our presence worked within the setting. These ecocentric philosophies compelled me to begin from a premise of connectedness. Their reference point provided a check for any schema or strategy I devised. They ensured that I adopted methods that would perform a fundamental assumption of environmental interrelatedness and generative co-construction.

They also revealed the need to recognize complexity and its potentials. A given ecosystem is inherently complex with a multiplicity of interactions between many changing bodies. Out of these interactions the potential for emergent properties or behaviors is also possible. These are the unknowable combined effects that are greater than the sum of their parts. To reflect these understandings, I designed a musicking strategy that drew from two practices that embody the cosmology I developed: improvisation and Deep Listening. Each of

these practices emphasize the simultaneity of collective and individual experience and understand musicking to be a generative whole. They each privilege adaptability and support my efforts to create an environmentally inclusive musicking framework. To summarize this approach, I refer to the following:

- A foundational premise of ecocentrism or other cosmology that includes understandings of diverse systems, holism, and interconnectedness
- Inclusion of an environment's existing sonic behaviors, such as acoustic and resonant potentials, animal life, or ambient noise and human activity
- An ability to adapt to environmental characteristics and their behaviors
- Methods for participants to orient their intersubjectivity

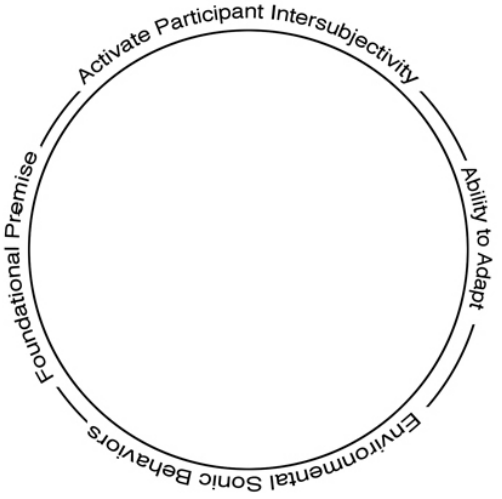

Figure 2.6: Eco-logical Musicking

The following sections will detail the backgrounds of improvisation and listening, and how they contributed to eco-logical musicking.

Improvisation as Eco-logical Practice: How and Why

Improvisation is a mode of musicking that is characterized as unscripted and flexible, qualities that allow musicians to interact with circumstances of the moment. It requires a virtuosic elasticity that inspires lifestyles and mindsets, and yet it is potentially accessible to anyone who chooses to partake in it. Improvisation exists in a variety of musical genres and in many cultures, but for my purposes I draw from traditions known as creative and free improvisation. It's creative in the manner in which the Chicago-based and Afrologiclly-informed Association for the Advancement of Creative Musicians (AACM) enfolds the term, as "an act of perpetual becoming."[80] and free in the ways in which Eurologically situated British improvisor Derek Bailey orients improvisation: as a music established by the sonic identities of those playing it, performed within rules of their own definition.[81] In these practices, improvisation is contextualized, immanently dynamic musicking through which, as Lewis's describes, "structure, meaning and context arise from the domain-specific analysis, generation, manipulation, and transformation of sonic symbols."[82] My research into these forms of improvisation was conducted in study with contributors to both types of improvisation, including multi-instrumentalist Roscoe Mitchell, also a member of the AACM, and guitarist Fred Frith, who emerged out of the Bailey's Eurologic

[80] George E. Lewis, *A Power Stronger Than Itself: The AACM and American Experimental Music*, Reprint edition (University of Chicago Press, 2008), xl.
[81] Derek Bailey, *Improvisation: Its Nature And Practice In Music*, Reprint edition (New York: Da Capo Lifelong Books, 1993), 83–84.
[82] Lewis, "Improvised," 274.

pedagogy. They taught me to consider musicking a generative co-mingling of components that arose out of distinctly situated relationships.

Of particular interest to me is that creative and free forms of improvisation experiment with non-hierarchical performance strategies. Their effectiveness relies on examinations of concepts of self and collaborative action. As percussionist and co-founder of the free improvisation group AMM Eddie Prevost observed, improvisation was for him "an experiment in social discourse. Improvising means individual responsibility for the sounds produced and collective responsibility for the overall performance."[83] While improvising participants feel the entanglements and impacts of their actions, experiences that deflate notions of individual control and emphasized interconnectedness and its effects.

Also useful to my efforts is the way in which improvisation articulates self-organizing systems and can be understood as emergent complexity. Ethnomusicologist and improvisor David Borgo describes improvisation as a particularly effective display of complex systems, emergence and distributed fields of creativity. Through the music of improvisors such as Evan Parker and Sam Rivers, Borgo framed free improvisation as a salient account of emergent complexity: distinct events that emerge out of what can be perceived as chaotic collective groupings. For instance, though he points to improvisation as a full-

[83] Daniel Fischlin and Ajay Heble, eds., *The Other Side of Nowhere: Jazz, Improvisation, and Communities in Dialogue* (Middletown, Conn: Wesleyan University Press, 2004), 358.

bodied experience that includes the continual engagement of the "musical environment, idea space, and the instrument itself," he also emphasizes that these various threads are capable of co-constructing new instances untraceable to their individual components.[84] For Borgo, improvisation offers evidence of the surprise of non-linearity, and illustrate outcomes that are disproportionate to their input.

In addition to Borgo's research, theorist Edgar Landgraf has invoked complexity theory to interpret improvisation, who framed improvisation as "a complex feedback process that builds forms out of contingent elements by relating present decisions to past decisions."[85] Musician/theorist Bennett Hogg was more specific in his description of musical-improvisation-as-complexity. He described it as a process of "complex and mediated sets of relationships between physical sounds, perceptual systems, personal associations, culturally significant gestures, bodily and emotional responses, observed actions and reactions, and culturally learned expectations."[86]

With these qualities I understand improvisation as a practice that acknowledges the perpetual becoming and contextual meaning-making of all

[84] David Borgo, *Sync or Swarm: Improvising Music in a Complex Age* (New York, N.Y; London: Bloomsbury Academic, 2006), 52.
[85] Edgar Landgraff, "Improvisation: Form and Event" in *Emergence and Embodiment: New Essays on Second-order Systems Theory,* ed. Bruce Clarke and Mark B. N. Hansen, (Durham, NC: Duke Univ. Press, 2009), 191.
[86] Jakub Ryszard Matyja and Andrea Schiavio, "Enactive music cognition: background and research themes." *Constructivist foundations* 8, no. 3 (2013): 354.

participants as musicking unfolds. However, as Georgina Born observed most auto-ethnographic accounts of improvisation don't go beyond the microsocialities of its own make-up.[87] R&R extended beyond the microcosm of ourselves and considered not only the materiality and social constructs of our production, but also the environment as a whole as contributor to our field of musicking. Situating ecocentrism as the pivot from which we engaged our improvisational strategies served to expand our purview to the greater environment, and improvisational practices enabled us to encompass the environments complex interactions.

Listening as Eco-logical Practice: How and Why

On September 25, 2010 I was invited by composer and Deep Listening founder Pauline Oliveros (1932 - 2016) to join an ensemble that performed the second presentation of her piece *Primordial Lift* (1998). The presentation took place at New York City's Issue Project Room, and the ensemble consisted of myself (oscillator), Pauline Oliveros (accordion), Jason Huang (violin) Anne Bourne (cello/voice), David Grubbs (harmonium), Miguel Frasconi (glass harmonica), and Andrew Deutsch (synthesizer). When I worked with Oliveros we frequently dipped into playful verbal quips and fast exchanges, and this rehearsal was no different. During one exchange I responded to a statement from her in jest, slyly saying "I hear ya' barkin' big dawg." As if the word 'dawg' was an elastic ball

[87] Georgina Born, "After Relational Aesthetics: Improvised Music, the Social, and (Re)Theorizing the Aesthetic," in *Improvisation and Social Aesthetics* ed. Georgina Born, Eric Lewis, and Will Straw, eds (Duke University Press, 2017), 33–58.

tossed in the air, she caught it and threw it back, leaning into the phrase with her native Texas drawl. We pursued a fun volley with the word, enjoying the touch of the tongue on the d, drawing out the coupling of the ‘a’ and ‘w’ as they softly slid into the glottal ‘g’. Between the two of us we stretched the phrase like water taffy into new configurations and meanings. Our play was driven by our attention to listening, and Oliveros was deep in the changes that our tumble into listening brought, as was her habit.

An emphasis on listening strongly supports eco-logical musicking. If we reflect back to Christopher Small’s definition of musicking, we find that listening is an active component in his illustration. In my ten years of study with Oliveros, I found listening to be such a productive aspect of musicking that I now position it as equal to, if not primary to, sounding in my compositional process and structures. This has had a number of effects, but in terms of eco-logical musicking, I reference listening’s ability to shift the origins of a musicking experience out of the domain of a single author and commute the activity to include listeners as well. I also include it as a process that engenders an expanded awareness of a plural, complex environment and its generative, relational arising. An attention to listening invites us to reconsider how we situate ourselves in an environment, and in relation to its components.

Listening was always primary sensory orientation for Oliveros. An aspect of her practice that I was particularly attuned to was her attention to what one might call nonmusical, or non-semantic, material. That is to say, she wasn't interested in the meaning of a sound, per se, but was drawn to its materiality and sensorial effects:

> "Sometimes during the mid-1930s I used to listen to my grandfather's crystal radio over earphones. I loved the crackling static. The same grandfather used to try to teach me the Morse Code with telegraph keys. I wasn't interested in the messages, but I loved the dit da dit dit rhythms. I used to spend a lot of times tuning my father's radio, especially to the whistles and white noise between the stations. I loved the peculiar acoustical phenomena which involved my parents' voices on long rides in the car. I would lie in the back seat listening intently to the modulation resultants produced by voices interacting with engine vibration. I didn't care what they were saying. I also loved our wind-up Victrola, especially when the mechanism was running down with a record playing. I loved all the negative operant phenomena of systems."[88]

Oliveros' propensity towards listening became an object of research with her inquiry Meditation Project (1973) a project that investigated exercises in concentration, based in listening, and their ability to contribute to, or change how, we make music.[89] The project, funded by the Rockefeller Foundation and sponsored by the Department of Music at the University of California, San Diego, drew from Oliveros' Sonic Meditations (1974), as well as exercises designed by

[88] Heidi Von Gunden, *The Music of Pauline Oliveros*, First edition (Metuchen, N.J: Scarecrow Pr, 1983), 51.
[89] Pauline Oliveros, *Software for People*, 2 edition (Kingston, NY: CreateSpace Independent Publishing Platform, 2015), 158.

kinesiologist and choreographer Elaine Summers and psychologist Dr. Ronald Lane of the Muir Counseling Service. Oliveros' Sonic Meditations was a compendium of text instructions she defined as activities with a focus on sound and listening.

A meditation, a word Oliveros adopted to indicate a steady awareness or attention, includes making sounds, actively imagining sounds, listening to present sounds and remembering past sounds. Sound making could be produced by voice, body sounds, sound making objects or instruments. Sound imagining is encouraged, and focused listening is engaged to expand auditory awareness of inner and outer environments for the participant.[90] The parameters of sonic meditations are often conveyed via text, and it is understood that the execution of the meditations themselves arise out of the unique conditions they are performed in. A striking feature of the meditations is that no special skills are necessary to participate, save a willingness to commit to the activity. This serves to empower all participants with the ability to actively contribute to the music-making experience through their own design. Because the music emerges without a central author or performer, and lacks strict codification, a sonic meditation works to negate inherent hierarchies embodied in contemporary composer/performer/audience dynamics and diffuses binaries of subject/other. In a sonic meditation each individual brings their history and experience to their listening or sounding, which is folded into the

[90] Pauline Oliveros, *On Sonic Meditation* (Center for Music Experiment and Related Research, University of California at San Diego, 1973).

group sound, yet individual perception of the group experience is recognized and valued.

In her sonic meditations, and the Meditation Project, Oliveros positioned listening as equal to sounding to focus on the resulting effects. Her goal, however, was not to reify the mid-19th century Wagnerian stoic posture of listening that would crescendo into a signal of a rational modern subject.[91] Nor was it an attempt to join the growing call heard from Marshall McLuhan, and like-minded cultural theorists, for the hearing-sense to depose the perceived hegemony of vision.[92] It was instead an effort on Oliveros' part to re-frame cultural values of receptivity, a quality often assigned to women and read as disempowering passivity. As a woman, lesbian composer in the mid-20th century, and an early innovator in electronics, Oliveros often grappled with various forms of oppression. Against the backdrop of civil rights action, which was the era in which she conducted the Meditation Project, Oliveros responded with advocacy for modes of cultural navigation and articulation engaged by women and framed them as valuable and productive.[93] With the Meditation Project, and a lifetime of work thereafter, Oliveros unpacked the qualities and characteristics of receptivity, and inquired after how listening was a meaningful manner of engagement. She proposed that listening had the ability to empower the individual and contribute to group consciousness

[91] For a discussion on listening practices of the 19th century see David Hendy, *Noise: A Human History of Sound and Listening*, Reprint edition (Ecco, 2013), 233.
[92] Christoph Cox and Daniel Warner, *Audio Culture: Readings in Modern Music* (A&C Black, 2004), 67.
[93] Oliveros, *Software for People*, 158–64.

through the simultaneity of shared and unique experience. In Meditation Project she concluded that, through repeated practice, sonic meditations rendered what she described as heightened states of awareness and expanded consciousness. She deduced through phenomenological reporting, psychological and biofeedback data, that participants, while listening in to what she termed "sonic energy," gained a greater sensitivity to each other, and that intrapersonal, communal and environmental communication and construction expanded.[94]

Oliveros' focus on listening continued to inform her work, and she eventually formalized the practice she called Deep Listening in 1985. I began working closely with her as her teaching assistant for her Deep Listening course at Mills College in 2007, where I earned my MFA. With her methods I discovered that my own focus on the flow of textural and timbral qualities of music making was based in a long-term listening attention that grounded itself in the shifting subtleties and shades of sound. In our studies I recognized how this attention worked for me, and intentionally emphasized this interest to build a foundation for my practice.

In attentive listening, I perceive the ongoing dynamics of an environment more acutely. I sense the energies of movements in my ears and body as the vibrations of sound connect with my cilia and skin. Listening, my consciousness

[94] Oliveros, *On Sonic Meditation*.

tunes in to the motions and states of the world as it arises. As I listen, I'm with its swings, drifts, streams, and splits, its expansions, contractions, evolutions and shifts as well as its thickness, softness, harshness or slimness. I also find that my awareness is achieved as a result of an interesting paradox that folds in on itself. My consciousness of flow and motion in the environment arise *because* of the relative stillness of listening, but in said stillness my awareness of my own activeness becomes apparent. In listening I become aware of the rates of my breathing and my heartbeat, the rhythms of my walking and the clicks and pops of my joints. And what was once almost inaudible becomes surprisingly loud as I tune into the crunchy timbres of cartilage in my hands and the drone of blood circulating round my body. Listening not only turns my attention to liveliness in my surroundings, it also tunes me into the multiplicity of movements and states in my own body as they occur within a greater shifting milieu.

From this perspective one's experience of one's self shifts from self *to* the milieu, and awareness of an environment's plural, simultaneous complexity becomes palpable. Attending to this plural simultaneity leads to the various rates, cycles and states of our own existence situated with the many sounds and rhythms of a given environment. Listening in to acoustic interactions with a cascading awareness can also be framed as a felt sense of being the coexistence of an ecology. The attention to this aspect of experience invites us to re-situate our world view from center of the world to node in a web of plural interactions. In

addition, perhaps most significantly, this re-situating engenders an analogous experience that to an ecocentric position as opposed to an anthropocentric one.

An adjustment in situational worldview also illuminates a relational sensibility, an awareness that our constituting is the result of ongoing contextualized interactions. This awareness is particularly available when a full-bodied listening is engaged, an aspect of listening I also strengthened when I worked with Oliveros. From the early days of the Meditation Project, Oliveros included somatic practices in her listening approach via her work with kinesiologist and choreographer Elaine Summers and karate master Dr. Lester Ingber.[95] She continued to infuse her listening methods with body-focused practices that promoted my own somatic sensitivity to sound's effects and interactions. To illustrate this phenomenon, I return to my participation in our performance of *Primordial Lift*.

[95] Oliveros, *Software for People*, 159.

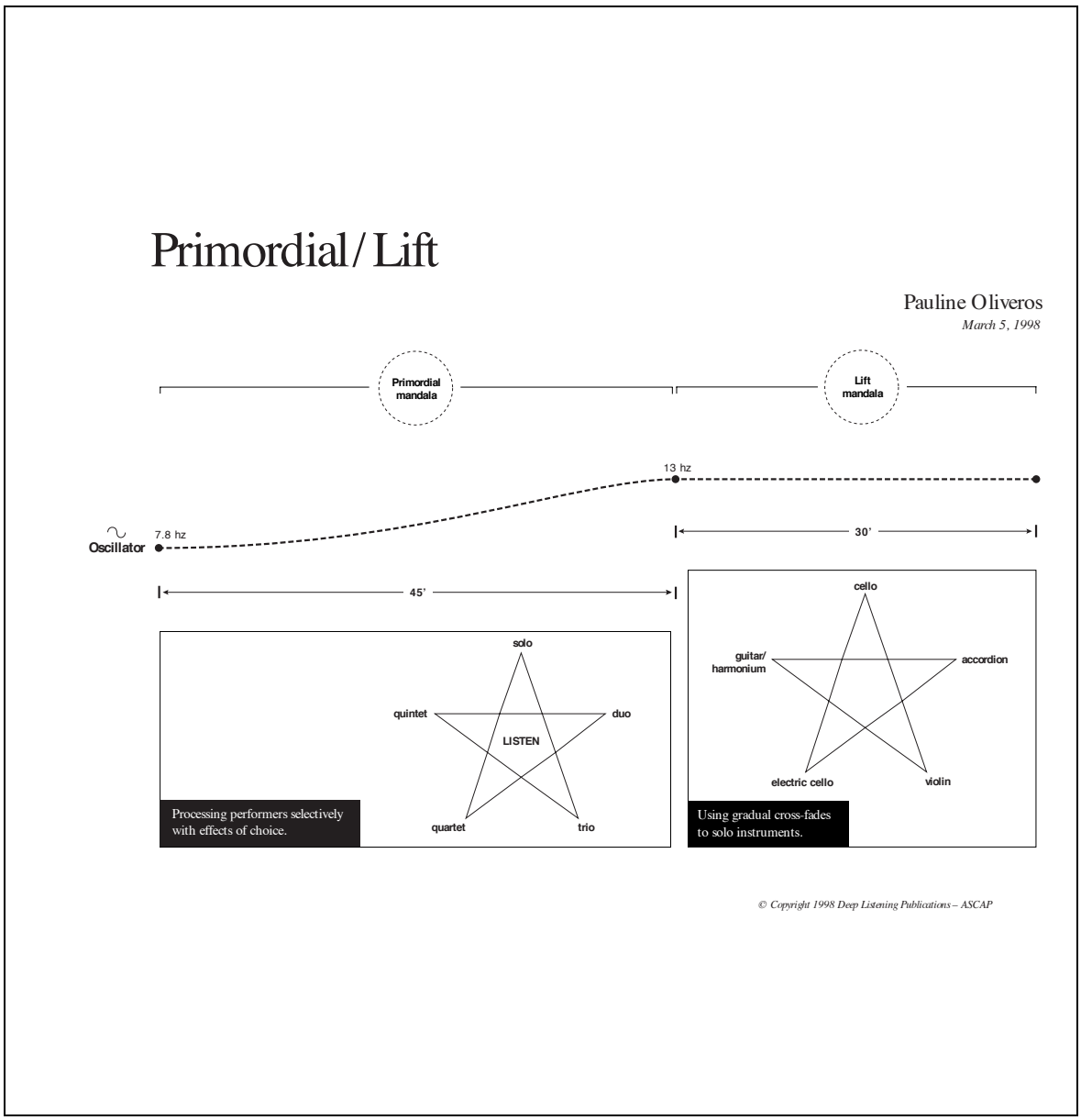

Figure 2.7: Page 1 of the score for *Primordial Lift* by Pauline Oliveros

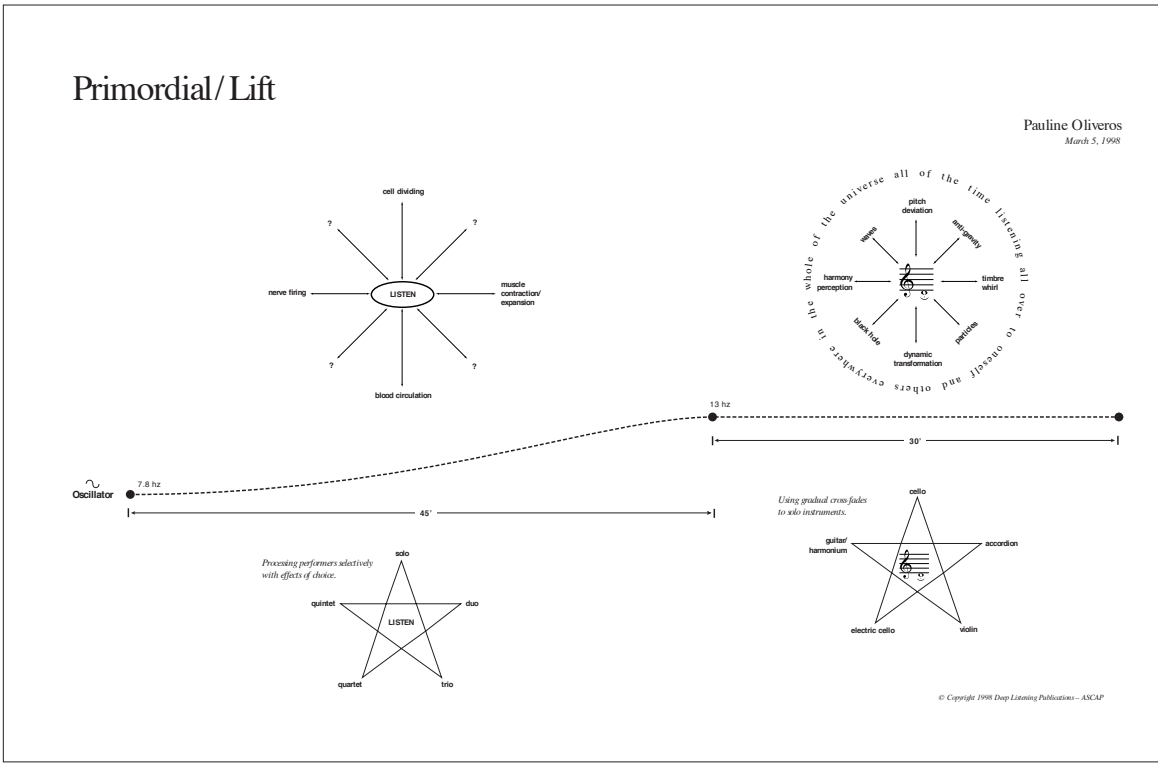

Figure 2.8: Page 2 of the score for *Primordial Lift* by Pauline Oliveros

Oliveros composed *Primordial Lift* to render an experience of a theorized shift in Schumann resonances: amplified electromagnetic waves in the earth's atmosphere that exist between the surface of the earth and the ionosphere. These waves are excited by lightning storms that have been measured to resonate at a

fundamental frequency of 7.83 Hz since 1952.[96] However, changes in the resonant frequency have been registered in the past twenty years, from 8.5 to 16.5 Hz and greater. *Primordial Lift* was a performance of this shift. For seventy-five minutes I performed the rising fundamental of 7.8 Hz to 13 Hz, on a vintage tube oscillator.

This is remarkable for two reasons: the increase in frequency was only 5.2 Hz, a small increment that was composed to occur over a relatively long duration of 45 minutes (I held the frequency for an additional 30 minutes). In addition, these frequencies are inaudible. The human audible range is 20 Hz to 20 kHz, with the outer limits of that range at best optimistic for most over 20 years of age. Therefor to 'hear' the inaudible my best recourse was to 'listen' for changes in pressure with my body as well as my ears: a full-bodied somatic listening. This phenomenon can be described with the analogy of the pressure one feels when large machinery passes by. We hear mid to high frequencies of its rumble in the ear, but the lower frequencies diffuse and envelope our bodies as well. The low-end sounds are typically felt in the chest or stomach as palpating beats of pressure. This is a haptic-like sense of knowing, not restricted to the hands but expanded to other parts of the body. In a manner of speaking, to perform *Primordial Lift*, I listened for the touch of resonance on my body

[96] Schumann Resonance, NASA, last modified May 28, 2013, https://www.nasa.gov/mission_pages/sunearth/news/gallery/schumann-resonance.html

I think of this as a relational form of listening and a contributor to a relational form of knowing, which locates cognition in the body and its embeddedness in environment.[97] A relational theory of knowing varies from a representational theory of mind that purports that our cognition is a brain-based image. Agent-environment theories of cognition emphasizes active, contextualized adaptation that engages an environment in itself as part of knowledge formation.[98] Enactive cognition also proposes that how and what we know is relationally brought forth in conjunction with environmental interaction. It emphasizes a being's mode of enjoining with the environment and sensorimotor patterns of perception and action.[99] Much like Næss and Native Science's theories that propose that elements of an ecosystem, and the ecosystem itself, emerge out of interconnected complexity, agent-environment cognition theory sees knowledge and self-making as an environmentally entangled and co-constitutive process. In my performance I knew the effects I performed with the oscillator through my body's immersed interaction in the environment. My somatic listening was my manner of knowing.

The changes in pressure driven by the low-end frequencies of the oscillator had another effect that was relationally known. The same energy that palpitated the air in the room that my body sensed also interacted with the sounds performed

[97] M. E. Müller, *Relational Knowledge Discovery*, 1 edition (Cambridge University Press, 2012), 17.
[98] Eric F. Clarke, *Ways of Listening: An Ecological Approach to the Perception of Musical Meaning: An Ecological Approach to the Perception of Musical Meaning, (*New York: Oxford University Press, 2005), 17.
[99] Evan Thompson, *Mind in Life*. (Cambridge, MA: BELKNAP, 2010), 23.

by the ensemble. Close listening revealed slight beatings or quivers in tones held by the cellist or guitar player. These quivers were another way that I knew the low-end frequency's rise was having an effect. As the frequency of the oscillator rose, the players adjusted in kind, communicating a shift. What I performed was made audible through listening to changes in sound from those around me. This was a relational form of listening, where what I knew was informed by listening for contextualized interaction. My knowledge wasn't only an inner mode of representation but a felt sense discovered in the entangled and contextualized process of listening.

When I apply this listening practice, with attention to reception in a full-bodied sense, to the practice of situated sound composition I find that my awareness of myself as part of a complex and diverse ecosystem increases. Tuned into the activities of a sonic milieu an anthropocentric stance and narrative of separated self-determinism no longer holds. Instead I know myself as one of many. I recognize that my creative production is a realization of the many bodies, as they relationally arise, of an environment. *Resonance & Resemblance* emerged out of listening to Manitoga. In listening I learned its acoustic qualities and behaviors and designed a way to interact with its ecosystem ecocentrically. The musicking that became R&R emerged out of a structure that combined listening, musical notation, and improvisatory components. The combination of these three musicking features promoted a co-operative experience and diffused traditional

notions of authorship. The integration of these methods fostered a flexible musicking ecosystem of a participants own definition that pointed towards the generative complexities of the environment and its interconnectedness. Going forward I'll detail how I folded listening and improvisation practices in R&R's design to contribute to a sensibility of plural, distributed action and interconnectedness, and add a focus on resonance.

The Structure for Resonance & Resemblance's Eco-logical Musicking

[Listening]

Listening functioned as a foundational building block for R&R in a variety of ways. To create the musicking structure, I spent weeks listening to Manitoga in various capacities: I listened while walking, sitting, floating, singing, and playing. I also listened and analyzed field recordings with which I identified otherwise unavailable details, information I later included in the score. In addition, I featured specific listening activities in the realization of R&R, which included a soundwalk and listening meditations. The first half of the 50-minute event was a 25-minute soundwalk.

A soundwalk was defined by acoustic ecologist and composer Hildegard Westerkamp as a walking excursion "whose main purpose is listening to the

environment."[100] It is a critical method engaged by sound studies researchers and artists since its initiation at the Canadian-based World Soundscape Project in the 1970s.[101] My inclusion of the technique worked to orient and connect participants to the location through their hearing sense while slowly moving about the woodland. The activity gave them the opportunity to coordinate their inner pace with the rates of Manitoga through an ambulatory and somatic listening. In their soundwalk listeners connected their feet, strides, heartbeats, ears and temperatures to the tempos, frequencies and states of the woodland. Soundwalkers knew the acoustic behaviors of their surroundings and established a relationship between those qualities and their own subjugated experience. As the first half of the R&R, the soundwalk meditation invited participants to focus on their personal perceptual experience as a contributing factor in the musicking as a whole, amid a co-constructive environment. They became active participants in a the ongoing musicking sphere.

I mapped out three walks among Manitoga's trails that offered a variety of opportunities for interesting listening engagements. I chose paths that dispersed the anticipated audience of a hundred or more, which avoided too many people in one area. I invited Lisa Kelley, Stephanie Loveless, and Michelle Negai, each trained in Oliveros' practice of Deep Listening, to guide the soundwalks with

[100] Hildegard Westerkamp, "Soundwalking," originally published in *Sound Heritage,* Volume III, no. 4, (1974) Victoria B.C.
[101] Kendall Wrightson, "An Introduction to Acoustic Ecology," *Soundscape—The Journal of Acoustic Ecology* 1, no. 1 (Spring 2000): 10.

techniques of their choice, which was also an invitation for them to work from their own subjective engagement. I walked the paths with Kelley, Loveless and Negai to acquaint them with their route, after which they went into the wood to learn its acoustic characteristics to develop their approaches to their task.

Welcome to *Resonance & Resemblance*, a sonic meditation for Russel Wright's woodland garden, Manitoga, by Suzanne Thorpe. The first half of our meditation invites you to participate in any, or all, of the following listening engagements, followed by our fifth, and final, musicking meditation.

I

Resonance Walking
A guided soundwalk meditation

Or, if you choose to engage in a sitting meditation, enjoy exploring the following:

II

Ear Expansion
Cover your ears with your hands
Listen to the sounds of your body, closely, for five deep breaths
Very slowly remove your hands
Take five more deep breaths, and expand your listening further outward with each breath

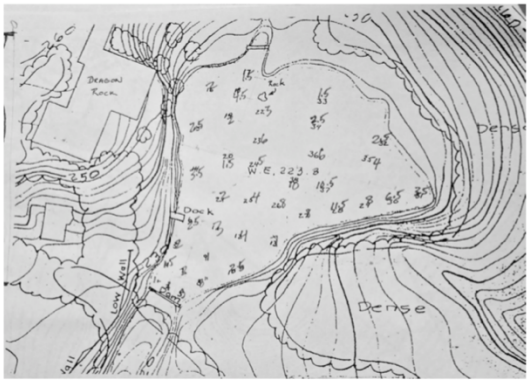

Figure 2.9: Example of distributed meditations for *Resonance & Resemblance*

I also distributed listening meditations in the program notes for R&R. The text-guided meditations were for those who couldn't physically participate in a soundwalk, and also served as suggestions for listening strategies during the performed portion of the event. They invited people to oscillate between what Oliveros called focused listening, which is concentrated on a specific sound, and global listening, which is listening to an environment in its entirety. In addition, I

engaged people's listening bodies with prompts to listen through particular body parts, other than the ear, with invitations to listen through one's chest or elbow. For attendees this attention to listening concentrated their awareness on their perception of their experience. The soundwalks and text meditations served as an invitation to listeners to shift their orientation of themselves from receiver to participant in the event. This emphasis on listening gave rise to a heightened awareness of interplay between the many actors in the environment, and exposed the fluctuating boundaries of our musicking, which expanded and contracted along with the oscillations we tuned into.

[Notation]

Eco-logical musicking maintains space for the acoustic behaviors of the environment through a number of strategies. Typically, I include geologic and biologic behaviors in situated sound installations by incorporating sensors. For instance, in *Balboa Arboretum*, commissioned by the San Diego Art Institute for the exhibit Balboa Park: 100 Years (2015), I featured field recordings of trees and compositional choices conducted in real time by local wind speed, which was detected via an anemometer. This transmitted a presence of the environment through its active behaviors. However, with R&R the sensors, so to speak, were us. One strategy I adopted embedded information about Manitoga's acoustic behaviors through musical notation. This may seem like an odd choice for a musicking experience that promotes flexibility, however notation has a place in this

system as well. I spent a year in Manitoga acquainting myself with its sound characteristics, details and salient behaviors. Because of the time it took to know these features, I concluded that notated elements were one way I could convey what I learned. Therefor I applied a technique known in improvisation practices as fixed, or structured, improvisation.

Composition and improvisation are often presented as binary practices, with accompanying contestations as to which form is superior.[102] But most discussions distill down to time being the major difference between the two. Composition is typically understood to transpire over a longer duration and notation is applied to realize a composer's thoughts. In contrast improvisation occurs in real-time, and the composer/performer has the flexibility to interact with conditions of the moment. A structured improvisation is a hybrid that combines scripted, or notated elements along with real-time, undetermined performance. For instance, American composer/musician Anthony Braxton, who was a prominent member of the previously mentioned AACM, developed an approach to group musicking that includes symbols to indicate a particular action, often in a pre-determined timeframe, along with flexible elements that enables musicking agents to contribute their own experience. For Braxton this approach allows "both disciplines (improvisational/fluid musics and notated/stable musics) to exist and evolve - as unified and independent realities (with its own secrets and particulars)."[103] It

[102] Bailey, *Improvisation*, 140.
[103] Anthony Braxton, "Introduction to *Catalog of Works*" in *Audio Culture: Readings in Modern Music,* ed.

enabled what he called primary planes of perception to co-exist: abstract realization, concrete realization and intuitive realization. For R&R the notated components of the musicking framework were bodies of knowledge, or concrete realizations, that took time to perceive. Though a participant could, and would, intuit some of this information through their interactions, there were intrinsic details that could not be worked out in our short group musicking event. The scored components therefor functioned like seeds, embryonic forms that have the potential to produce the qualities and characteristics of their contributors as they grow into new forms. The notation contained acoustic characteristics of Manitoga's rocks, trees, water and leaves, among others, and R&R evolved these details in the real time musicking iterations and interpretations.

The salient features that emerged in my listening residencies included Manitoga's noise floor, resonant frequencies, and reflective qualities. A noise floor is the sum of signals in a particular environment, minus the sound a person may perform or play. Manitoga's summer environment was sonically complex, thick with birds, insects, and humidity. Knowing the amplitude of the noise floor informed my choice of instrument (the wooden recorder) and application of dynamics in the score. A resonant frequency is a frequency that an object or body resonates at when it's plucked, strummed or stimulated by a sound. Knowing the environment's resonant frequency potentials informed the pitches we performed during our

Christoph Cox and Daniel Warner, (A&C Black, 2004) 202.

musicking. Lastly, the reflective qualities of the granite and water had a tendency to prolong an impulse wave and diffuse it across the quarry. This behavior raised the potential for interesting acoustic phenomena to occur if sounds were active at particular intensities or rhythms, and/or traveled in certain trajectories. I'll continue to discuss the impact of these details in later chapters, but for now I'll point to how they were realized in the score. Spectral analysis of recordings revealed a strong, consistent presence of frequencies relative to the pitches D, E, G, B. These findings suggested that these pitches could stimulate resonances in the environment, and they became the basis of the musicking composition. Each performer was assigned a single note to concentrate on. They focused on one note and applied their own listening experiences to work with their sound's behaviors and interactions with the environment, and each other, as they played. Noting the activeness of sound in the reflective qualities of the quarry, I specified particular gestures to emphasize acoustic and psychoacoustic phenomena, such as repeated, loud trills or short, staccato rhythmic figures. We particularly enjoyed directing our attention to the performance of long, sustained notes played in our slowly turning kayaks, and their ability to activate pitch bending and dissonances as they intersected with each other and entangled with water and granite cliffs.

[Improvised flexibility and listening]

Improvisatory aspects, agency, and flexibility for performers in changing conditions were activated with content developed by performers' subjective discernment, and application of focused listening strategies. The performers for R&R were Katie Down, Madison Greenstone, Anne Guthrie and Adam Tinkle. Each are experienced improvisors and deep listeners. Down is a musician and music therapist and part of Oliveros' Deep Listening community; Guthrie is a musician as well as an acoustic architect; Tinkle studies Oliveros' techniques with resonance, and he and Greenstone are improvisers, multi-instrumentalists, performers and researchers who enfold listening into their practices. As we developed our approach to R&R our first activities included listening meditations, I developed to orient the group with Manitoga. At my request, each performer went on an hour-long soundwalk in the wood to attune themselves to Manitoga's environment. We followed this activity with listening meditations around the quarry that brought attention to our bodily interactions with sounds in the quarry. This somatic listening expanded our group's awareness of our own engagement with the environment. Our group's actions slowed to the pace of the environment, and our ears became accustomed to the noise floor. In listening we understood the activeness of the environment and its subtleties, and it was this increased sensitivity to Manitoga's sound character that became the touchstone for our musicking choices as R&R progressed.

In addition, I included improvisatory elements through accompanying text in the score. The score invited performers to develop their musicking as they saw fit in the conditions, they were in. Examples included suggestions for performers to merge their sound with another of their choice; follow along with a fellow player's sound until it ended; imitate an animal close by, or far away, or add new rhythmic figures as they determined appropriate to the ongoing dialog. Performers were asked to play densely or sparsely for specified durations or add or subtract gestures to achieve certain acoustic effects. In the end, however, it was the performers' discernment in the moment that determined the intensities they performed at, based on their assessment of circumstances in relation to their own musicking. In this way the performers determined the development of content between each other and the environment they were within. They also had the option to sound with environmental elements and perform their own entanglements.

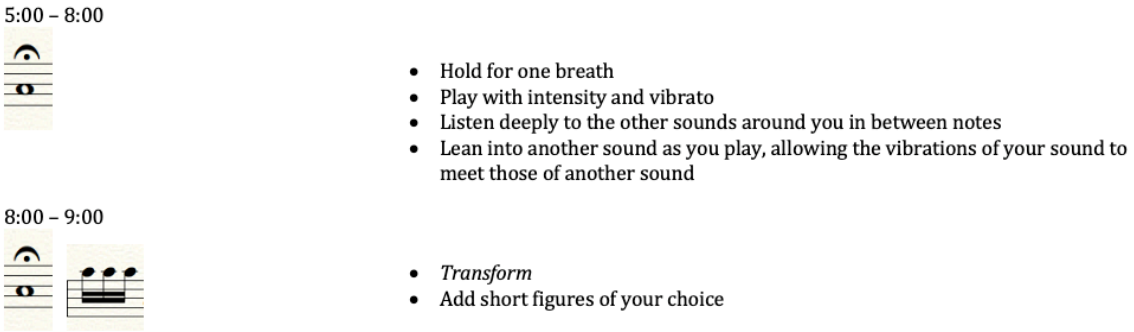

Figure 2.10: Sample of score for *Resonance & Resemblance*, 2017

Conclusion

The score for R&R was simple by design, a tactic that created legibility for the many co-operators, human and non. The simplicity of the score supported inclusion from a broad community of sound producers. And, paradoxically, the complexity of the environment became audible because of R&R's simplicity. This, combined with its flexibility and attention to listening, rendered a musicking experience that challenged traditional hegemonic power dynamics embedded in normative compositional processes to diffuse anthropocentric focus. Our dynamic, inclusive process directed our attention to the entangled interactions of each other. Focused on listening, participants tuned to their own involvement, and the liveliness and interactions of the inhabitants of their surroundings became evident.

As I will demonstrate going forward, *Resonance & Resemblance* was a particularly effective engagement that engendered sensibilities of shared existence between participants and the environment. In the elastic framework provided by eco-logcial musicking, and its adherence to a philosophy of generative wholeness, participants were afforded the opportunity to recognize elements of the environment in themselves as they engaged with the musicking milieu. In addition, an equal emphasis to listening lent each participant an opportunity to experience singular expressions of shared sensibilities in a relational and generative co-mingling. Going forward I will focus specifically on resonance's role in R&R, and its

ability to reveal material perspective, sensibilities of interconnectedness and the dynamics of a pluralistic world.

Chapter 2, in part, has been submitted for publication of the material as it may appear in Music Research Forum published by the University of Cincinnati College-Conservatory of Music, 2020. I, Suzanne Thorpe, was the primary investigator and author of this paper.

Chapter Three

Listening Outward to Resonant Perspective

{Invitation to Practice}

Rochelle Salts Lullaby

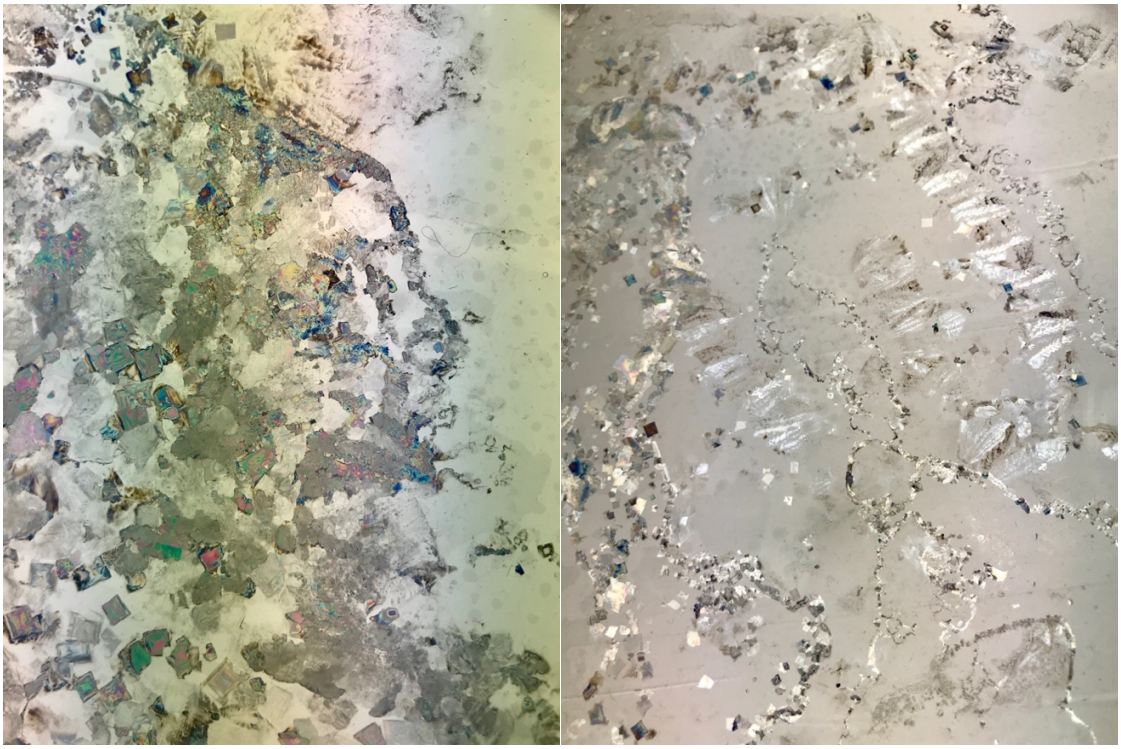

Figure 3.1: Images of growing crystals from the sound installation *Myco-crystaline Improvisation*, November 30, 2018

On Friday, November 30, 2018 media artists Nathalie Dubois Calero and Michelle Temple presented *Myco-crystaline Improvisation*, a sound installation that investigated the relationship between audio signals, both audible and inaudible to humans, and the concurrent growth of bacteria and Potassium Sodium Tartrate crystals. They initiated their investigation through the transduction of the audio into the crystals. Potassium Sodium Tartrate crystals, aka Rochelle salts, are piezoelectric, meaning they have the potential to accumulate and emit an electrical charge in response to mechanical stress. They also inversely generate a mechanical strain when an electrical impulse is applied. These crystals are found in audio equipment such as crystal radios, microphones and turntables. Crystals, ceramics,

bone and certain proteins are all materials that have this potential. When Temple played specific sine tones to the crystals as they formed, she noticed that different tones produced distinct colors and shapes as they grew (see figure 3.1). The goal was to illuminate areas of sensitivity between human and non-human systems with sound. As I visited with the growing crystals, and hummed with their drone, I wondered whether or not we could tune the crystals to have a frequency propensity, or if perhaps they were tuning us? And can this be done in such a way as to nurture it together with song? To perform your version of this question, follow these instructions:

Piezo Crystal/Potassium Sodium Tartrate Recipe (aka Rochelle Salts)

You will need:

1. A small Pyrex measuring cup
2. A medium saucepan
3. Sodium Carbonate (aka Soda Ash, used as a dye fixer, available at most art supply stores)
2. Potassium Bitartrate (aka Cream of Tartar, available at most grocery stores) - 7oz
3. 1 cup purified water

Method:

1. Mix together the Potassium Bitartrate and water into a glass measuring cup, stir out any clumps.

2. Place the glass measuring cup in a pot of water and bring the pot of water to a gentle simmer - you're looking for the water to be just bubbling, not at a full rolling boil. If you have a food thermometer, measure the temperature of the Potassium Bitartrate solution to be around 180 degrees F.

3. When the solution has reached the correct temperature, add the Sodium Carbonate to the Potassium Bitartrate solution a 1/2 tsp at a time. The mixture will bubble up and fizz loudly!

Let the fizzing settle and then give the mixture a good stir.

Repeat this process (a lot!) until the fizzing stops and the solution turns from cloudy to clear. (This happens quite suddenly, so you will know when it's ready!)

4. Remove the glass measuring cup from the hot water bath. Pour the mixture through a coffee filter into a clean container.

5. Let the container sit in a cool, clean place for a few days (it can take up to 5 days).

6. Set up a drone performance (sustained tones focused on a single frequency) for them while they form. Suggestions to accomplish this include:

A. Download a drone app to your phone or tablet, such as Sruti Box. This app performs like a shruti, a bellowed instrument that performs drones, originally from India. You could also choose an app that performs like an organ if you prefer.

B. Place a small speaker, such as bluetooth speaker, to tether your device to near the crystals.

C. Pick a root note, or pitch, preferably one you can sing comfortably, that will be the tone you will stay with as your crystals develop. Regularly perform drones for the crystals, and join in often by humming along. Notice the effects.

Maryanne Amacher: Joining Bodies Through Sound

I met composer and sound artist Maryanne Amacher (1938 (or 43) – 2009) once, when I interviewed for Bard College's MFA program in 2006, where she taught.[104] She had propped herself against the back wall of the interview room, and wore a costume she's well known for: ski overalls, a leather jacket and a bomber hat. As I described my electroacoustic practice to the group, she seemed to squint at me through her dark rimmed glasses in an attempt to connect to my description. At one point something I said caught her attention, and she erupted with a directive. In her needle-like voice (if there could be a female vocal companion to the wry drawl of William S. Burroughs, hers was it) she declared that I should study the Sufis. We all stopped to stare at her (the squinting could also have been sleeping). She went on to exclaim that the Sufis, well, they know what vibrations are and where they take us, and I (the author) was channeling vibrations into a place of communion between music and technology.

At the time, I wasn't familiar with the Sufis, but I was familiar with Amacher's practice, which was renowned for an aggressive focus on the palpable, somatic effects of sound. She payed particular attention to the vibrational energy that is sound, a quality, I would come to find out, that correlated well with her inspiration

[104] Allan Kozinn,"Maryanne Amacher, 71, Visceral Composer, Dies," *New York Time,* Oct 28, 2009, A30.

from Sufism. Sufism is an Islamic mystical practice that seeks to understand the truth of divine love and knowledge through the direct experience of God.[105] According to Sufi master Hazrat Inayat Khan (1882 - 1927) that direct experience is enacted through vibrations. For Sufis every thing is a vibration and a creator of vibrations, and our perceptions of them depend on their grade of activity and plane of existence. The "essential part of each and every being is composed of fine vibrations," and in each individual there are many small beings.[106] Khan was one of the first to bring Sufism to the West and believed that sound and music were significant experiential modes through which to access divine truth. For Kahn, sound was evidence of existence, as all things were derived from and formed vibrations, and had sound within. Sounds heard were ways in which to know oneself and others, and music was a source of harmony and a medium between God and man.

I do not intend to investigate or speculate about Amacher's relationship with the divine aspects of Sufism. However I can locate Amacher's interest in Sufism in their shared inquiry into the vibrational effects of sound and the overlapping attention to sounds generative behaviors. Amacher's compositional practice was a deep and intensely concentrated investigation into the behavioral qualities of sound as well as how it is perceived. Through her creative experiments she

[105] Martin Ling, *What is Sufism?* (Lahore: Suhail Academy, Chowk Urdu Bazar, 2005). 10.
[106] Hazrat Inayat Khan, *The Mysticism of Sound and Music: The Sufi Teaching of Hazrat Inayat Khan*, Revised edition (Boston : New York: Shambhala, 1996), 125.

proposed that places and bodies had particular sound propensities. She combined this proposition with an experiential knowledge of sound's behaviors, and our perceptions of sound, to create what she described as "immersive sonic architectures" that constructed, according to her, "distinct transformative experiences."[107] Going forward I will narrate a brief history of Amacher and her signature techniques. I pay close attention to her adaptation of resonance, and the manner in which she situated it the with somatically produced sounds of participants in her musicking events. I speculate that Amacher's use of these two gestures signals her own proposal of the world as a lively and generative intermingling of agential elements that could be recognized through perspectives gained in resonance.

From Sound Joined Places to Sound Joined Bodies

Amacher completed undergraduate and graduate work in piano and composition studies at University of Pennsylvania. In addition to acoustic instruments, Amacher composed with analog and digital electronics. She studied composition in Austria and England and worked privately with German electronic music composer Karlheinz Stockhausen. She had a particular interest in the

[107] Maryanne Amacher, *Psychoacoustic* "Phenomena In Musical Composition: Some Features of a Perceptual Geography," in *Arcana III: Musicians on Music*, ed. John Zorn, First Edition edition (New York: Hips Road/Tzadik, 2008), 10.

physics of sound, how it could be correlated with place, and interacted with architecture and bodies.[108]

While a resident at University of Buffalo in 1967, and a fellow at MIT's Center for Advanced Visual Studies (1973 - 76), Amacher produced a series of work she called City-Links, a compendium of telematic performances that stretched from 1967 - 1988.[109] To create a City-Links piece Amacher placed microphones at strategic locations in specific places, and transmitted sound through specially assigned telephone lines to her mixing board. Amacher listened to, combined and modified the relayed sounds, and broadcast them to new places. For instance, City-Links #15 featured sound broadcast on July 3, 1976 from a set of microphones at Boston Harbor's Pier 6 to the mixing console at NYC's WBAI, FM. From there, Amacher transmitted her mix to Paris via Radio France Musique. Durations of the works were flexible, as a City-links piece could last 20 minutes, 28 hours or 5 years, as in City-Links #4, which occurred from November 1973 - May 1976.

Listening to transmitted sounds in her studio allowed Amacher the comfort and focus to listen over long periods of time. This durational perspective

[108] Kozinn, *Amacher Dies*, A30.
[109] *Maryanne Amacher: City-Links* edited by Micah Silver (New York: Ludlow 38 Goethe Institute, 2010.) Exhibition catalogue, accessed July 10, 2019. http://www.ludlow38.org/files/mabooklet.pdf

illuminated and magnified the unique characteristics and changes of a place's sounds. In a 1989 interview with Ear Magazine, Amacher reflected that a "wonderful thing" about living with sound in this way was that "I would come in and it would be different according to different weather and changes."[110] With these pieces Amacher came to believe that the sound traits of a place were as singular a signature as any other component. She identified places as having a fundamental pitch, or resonant tone. For example, she related Boston Harbor to an F# and New York Harbor to an E. With this information she created a series within the series of City-links performances she called *Tone and Place* through which she studied a place's tone. For instance, *Tone and Place, Work 2* (August 10 -12, 1975) focused on the acoustic space surrounding a hotel at Pass Christian, Mississippi, on the Gulf of Mexico. The tropical area featured flora such as Palmenito and Royal palms, a grove with water oaks, and their accompanying ecosystem. In her notes, Amacher observed that the "fundamental or resonant tone in the air of the Gulf site is a frequency between 74 and 76 hz." She went on to state that "the work has been in observing the site acoustically and interpreting some characteristics of the acoustic space. Observing levels of movement in the tone within the breeze, that autoperception is not easily accustomed to receive, manipulate, or act with; detecting subjectively, degrees of movement within the tone which find correspondence to movements within self."[111] Cumulatively these pieces

[110] Leah Durner, "Maryanne Amacher: Architect of Aural Design." *Ear Magazine*, February 1989, 28 – 34.
[111] Silver, *City-Links*

conducted Amacher's attention to the resonant signatures of place and resonance's contextualized productivity.

With her Citi-Links project Amacher not only identified a place's sonic identity and fluctuations, but also uncovered listeners' abilities to perceive and adjust to this phenomenon. With this observation she began to focus on the perception of sound, or psychoacoustics, and explored how psychoacoustic phenomena could be intentionally included in her compositional process. These phenomena included body tones: sounds that the body produces on its own. In a 1977 text Amacher qualified these sounds as "additional tones," and "response tones."[112] Additional tones, according to Amacher, were sounds produced, and heard, in addition to those performed in music. In other words, they were already there. Additional tones were different from what Amacher called response tones, which she described as sounds produced by the ear when interacting with particular acoustic intervals. In the vernacular of neuroscientists and otologists, which Amacher would later adopt, both sounds are otoacoustic emissions, or OAEs: sounds which originate from the cochlea. Spontaneous OAEs happen without external stimuli, while distortion-product otoacoustic emissions (DPOAEs) and sustained-frequency otoacoustic emissions (SFOAEs), are the result of external stimuli such as two simultaneous tones of different frequencies.[113] To

[112] Amacher, *Psychoacoustic Phenomena*, 15.
[113] Jonathan Kirk, "Otoacoustic Emissions as a Compositional Tool," Proceedings Paper, International Computer Music Association, New York, 2010. Accessed July 2019.

work with these characteristics, Amacher developed an approach she called "perceptual geography," a method with which she intentionally composed with OAEs in mind.[114] Perceptual geography is the mapping of interplay between tones of music, a place and a body. With this technique, and the performance of sounds at what Amacher called a "high and exciting" amplitude, she accessed a phenomenon that would, in her words, "cause your ears to act as neurophonic instruments that emit sounds that will seem to be issuing directly from your head ... (my audiences) discover they are producing a tonal dimension of the music which interacts melodically, rhythmically, and spatially with the tones in the room."[115]

At the near end of the City-Links series, Amacher combined what she learned about psychoacoustic phenomena and resonant features of place as compositional elements in her next series of sound installations, which fell under the umbrella of *Music for Sound Joined Rooms* (MSJR). In pieces composed for the MSJR series Amacher focused on the architectural features of buildings, and their contributions to tone production, along with psychoacoustic dimensions. Amacher brought architectural contributions to the forefront via an intentional invocation of structure-borne sound. Structure-borne sound is sound carried by a solid medium. Typically, we focus on air-borne sound events, such as speech or music, which travel through the medium of air. However, many acoustic instances

[114] Amacher, *Psychoacoustic Phenomena*, 15.
[115] Franziska Schroeder, "Bodily Instruments and Instrumental Bodies.," Vol. 25. p. 74.

are structure-borne, sounds that travel through bodies we perceive as solid, such as walls or floors. For instance, sound produced by an airplane's engines is borne by the materials of the body of the plane. This structure-borne sound contributes to the sonic ambience (and fatigue) experienced in the cabin via sound waves that are sensed both aurally and tactilely.[116]

Beams, walls, plates or shells all have the potential to propagate sound vibrations. This propagation supported Amacher's belief that her music came to "life" when it became "PART OF THE ARCHITECTURE IT SOUNDS IN" (caps hers).[117] Her experience taught her that working with structure-borne sound enhanced and magnified the physical aspects of music, it's "timbre, resonance, shapes and phrases."[118] She highlighted this aspect of musicking with carefully chosen chords and precisely placed sounds that enjoined nearby rooms or swept sound from one room to the next by working with a building's resonances. She also specifically situated speakers in relationship to structures to create thick, tangible sound events that she called sound characters: shapes of sound that had tactile presence. Amacher thought of sound characters as durational events of energy that had behaviors and effect, much like any other entity we might describe as a character: "their curves, sensitive drifts and turns can float or coast SOLIDLY, as a FRAGILE, yet VIVID PRESENCE, with real focus and penetrating

[116] Otso Lähdeoja, "Structure-Borne Sound and Aurally Active Spaces," Proceedings Paper, NIME, 2016. Accessed March 2018.
[117] Maryanne Amacher, *Direction of Work About the Big Waves of Structure Born Sound*, 1983, 1.
[118] Amacher, *Dirctions of Work*, 4.

mystery."[119] She embedded her sound characters with visual media and text that included carefully placed quotes, photos or objects that, when heard in context, suggested cinema-like dramas and fantasies. Amacher imagined her sound characters as performing soap-opera like scenarios, such as "What happens to 'WAVE #4' when it's set up to meet 'THE FRIGHT.' 'DEEP AND DEEPEST TONE' disappears. Was it really shot down by 'THE HARDBEAT FORCE?' Will it reappear?"[120] To experience these pieces, Amacher wanted audiences to amble, pause, sit, listen, look and read in their own time, as opposed to the encapsulated timeframe of a typical performance. When combined with a listener's musicking contributions via OAEs, Amacher's installations became potent, swirling, palpable immersive experiences of sound's behavior in and around bodies.

To my ear, this active exchange of bodies and structure amid sound is particularly evident in *Living Sound, Patent Pending (Traveling Musicians Being Prepared)* (LSPP), the first in Amacher's MSJR series. The installation was commissioned by the Walker Arts Center in Minneapolis-St. Paul for their New Music America Festival, June 7-14, 1980. The piece was installed in the nearly empty Victorian home of conductor Dennis Russell Davies and filmmaker, Molly Davies, and presented at midnight, with the house dramatically lit by tall quartz spotlights outside. Inside, Amacher projected expanses of a full spectrum of sound at extreme amplitudes throughout the house, conjuring sound characters that held

[119] Ibid. 5.
[120] Maryanne Amacher, *About the Mini Sound Series,* 2.

space and moved throughout the place. In various rooms she juxtaposed sound characters with images of DNA, as well as excerpts from various text and storyboards. They narrated themes of molecular science and science fiction to portent a new symbiotic organism that could consciously reveal the sounds produced by our own bodies in a musicking event: a biological augmentation of sorts that would expand our musicking experience by enhancing our body's existing otoacoustic emissions. Amacher's embodied, new musicking organism was most explicitly invoked in the Davies' music room. Here, Amacher situated Davies' two grand pianos with 21 petri dishes that contained an organic substance along with two traveling instrument cases with labels that read 'fragile,' 'traveling musicians being prepared (Living Sound, Patent Pending),' and 'the molecular orchestra (Living Sound, Patent Pending).' Throughout the room on music stands were also story boards that referred to "symbiotic aids," "companions for enhancing recognition," "sound feed energy," and "making new scores." With her story boards and theatrical props, embedded in Amacher's sound architecture, Amacher proposed an enhanced musicking body could emerge.[121]

[121] Maryanne Amacher, "Living Sound (Patent Pending),"in SUPREME CONNECTIONS LABORATORY READER, ed. Bill Dietz, Micah Silver and Robert The, (Kingston/Berlin, 2012) 6.

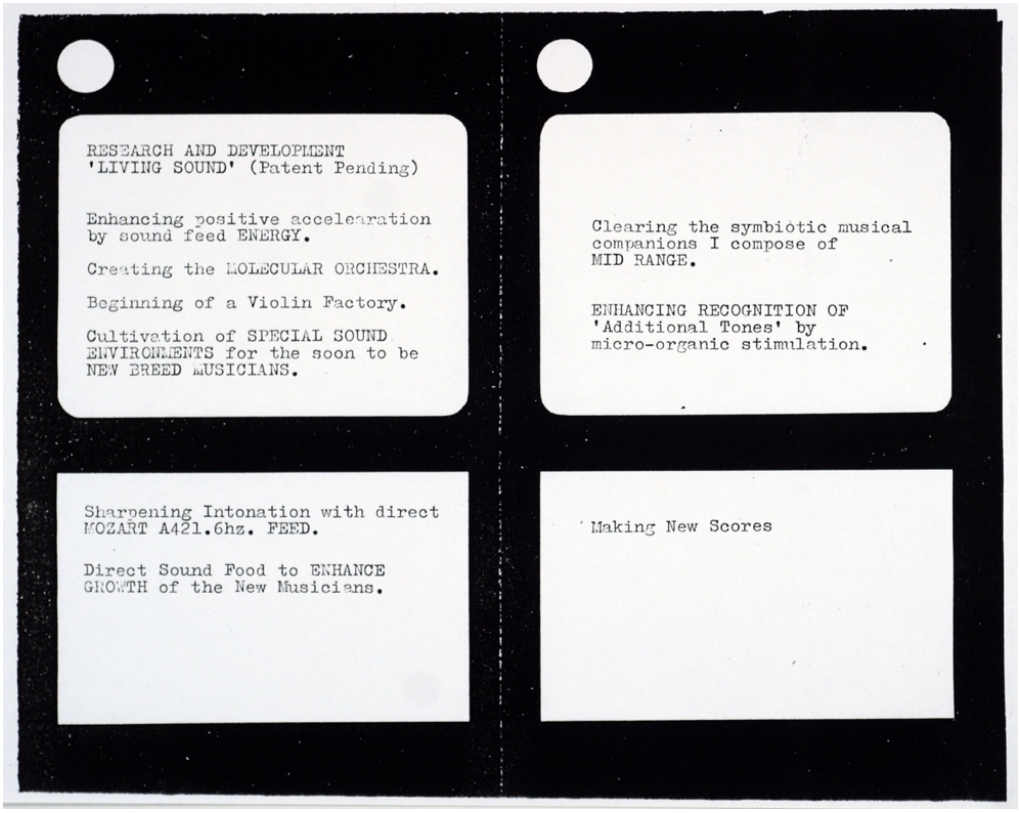

Figure 3.2: Story boards from Amacher's *Living Sound, Patent Pending (Traveling Musicians Being Prepared)* from the SUPREME CONNECTIONS LABORATORY READER

By all accounts *Living Sound, Patent Pending (Traveling Musicians Being Prepared)* was a forcefield that palpitated, circulated, coalesced and flowed to conduct participants towards the hidden possibilities of their own musicking, within a greater structure of musicking materials. Amacher's composition were convergences of generative intensities produced by the combined entanglements of a multiplicity of bodies and their unique qualities and behaviors. Amacher's sound transformations came into being as a result of the dynamic and animated qualities of the material environment in its simultaneous entirety. She listened

deeply to a place to understand the behaviors of its components, and the musicking was a convergence of embedded, situated bodies of various states.

Resonance figured strongly in Amacher's process and was particularly at play in her work with structure-borne sound. Her City-links series taught her that places have a resonant frequency: a prominent, identifiable pitch or tone produced by a body or grouping of bodies. Buildings and rooms also have resonant frequencies, a propensity dependent on the material make-up of its walls, beams, floors and ceilings. When a sound energy matches or resembles these specificities, the structure will magnify those frequencies. Amacher situated speakers and pitches in specific places within the structure, and, when a sound wave was induced into that structure or object its specificities, or resonant modes, determined the sounds that it intensified.[122] In a way, the structures acted similarly to the sympathetic strings of a sitar. These strings aren't actually plucked by a performer but are tuned to resonate with specific tones that enable dramatic sustains and emphasis of particular frequencies. With the resonant vibration of structure, Amacher dramatically sustained and amplified structurally sympathetic frequencies into clouds of sound that hovered and interacted with other forces in the room.

[122] Lähdeoja, *Structure-Borne Sound*

With her audience immersed in vectors of sound and visuals, Amacher also emphasized the audience's physical ability to contribute to a musicking event. She pointedly directed listener's attention to their own capacity to produce OAEs. She embraced and nurtured our capability to create tones in tandem with, and in response to, existing musical sounds, sounds "within our own ears and brain (almost as another instrument joining the orchestra)."[123] She thought of this phenomenon as "EXTREMELY RESONANT INSTRUMENTS".[124] However, this wasn't a mere suggestion of the drama depicted in the Davies' music room. In actuality, the extreme amplitudes Amacher performed her work at, coupled with the pointed choice of sound frequencies, held the very real potential to excite distortion product and sustained otoacoustic emissions. In addition, there were the always-possible spontaneous OAEs of the audience members. With this combined sonic potential, a question arises: how did Amacher anticipate the contribution of spontaneous OAE's to this mass of resonating process? Or, to hypothesize in Amacher's cinema-scope style: what would happen to OAE #7 when it came into contact with the contents of Petri dish #13? Would their signals cancel each other out to make room for sound character Low Rumble? Or would they swell into resonance with each other to produce an amplified entanglement with the chorus sounding beyond the bodies they were born(e) from? But let me unpack these very resonant materialist potentials further.

[123] Amacher, *Living Sound*, 5.
[124] Amacher, *Psychoacoustic Phenomena,* 19.

As I've demonstrated Amacher intentionally invoked the resonant potentials in a thing, place or body in a musicking experience. This practice points towards a subtext embedded in LSPP*,* one that addresses the resonant potentials of Amacher's new musical organisms. The subtext starts with the knowledge that all things have a propensity to vibrate at a particular rate, and that the phenomenon of resonance is an activation of those propensities in a vibrating system. With this understanding the probability emerges that Amacher's new molecular musicians resonated at their own rate. Amacher also seems to speculate that they could be tuned. Immersed in Amacher's sound clouds, the symbiotic organism may have taken on a material propensity and emerged to resonate at specific frequencies. If these molecular musicians produced sound in combination with a listeners' otoacoustic emissions, then a new tone becomes possible. This is what Amacher called a response tone, a sound produced by the ear when it interacts with particular acoustic intervals. This combination could then initiate entirely new musical melodies or modulations.

Another provocative possibility is that Amacher's companions for enhanced recognition acted like the sympathetic strings of our previously mentioned sitar. In resonance with our bodies they intensified and amplified particular frequencies in our musicking experience. And, as these amplified emissions rippled outward from our ears, and intertwined with the structure-borne sound of the architectural elements, we would then hear our material entanglements. Amacher frequently

speculated about this aural meeting ground and queried who, or what, were the agential actors. In reference to a confluence of (a) room tones, (b) the cochlea and (c) the brain, she asks "where in this anatomy, or perceptual geography, does the choice of perceptual mode enter the composition as a 'conscious' musical parameter?"[125] The mere question on Amacher's part is evidence of her recognition of a broad field of external, as well as internal, impactful actors.

With an emphasis on resonance, Amacher's *Living Sound, Patent Pending* emerges as a strong proposal for a distributed and impactful world. Her attention to the specificities of bodies and the multiplicity of ways in which they produce sound suggests that the transformations that occurred in her musicking experiences were a co-constructed process of many actors. In her sound structures, bodies resonated together, and became acquainted with each other's characteristics, a confluence that engendered an instance of material interconnectedness. Going forward I'll expand further on how an immersive, resonating environment diffuses a sense of separate and differentiated self. In addition, I will address how what I call 'listening outward' advances a notion of resonance as shared perspective.

[125] Amacher, *Psychoacoustic Phenomena*, 19.

Things and Spaces Speaking Together

Knowing the world in resonance can be qualified as an old way of being for humans: what Andrew Pickering calls a non-modern ontology, where distinction between subject and object was blurred, and experience was fused with the source of experience.[126] In seemingly tangential support of a resonant non-modern ontology, cultural historian Walter J. Ong proposed that early humans would have heard sounds in their habitats holistically, not in isolation, and a thing's sound was considered a form of connectivity. In his study of orally based, pre-literate cultures, Ong proposed that sound for early humans revealed the interior events of a thing and connected the interior of a thing to the interior of us. According to Ong, hearing a thing for pre-historic humans was understood as "listening to the voice of the spirit of a thing," and, when a thing's sound was heard in one's self, a connection was made to that thing's spirit.[127]

In addition, a structure's acoustics have also been historically engaged to amplify a thing's spirit. In a study of over 150 pre-historic sites, acoustic archeologist Steven J. Waller found that cave wall images of animals who generated loud sounds as they moved, such as bison, bulls or deer, were most often found in highly reverberant spaces. In contrast, images of comparably silent

[126] Andrew Pickering, "Ontological Theatre Gordon Pask, Cybernetics, and the Arts." *Cybernetics & Human Knowing*, Volume 14, Number 4 (2007): 43-57.
[127] Barry Blesser and Linda-Ruth Salter, *Spaces Speak, Are You Listening?: Experiencing Aural Architecture* (Cambridge, Mass.: The MIT Press, 2009), 22.

animals, such as felines, were found in acoustically dampened areas. This practice was at times so refined that “sonic hot spots” were activated, areas where specific frequencies were amplified in resonance.[128] A more contemporary example of activating resonance in Western history includes Bronze Age structures found in Great Britain, thought to have been used for rituals and ceremonies. These chambers were found to carry distinct acoustic resonances around 110 Hz, a frequency well within range of the male voice. In addition, structural elements were specifically configured to produce dominant standing waves along axis that correlated with images. Because of these features, acoustic historians Barry Blesser and Linda-Ruth Salter hypothesized that the chamber’s resonant features were intentionally incurred to enhance male chanting in ritual ceremonies and suggest animated images.[129]

These pre-historic and Bronze Age examples indicate a strong tendency to locate a thing’s being in its sound. They also point to humans’ engagement of materiality’s sonic effects to not only emphasize a thing as an agent in sound, but also accentuate interconnectedness. A sensibility of interconnectedness can be an effect of immersive sound diffusion because sound’s location contributes to our sense of the external world. How a sound is distributed conveys information about here and there, separateness and togetherness. For example, when we listen to sounds in an outdoor park, we tend to hear them as flat and with a distinct

[128] Blesser and Salter, 75.
[129] Ibid. 76.

location. In addition, without reflective surfaces, our sensibility of the external world is that it is disconnected. On the other hand, in a closed space, sound waves emanate from many surfaces, and its origin is difficult to detect. In a closed space with reflective surfaces, a listener is in a full diffusion of sound, an experience that challenges orientation and perceptions of segregation. In the resonant and reverberant spaces of caverns, caves and chambers listeners would have experienced the world as immersive, and sensibilities of interconnectedness would have been enhanced.[130]

Musicians often seek out reverberant places for their amplifying, sustaining and immersive effects. Indeed, there has been a recent rise in repurposing reverberant industrial spaces as music venues, perhaps signaling a desire for material fusion. The TANK Center for Sonic Arts, established in 2015 in Rangely, Colarado, is a 65-gallon water tank, and part of a railroad water treatment facility dated to 1940.[131] Buffalo, NY now features Silo City, a looming set of grain elevators built in 1906 by the American Malting Corporation that are now an arts and entertainment complex.[132] Pauline Olivero's collaborator Stuart Dempster was ahead of this trend when he adapted the Dan Harpole Cistern (formerly known as the Fort Worden Cistern) as musicking place, a 2 million-gallon cistern in Port Townsend, WA.[133] The cistern's staggering 45-second reverb is the result of a

[130] Ibid. 144 – 145.
[131] Tank Sound, https://tanksounds.org/the-tank/
[132] Silo City, http://www.silo.city/american-grain-elevator/
[133] Paula Matthusen, "Deep Listening Deep: On the Pursuit of Acoustically Unique Spaces." In *Anthology of*

concrete cylinder that is 200 ft. in diameter and 14 ft. high, with 89 concrete pillars throughout. Dempster, a trombonist, composer and improviser, was introduced to the structure in 1978, but due to safety issues, didn't get access to it until 1988. That year, Dempster, Oliveros, vocalist/electronic musician Panaiotis and sound engineer Al Swanson convened in the cistern to record *Deep Listening,* an album of performances that focused on the resonant features of the cistern. In liner notes for the release, Oliveros shared that playing in the cistern changed the performers' sensibilities from playing an individual instrument to collectively playing a single medium. Audio engineer Al Swanson's observations of the experience are even more interesting from an audiophile perspective. His attempts to hold on to recording concepts such as imaging and phase integrity were dashed in the presence of reverberant wash:

> "It's funny what this does to your head. As an engineer I tried to analyze all this objectively, but I found I couldn't do it. In a kind of acoustic uncertainty principle, there was no way to simultaneously pin down both the objective audio parameters and the audible reality of the situation."[134]

Essays on Deep Listening, eds. Monique Buzzarte and Tom Bickley, (Ministry of Maat, Inc, 2012) 59.
[134] Nat Evans, "The Cistern Chapel: Resonance from the Pacific Northwest." New Music Box. https://nmbx.newmusicusa.org/cistern-chapel/ (accessed August 2019).

Figure 3.3: Pauline Oliveros in the Dan Harpole Cistern

In reverberant spaces we lose our ability to discern discretion and separation. Our habits of delineation are challenged as distinctions between sender and receiver are blurred, and our assumptions between motion and inertia no longer hold. *Living Sound (Patent Pending)* was an immersive experience for all involved. In its resonation, one can well imagine that images of DNA, and petri dishes filled with substance had a legible vitality much like the animal drawings found in caves from long ago. In the immersive experience of reverberation, we could indeed conceive of a molecular orchestra, playing in concert with our own bodies.

Also, Amacher's convergence of resonance and inner-ear tones offers another binary fusing effect. Immersion in a broad diffusion of sound makes us less aware of the container we are in. Neuroscientists Barry Blesser and Linda Ruth-Salter liken this phenomenon to being in lake, as opposed to a bathtub.[135] Though we are immersed in water in a bathtub *and* a lake, and both are containers of sorts, we're not aware of the lake's bottom and sides. Listening to fully diffused sound is analogous to swimming in a lake of sound, we hear sound without awareness of the container it's happening in. With this in mind, I draw attention to the effects of reverberation inside *us* by way of Amacher's additional and response tones. When we experience internally diffused resonant tones we could effectively lose a sense of our own container. Our sense of ourselves as a solid, separate

[135] Blesser and Salter, *Spaces Speak, Are You Listening?*, 145.

mass, would be challenged. Immersed in sound, both inside and outside of our containers, our perceptions of previously understood boundaries dissolve to instead amplify the continuum of existence.

At the same time, however, I do not believe Amacher's work was an argument for the dissolution of identity. Though I read a narrative of interdependence into Amacher's use of resonance, I also find her work to advocate for the simultaneous presence of form. Through Amacher's process we can see that she understood form and flux as existing simultaneously, and of equal importance. An aspect of LSPP where this was evident was in Amacher's desire for distinct sound shapes: figures of discernable sound substance that were ephemeral and temporary yet held space. To create opportunities for sound shapes, Amacher had to recognize the importance of an individual structure's specifics, which was what made resonances in LSPP possible. I think of this as the grounded perspective of the plaster of a wall, or the clay tile of a floor that responded to frequencies differently, with their own particularities born out of their personal reference point. In addition, these grounded perspectives might also bloom into fuller forms when they met others. A resonating body immersed in LSPP held the potential to converse with a multiplicity of partial perspectives and experience a deeper understanding of each other. In addition, a notable component of this immersive experience was the potential for resonances to cross what would normally be considered concrete forms. In this co-mingling of qualities

lies the significant suggestion by Amacher that the stuff that makes up our environment is an active and constitutive contributor to our experience, as much so as our human selves. If listeners were attentive to their experience of shared perspectives, their own understandings of the world as pluralistic and impactful would expand.

Listening Outward

I'd like to return for a moment to my earlier conjecture regarding Amacher's multiplied OAEs. Previously I speculated about the potential of OAEs to point us away from the inner ear if we followed their sound outward, which is an unusual mussing in regard to listening. We often frame hearing as reception and listening as an internal event. We attribute seeking outward to the eye, and reception inward to the ear. As Veit Erlmann's insights noted, for the past three hundred years listening *in* to resonance has been one of the key contributors to modern concepts of personhood, for when we hear "we are with us."[136] French philosopher Jean Luc Nancy proposed the act of listening as a potential ascendency from subject-hood, yet eventually circled back to self in his proposal of listening's ontological effects. Nancy held that in resonance's "infinite tension and rebound, the amplitude of sonorous deployment and the slightness of its simultaneous redeployment" was the synchronous act of losing *and* finding self.[137] Though I

[136] Erlmann, *Reason and Resonance*, 321.
[137] Jean-Luc Nancy, *Listening*, trans. Charlotte Mandell, 1 edition (New York: Fordham University Press, 2007), 23.

agree with the simultaneity in Nancy's thought, I think it's a worthwhile effort to include an account of what we are becoming *with* in listening. Without this attention I fear listening is at risk of listing into solipsistic self-reflexiveness and holds the potential to reify the binaries I believe resonance can move beyond. When we hear resonance, we are also with others in resonance. Given this I ask: though resonance is inherently inter-being in itself, how can we emphasize the many beings our sounding is comprised of? I propose that a way to include an environment's becoming, and all its inhabitants, in our listening and ontological scope, is to cultivate a sense of listening outward.

Ethnomusicologist Tom Rice catalogued a number of phrases that lend attributes to listening that include "listening for," "listening to," "listening in," and "listening up."[138] One phrase, "listening out for," distinctly shifts our attention beyond ourselves. When we listen *out* for something, our attention is drawn to that thing in its sonic being, and there is an enjoinment with it as we hear our insides meet. This isn't a directive to project our experience on to the outside world, nor is it an attempt to detach from self. Instead it's an invitation to expand our awareness to the porosity of our corporeal boundaries in the sensorial world of sound, and be with sounds, and selves, meeting. Imagine following our ear tones as they emanate away from the opening which is the ear. Now place your attention on the external meetings of bodies in inter-material resonance, which Amacher had

[138] Tom Rice, 'Listening,' In *Keywords in Sound*, ed. David Novak and Matt Sakakeeny (Durham ; London: Duke University Press Books, 2015), 100.

carefully situated. This act holds the potential to lift us out of self-locked autoresonant listening, which Erlmann pointed to as a frequent problem in correlations between resonance and subjective/object identity. Instead, following sounds outward leads us to interdependent-resonant listening, where our specificities and perspectives meet. It points us away from the binary of cause and effect of stimuli, and towards our co-arising. In listening outward to our enjoinment, in resonance, our sensibilities of community and connection expand. We have a greater understanding of collective enaction, reaching beyond ourselves to the community, and communing, of each other.

Listening outward also exposes our own being. When we hear ourselves, in relation to others, our attention is drawn away from the shield of inner, private reverie and towards our exposed, shared selves. Suddenly, in listening outward, our hidden, inaudible secrets are exposed in interaction with the outside world. Oliveros composed a meditation, the *Tuning Meditation* (1971) that beautifully performs collective outward listening and its effects. As was typical with Oliveros' work, the meditation embodies a radical departure from traditional determinations of music making with an invitation to the audience to be the composers *and* performers of the work. It is simple in technique but intense in focus and engenders all participants with an ability to contribute to its outcome. Following is an iteration of the original, called *The World Wide Tuning Meditation* from 2007:[139]

[139] Dana Reason, "Listening From the Inside Out: Pauline Oliveros and Deep Listening." In *Anthology of Essays on Deep Listening*. Eds. Monique Buzzarte and Tom Bickley. (Ministry of Maat, Inc, 2012.) 97.

{Invitation to Practice}

The World Wide Tuning Meditation (2007) by Pauline Oliveros
Begin by taking a deep breath and letting it all the way out with air sound.

Listen with your mind's ear for a tone.

On the next breath using any vowel sound, sing the tone that you have silently perceived on one comfortable breath.

Listen to the whole field of sound the group is making.

Select a voice distant from you and tune as exactly as possible to the tone you are hearing from that voice.

Listen again to the whole field of sound the group is making.
Contribute by singing a new tone that no one else is singing.

Continue by listening then singing a tone of your own or tuning to the tone of another voice alternately.

Commentary:
Always keep the same tone for any single breath. Change to a new tone on another breath.
Listen for distant partners for tuning
Sound your new tone so that it may be heard distantly.
Communicate with as many difference voices as possible.
Sing warmly!

I experienced a performance of the *Tuning Meditation* with about 200 participants, conducted by Oliveros at Brooklyn College (2012). As I sang and

listened outward, and an enlarged sense of connectivity and presence to those around me occurred. However, this didn't happen without work. I had to overcome my initial shyness, triggered in part by a public display of self as I heard myself sounding with others. But as the group became more focused on our correspondence with each other, self-consciousness drifted away. It was replaced by waves of textures and clouds of intensities as connections were made throughout the auditorium. The piece became playful for me, as I mingled with the audience members, and heard my voice resonating with others. The meditation felt satisfying and fulfilling, a result of listen outward to our various communions. Its success, though, was contingent on our ability to grow accustomed to our self-awareness as we publicly heard ourselves with others. In this public hearing there arose an accountability, a sense that we needed each other to be present, and collectively acknowledge our ongoing dynamics in order to thrive. Listening outward we needed to meet each other and our specificities to engender our ebb and flow. Our individual presence was necessary for the group's success, and that occurred by acknowledging and being with each other's perspectives. This, to me, was audible witnessing, testaments to our co-existence and co-generation. It was the experience of a series of acknowledgements of each other that formed out of convergences, witnessed while listening outward to where our sound resounded with another. Listening outward we acknowledged each other's perspectives.

Though this particular meditation was focused on people, Oliveros did broaden her scope to include the non-human world, especially during the time that the *Tuning Meditation* was composed in 1971. During this phase of her career, approximately 1965 - 75, Oliveros was also involved with the Sonic Arts Group (SAG), which was known as the Sonic Arts Union, and at various times counted among its members Robert Ashley, David Behrman, Alvin Lucier, Gordon Mumma and David Tudor.[140] Resonance and feedback systems were a central source of concept and content for the group. They frequently focused on the active dynamics between listeners and the acoustic characteristics of the places they were in, with particular attention to specific resonant qualities. Significant pieces that featured resonance as a compositional component composed by Oliveros at this time included *In Memoriam Nikola Tesla, Cosmic Engineer* (1969), which was inspired by a story that Tesla caused an earthquake in New York City by tuning an oscillator to the resonant frequency of the building he worked in. The score's variables included listening for changes in resonance due to the shape of a space, the weather, surface materials, transmission loss, and air-borne versus structure-borne sound, among others. However, different from the rest of the SAG group, Oliveros turned her attention to the experience of resonances in people, amongst each other and the environment, with meditations such as the *Tuning Mediation*

[140] Adam Tinkle, "The SAG Representative for the West Coast: Pauline Oliveros's Resonance Aesthetics in Context, 1964–1970," *American Music Review* 47, no. 1 (2017) 1 -6.

and *Environmental Dialogue* (1974), a meditation in which participants are invited to listen to, and sing with, sounds and resonances from the environment.

Amacher's LSPP, however, strategically and emphatically focused on the enjoinment of structure and people in resonance. In resonance forms coupled and coalesced regardless of, and because of, their material makeup. And the experience of navigating and negotiating one's way could be heard by listening outward to shared resonances. Listening outward in LSPP allowed participants to know the sounding of other bodies and witness a co-mingling with their own. Listening outward there was an opportunity to perceive and be with material perspective with our own. Going forward I'll detail how Amacher's particular techniques informed my own, and how listening outward allowed an experience of shared perspective.

Resemblances to Living Sound and Resonances of Place

Amacher's research and creative work contributed a great deal to my development of R&R. Inspired in part by Living Sound (Patent Pending), I folded similar principles and methods that involved resonant potentials and psychoacoustic possibilities into the work. My thought was that Manitoga had a sonic signature, much like the place tones that Amacher discovered in her Citylinks series. Specifically, I believed I could identify resonant features in the quarry pool and engage the reflective surfaces of water and resonant features of

granite to stimulate psychoacoustic possibilities. As I listened and sounded in the quarry, I discovered a vociferousness in the granite that was surprising in its generous effects. Resonating with granite in particular proved to be an unexpectedly plush experience across forms.

On the morning of September 12, 2016, I hiked the descent and ascent of the quarry pool repeatedly, listening at every level. The days continued to be warm, and the character of sounds evolved throughout the day. In the morning I heard mostly birdsong, along with the occasional gulp of a fish feeding on the surface of the pond, a sound that stood out in the crisp morning temperatures, as fish stay at cooler depths when its warm. Also, temperature dependent is the neuromuscular structure that enables the cycles of cicadas and their prolonged bursts. As the day progressed, and sun crept into the quarry, it warmed the cicadas into long stretches of sound. Eventually, cicada drones cross faded into a diffusion of cricket rhythms as evening moved in. The progressing day brought other drones too: traffic from nearby Interstate 87 notably picked up during the evening rush, and planes at various heights and sizes, traveling to or from one of the many area airports increased their traffic in the afternoon. These temporal and temperature-based features were important as they told me what would be present at certain times of the day, which in turn informed our musicking time and date.

In the afternoon I embarked on a series of *sound drifts*, as opposed to soundwalks if you will, in which I meandered and paddled around the pond in a kayak, focused on sound. During these first floating derives I had a few goals in mind: a) choose an instrument to feature during the meditation, and b) learn what the sounds of different instruments told me about the quarry. The instruments I considered were the recorder and Irish tin whistle. I experimented with the tin whistle because I was interested in how the metal would interact with granite and water. I assumed its relatively pure sound wave could contend with the flowing reflections of water and angular surfaces of granite, but the weightier body of the recorder proved to have more presence in conversation with the quarry pool's characters. The recorder's sound was full, but also sharp enough to stand out and engage with the characteristics of the surroundings.

The following are field notes from my solo kayak excursion. These notes document variations in sound's behavior that informed later choices in technique adopted for the score.

- Interaction with water and granite surfaces is tangible
- Playing close to the granite wall inspired more directional call and response
- When in the center of the pool, sound from within the quarry felt diffused and non-locative
- Short musical figures with frequent pauses were equally effective as long tones.
- Differences: short bursts invite a notable play between walls of the quarry and water that sometimes emphasized location, whereas long tones performed a blend of instrument, water and granite.
- Short figures also increased bird chatter
- Tin whistle not able to hold presence as well as recorder
- Long tones could interact with the drones of the cicadas

I also invited two people to play the recorders in the quarry pool, while I recorded and listened on shore. They repeated the experiments I performed in solo, so I could hear the effect of techniques featuring multiple players.

Field notes from playing with multiple players:

- Rapid, repeated figures produced palpable acoustic phenomena that resembled difference tones
- Slight detuning in pitch made the character of the recorders more audible and added to diffused disonances in the quarry
- Closely tuned pitches had the effect of blending the instruments into a single body, and pulsations were audible

On September 13, 2016 I spent the day listening with electronics. I listened with headphones through the microphones and pre-amp of a field recorder and heard details my ear otherwise lost in the soundscape. I noticed, and noted, that certain spots resonated more than others, pointing to possible hot spots in the quarry pool. I was also able to distinguish detailed qualities of sounds more distinctly listening with the headphones. In addition to listening with the field recorder, I projected impulses and sine sweeps to listen for their decay. An impulse response is the reaction of a space, place or thing to an external sound impulse. Sounds that have a longer decay after the impulse is sounded are considered resonant features. Another way to determine resonant features is to project a sine sweep. This is a quick projection of a full sweep of the human audible spectrum (20Hz - 20kHz) in a sinusoidal form, and at equal amplitude. Frequencies that peak in amplitude also indicate resonant frequencies. That afternoon I carried out impulse responses and sine sweeps in the quarry pool. I

recorded them with flat-frequency microphones, which are microphones that have an equal sensitivity to frequency, that I placed in strategic places around the quarry to later analyze and compare. I also took field recordings of the quarry at various times of the day. Later, when I reviewed the recordings through spectral analysis, a technology that creates a visual of the distribution of frequency in amplitude and time, I noticed a dense, thick sound environment, as well as certain frequencies that lingered.

I correlated the frequencies that stood out to relative pitches, and they became the basis for the recorder performance of our musicking event. My concept was that if we played resonant pitches they would accentuate and stimulate potential resonant and psychoacoustic phenomena inherent in the quarry. Though the quarry was an outdoor site with a rich soundscape of a living ecosystem, my hypothesis was that the structure of the granite could function similarly to the structure of the house in Amacher's LSPP. The quarry pool was a basin: 2/3rds of it was surrounded by 30 feet of granite face, and its entirety was circled by a dense halo of sky reaching hemlocks. In addition, its floor, so to speak, was water, which had its own capacities for reflective acoustic behaviors. This combination resulted in an average of a 3 - 5 second decay of sound, which signaled a capacity for active and playful acoustic phenomena, and an opportunity to engage resonant features. And as mentioned earlier, the granite displayed a surprising and exciting array of activity that was creatively conductive.

Listening Out Toward Granite

In the quarry pool the granite's scarred, smooth, yet chunky, gray face was prominently displayed for all to see. It's surface, sometimes jagged, sometimes smooth, held the heat of the sun, and diffused the chill of shade. In sounding it was remarkably active, and its interactions with sound challenged assumptions. Due to its hard surface I expected that it would reflect back that which it had received, equally, without changes or contributions. However, listening out towards sounds as they moved in and around the quarry basin, and comparing them with my previously known sensations, I detected subtle transformations as it interplayed with granite. A ping generated by a pure sine tone and its smooth wave form, returned with a slight waver, sometimes to the point of warble. And with closer attention I was able to hear what didn't return. Overtones of a frequency seemed to be absorbed by the granite to ever-so-slightly change a rebounding sound, perhaps with slightly less highs, or maybe a low roll. These behaviors challenged my assumption of granite's matter. Instead of knowing granite as an inert edifice, I began to consider its possibilities of motion and absorption.

Figure 3.4: A close-up of Manitoga's granite

Finnish architect Juhani Pallasmaa, who advocates for inclusion of a full sensorium in architectural design, felt that a consummation with stone could be experienced in sound.[141] I read this as a referral to a resonant embrace, a bloom from which we can experience stone's qualities. This sensorially based notion gained more support when I encountered the research of a group that developed an acoustic technique based on resonance to assess the resonant properties of granite. The granite they worked with displayed a responsiveness in resonant frequencies between 4 - 10 kHz, which they determined using piezoelectric receivers (have you grown your crystals yet? Maybe now is a good time to pause and sing to them). These resonant frequencies in turn allowed them to determine

[141] Juhani Pallasmaa, *The Eyes of the Skin: Architecture and the Senses*, 3 edition (Chichester: Wiley, 2012) 23.

velocity, which ranged from 2500 - 6000 m/s.[142] With this information they were able to calculate that granite had elasticity, and to what degree. In resonance they were able to evaluate granite's porosity, absorption, density and strength. Another group of researchers who experimented with resonance and granite compared the transmission of vibrational resonance to that of seismic pulses in granite. This project demonstrated that granite displayed a characteristic called elastic scattering in grain clusters. This is a conservation of kinetic energy with propagation modified by interaction with other particles and translates to a tendency to reflect particles.[143] However, there were still pockets of dispersed energy, or absorption. Though the thick granite of Manitoga's quarry pool wouldn't absorb much sound, there remained a little wiggle room, a small possibility for energy absorption in granite's porosity. Among the situated knowledges of my listening experience, and the observations of the geologists, faint shades of change in granite's return of sound grew into more than imagined coincidence. Perhaps, when we resonate with granite's reflections, we sense the ever-so-slowly shifting qualities of its character in the minute grains of its enormous body. With R&R I assumed this to be true as I continued to assemble the sonic meditation.

[142] San Emeterio and Luis José, "Resonance-based Acoustic Technique Applied to the Determination of Young's Modulus in Granites." Proceedings Paper, 19th International Congress on Acoustics Madrid, 2 – 7 September 2007. Accessed August 2019.

[143] Dane P. Blair, "A Direct Comparison between Vibrational Resonance and Pulse Transmission Data for Assessment of Seismic Attenuation in Rock," *GEOPHYSICS* 55, no. 1 (January 1990): 51–60.

Situated Frequencies and Speakers

Another strategy I adopted from LSPP was Amacher's technique of situating speakers to produce sound shapes. It is well known that Amacher spent a significant amount of time arranging speakers in relationship to a wall, ceiling, floor, corner, arch or curve to prompt sound characters. She also situated frequencies in such a way as to interact with a listener's own ear tones. Her techniques roused behaviors in sound that were perceived by listeners as generative figures in particular and personal ways that offered the possibility for unique intersections. As I worked in the quarry, I noticed potential for similar invocations of activity. I engaged a few strategies that encouraged these possibilities, including specific frequency and rhythmic choices in the score, as well as speaker placement around the quarry through which I performed a psychoacoustic technique with electronics.

As I drifted around the quarry pool, and played long tones on the recorder, I noticed that the reflections and resonances converged with my own sound. When they combined, I perceived exciting dissonances and textures in my ear, down my neck, and in my chest. My sounds interacted and reflected with the surroundings and returned to resonate with my own ongoing tones on the recorder. When I invited more recorder players to play, the effects were magnified, and I focused on techniques that could accentuate these sound behaviors and perceptions. Specifically, I emphasized sustained figures in the score by inviting players to follow their sound as it met others. In addition, when high pitches were continuously trilled and performed at a raised volume in chorus, there was an exciting perception of new tones, perhaps in the quarry as well as in us. There were too many variables in the setting to confidently state that inner-ear effects were stimulated, but the possibility of their perception was present as sounds, and their very slight differences, converged. I also multiplied these effects with strategically placed speakers around the quarry. In previous sound installations I developed a technique in which I projected two sine-tone frequencies that were very close together in value amid hard materials, which initiated a perception of moving clusters of sound. The technique involved performing what are colloquially known as beating patterns, which are psychoacoustic perceptions of variations in volume and tone that is legible as a beat, caused by the interference of two very close frequencies. The method that I've developed builds on this phenomenon, however I project the different frequencies out of separate speakers, so that the

frequency interference occurs in air. When I've done this in spaces that have reflective surfaces, such as a stone courtyard, there was an added perception of skittering, scampering and sometimes spinning assemblages of sound.

Figure 3.5: One of five speakers suspended from a tree

For R&R I carefully situated five speakers around the circumference of the quarry in such a way as to project sound directly towards the granite surface or water. The sounds we heard, then, were reflections that traveled particular trajectories to meet other reflected sounds. In max/msp, a digital sound software, I

designed an instrument through which I played frequencies that were close to the pitches that were the foundation of the score, the theorized resonant frequencies of the quarry. With the instrument I played 3 second pulses that simultaneously projected two very close frequencies, such as 6989kHz and 6999kHz out of every other speaker. For example, I directed 6989kHz to play out of speakers 1, 3 and 5, and 6999kHz to play out of speakers 2 and 4. This produced sounds that were perceived as having a quivering vibrato that seemed to flit in the trees or hang above the water and cliffs.

Conclusion

Our collective of sounds, our recorders, reflections, sine-tones and the sonic persona of our surroundings, occurred in the basin of the quarry pool to ring, reflect and resurface. Their movement in the immersive quarry environment challenged our assumptions about location and the solidity of bodies. Listening outward, those of us that made sound heard ourselves as we merged with others. And all of our human participants heard themselves within our resonances: the full-bodied blooms of sound that came into being among the community of many bodies. Resonance had a unique ability to communicate material presence, an effect Amacher directly encouraged. It had the potential to simultaneously hold our particulars as it emphasized connectivity in our world. It engendered a sensory attentiveness that could, as Jane Bennett proposed, lead us to the powers of matter and “inspire a greater sense of the extent to which all bodies are kin in the

sense of inextricably enmeshed in a dense network of relations."[144] In resonance we were aware of our inter-being, a state that challenged binaries and separateness. In listening outward to our resonances, we had the opportunity to be with our inter-being. We could grow beyond our autoresonant selves and hear shared perspectives that pointed us toward a richly diverse and interconnected field.

[144] Bennett, *Vibrant Matter,* 13.

Chapter Four

Resemblances Through Resonance

In the early spring of 2008, I met California-based sound and sculpture artist Jacqueline Kiyomi Gordon (b. 1982) at my live/work loft in Oakland, California. She was working on an early iteration of what would become a series of sound art pieces she called Noise Blankets. This version was an amalgam of large knitted patches interspersed with speaker cones. She had woven the wires that connected the speakers into the overall weave making for a strange and beguiling knit of plastic and wool. It hung from our 20-foot ceilings and had wool and plastic tentacles that seemed to demand an embrace. This was my first engagement with Gordon's perception of sound, which she perceives as if it has the same physical presence as that of more tangible sculptural materials. Using craft techniques along with sculptural and architectural approaches she creates sound installations using a surprising array of materials that includes wool, felt, concrete, plastic and more. Her sound installations emerge out of the feedback systems that occur between material, sound and herself. Gordon described her compositional process as one that springs out of moments where she becomes conscious of a localized and specific sound between her and a material, which I correlate with my qualification in the previous chapter as an experience of shared perspective. Gordon states that this awareness pulls her in to a particular relationship to the materials she is working with. She counts on the recursive communication of information between bodies, human and non, to compose her pieces and relies on

this somatic feedback process to conduct a listener's experience towards a multiplicity or perspectives.

Following is a conversation between myself (ST) and Gordon (JKG), conducted on May 3, 2019. In it we discussed her background and creative process, as well as specific pieces that demonstrate her methods, a generative process that emerged out of the confluence of sound, resonance and material.

ST: When we first met you were trouble shooting one of your sound blankets at the loft in Oakland I used to live in. I think it was 2008?

JKG: Yea, I'm always troubleshooting (laughs)

ST: The blanket was a beautiful large-scale form, something like 8 x 15 feet … and we lived with it for a while … we had the space, so we could … but what I remember most was my attraction to the textures. I remember the wires and speakers were intertwined with these rough, heavy fabrics …

JKG: Yea the yarn.

ST: The speakers were interspersed with material as if they were squares in a quilt. I was fascinated by that and wanted to get in it. To wrap myself in sound and fabric.

JKG: Yes! I wanted to create a space that was attractive like that, that you would enter into and feel comfortable entering into, and desire to be inside of it. Up until that time all the installations I'd experienced were a white room with speakers hanging on the wall, pointing down at you in a very aggressive way, with no comfort, no nothing. They were very technical, or techno-fetishy, and I never felt like sitting in there for any length of time. And I knew if I didn't spend time with something, I'm not understanding the work, so I tried something different.

ST: I'd like to rewind a little further and visit your history a little bit. You have a visual design background, right?

JKG: Well I went to the San Francisco Art Institute which is a very experimental art school. I had gone to a fine arts high school before that and got interested in SFAI at a recruitment fair there. The SFAI recruiter invited me to a film screening of alumni and faculty, and it turned out to be (experimental film maker) Craig Baldwin, and that fucking blew my mind. Then, while at SFAI, I took a class on the history of sound, and was introduced to Cage, Stockhausen, Xenakis, and some Japanese composers that were pretty mind-blowing. And (sound artist/instrument designer/performer) Laetitia Sonami was teaching there too, and I took all of her classes.

During that time, I also went to New York, and that's when I got to go to La Monte Yong's Dream House, the sound art gallery Diapason, and I volunteered for free103point9, the sound art radio station. (Laughs) I feel like my whole time there was curated by that list serve Spotborg, do you remember that? It was an email list of noise events, and that's how I got into all that stuff. And a friend worked at the Dreamhouse, so I got to hang out by myself there a lot, which totally changed me. Then I got to to go to the anechoic chamber at Bell labs, and that's when I was like, I have to work with sound, there's no way around it, this is doing more for me than my paintings.

ST: I've taken an opposite path in the sense that sound has always been the primary medium I've worked with but I've recently become attracted to sculpture. I feel like some sculpture has a similar somatic effect to sound, in that I hear it, and feel its movement, with my body.

JKG: Yeah, there's a lot of crossover between minimalist sculpture, dance and sound. I was thinking about this a lot, how minimalism manifested in dance and music and sculpture, and the effects on the body, and how we think about space, and the relationship of our bodies to an object. But the object doesn't have to be a stationary item. To me sound can also be an object that moves us. So how a sculpture might move you through a space can be very similar to a choreography, and similar to how a sound can move you through a space in a choreographic way.

ST: Yes! And I see your sound sculptures as performing in this way. I'm thinking now of "Not Exactly B Flat" (Empty Gallery, Hong Kong 2017) which features large inflatable walls, laid out in a maze, in an even larger room, with a sound composition, that participants navigate their way through. It seems that the plastic inflatables, and their material behaviors, combine with the sound and listener's bodies to perform a conduction of sorts, guiding how and what is heard, as well as when. It seems that you

are specifically situating these materials as participants, together, in the compositions.

Figure 4.1: Jacqueline Kiyomi Gordon's 9 channel inflatable sound installation "Not Exactly B Flat" (Empty Gallery, Hong Kong 2017). Pictured are the inflatable walls.

JKG: Yes, absolutely. To me that involves acoustics. I don't finish any kind of sound element to any of my work until the sculptures are in place. And then I'm moving speakers, and often have to edit the audio in that process … in fact I really don't finish the piece until I'm installing.

ST: I'm very interested in how you choose materials, and how they, in turn, inform your process.

JKG: Hmmm sometimes they work together and sometimes they don't … I feel like I'm still very much working this out … it's very intuitive for me. But let me think of something specific, like "It Only Happens All the Time" (Yerba Buena Center for the Arts, CA 2014). It had geometric fabric along the walls, and in the middle of the space was a sculpture. It was very heavy. On one side was plaster and thick felt, and the other side was plexiglass. At this point I started consulting with an acoustics designer, and he would tell me to spread speakers at least x inches apart to help with y frequencies. This helped me a lot, because up until then I was doing it all by ear. With his help, things really started to click for me, and I realized that the choice of materials was really dependent on the acoustic experience that I wanted this to have. So one side of the sculpture was

hard, curved plexiglass, with a speaker directed into its curve with a really intense focus. And the other side was cozy and intimate because of thick, cotton felt and a loveseat. But to go back to the body, I think I've been trying to understand and communicate how a body exists in relationship to these materials and sound.

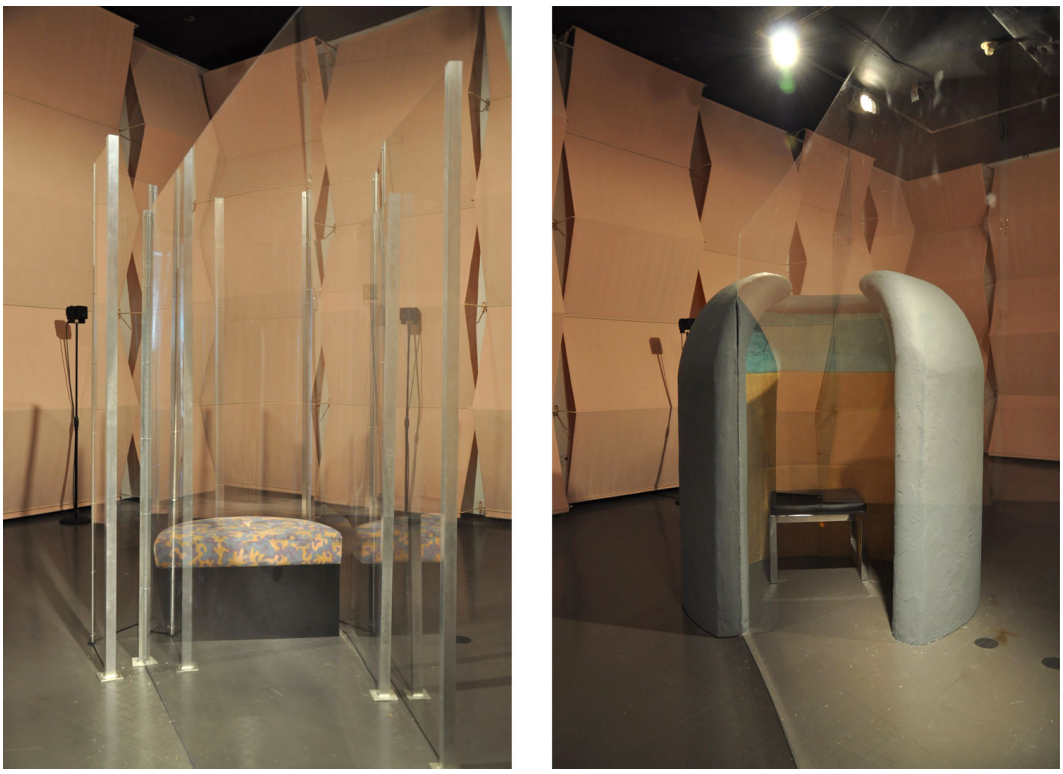

Figure 4.2 Jacqueline Kiyomi Gordon's 15.1 surround sound installation *It Only Happens All the Time* (Yerba Buena Center for the Arts, CA 2014), featuring two of three listening environments.

Figure 4.3: Jacqueline Kiyomi Gordon's *Noise Blankets*, Luckman Center for the Arts, 2017

ST: How do the Noise Blankets fit into this scheme? (Et Al, San Francisco, 2016 and Empty Gallery, Hong Kong, 2017)

JKG: The Noise Blanket series was different; in that they were designed to change how sound exited a speaker. They're modeled after actual noise blankets that you see hanging on a construction site generator, or something, and I'm using them to reference how we have regulated noise and sound. The materials for the first generation were silicon, fiberglass, cotton and nylon, and the second generation was silicon, fake fur, and nylon.

On one hand I was thinking about how bodies change a space and how we hear sound. Like when you test sound in a space before the audience is there, and the bodies of the audience change the whole dynamic when they get there. I was also thinking of my love for blankets. They were a way to deal with my depression when I was a kid. I always want the safety of blanket; I always want to be wrapped in them.

I was working with directional speakers, and I really loved how you could control sound in such an amazing way with them, but they sound like shit. So, I thought about how I could move sound as it exited a speaker, without using directionals. At first I completely covered the speaker, and wanted to EQ the sound, but that didn't really work. So I ended up molding the blankets, playing with the geometry of them, so that the speakers could kind of pop out a little bit, and the sound could curve around them.

ST: Do you play sounds from your pieces while forming or choosing the materials?

JKG: I try to as much as I can. Even if I don't have the sounds finished, I know what frequency range they're in, or if there's a rhythm, or how much noise there might be between the sound and the materials.

ST: Do you feel that the sounds help you to know the materials?

JKG: Oh yeah, completely. Completely. I can speak to this because I had such a misunderstanding of materials in the beginning. My first tests with the directional speakers, I was trying to work in a way where it would have no reflection. I tested them with pieces of rockwool (sound absorption material), and it didn't work, and I thought, ok, what next? So I started making the rockwool bigger, moved it this way, moved it that way. Then I introduced different frequencies … and then oh! This frequency sort of does it … and when I worked with a narrow range of frequencies, that's when I learned a lot.

ST: To me it's about learning how the materials, sound and, for instance as in your case wool, interact. My ability to guess is pretty good, but its their combination that teaches me.

JKG: Yes, absolutely. They happen organically together. What is important is the surface, the mass and geometry. So if you think about how those three things function with each other, that's how you know how they perform, and the performativity of the material.

ST: And how was it working with wool? I love the provocative suggestion you make by situating wool with sound, it's very unusual. And in "Cold War Cycles Warm" (Frieze NY Art Fair, NY 2018*)* you juxtapose a plush, thick wool sweater with molded concrete in the same sound installation.

Figure 4.4: Jacqueline Kiyomi Gordon's *Cold World Cycles Warm*, Frieze NY Art Fair, NY 2018

JKG: That was wool, hair and nylon. And the geometry of those materials were equally as complex as the cement sculptures. Think about wool as hair, and a handful is super chaotic, intersecting and complex. And the concrete can be super complex, the bubbles, and it has a lot of mass. I cast the concrete to have a complex surface area, naturally chaotic, no repeated patterns. Also, the materials symbolically related to the physical weight of sound.

ST: And it seems to me, that this trio of forces, the weight of our bodies, sound and these unusual materials, are constituting our experience.

JKG: Yes. And for me, there is this intimacy that is created. This tactile intimacy. I have this desire to be held and heard at the same time, and with all of these things together, this beautiful relationship can happen. It's almost like a loving thing. And my desire with this intimacy thing is that we become more sensitive. We need to become more empathetic we need to become more attentive, and that's something that these experiences can teach us.

Artisan's and Resonating Perspectives

Jane Bennett argued that all things have vitality if we allow for their inherent vibratory force. However, she acknowledged that not all things clearly demonstrate their active states. To the typical observer, a thing's movement or impact is camouflaged by its apparently solidified or rigid presentation (imagine how you perceive a steel beam, or the layers of shale in a mountain). Bennett points out though, that artisans, such as woodworkers or metallurgists, are among those who know that there exists "variable intensive affects and incipient qualities of matter that external forms can only bring out and facilitate."[145] For instance, a metal sheet isn't a passive resistor of formation but is actively engaged in its own being, which becomes more readily available when one works with it. Being, and its propensities and intensities, is more or less legible depending on its context with other forces around it. Bennett's examples aimed to unsubstantiate notions of inert substance and close the gap of understanding that separates organic from in inorganic material. Yet we struggle to overcome the hurdles of not only established

[145] Jane Bennett, *Vibrant Matter: A Political Ecology of Things*, unknown edition (Durham: Duke University Press Books, 2010), 56.

narratives of stable bodies, but also our experience of them. Bennett pointed to their sluggish rates of motion and pace of change as too slow for us to comprehend. She also hinted that sound can be an external form that alerts us to a thing's intensities and affects. An example is her reference to Nietzsche's contention that food comes alive in the "presence of the materiality of certain newspapers, Wagnerian music and the bodily practice of asceticism."[146]

Going forward I build off of Bennett's sound-focused example to point to resonance as a functioning phenomenon in Gordon's process of material knowing. In resonance Gordon was availed a perspective of material being that also pointed towards its impact and connectivity to us. Resonance conducted interaction between Gordon and her materials. In the presence of sound, Gordon's body and materials moved and resonated together to inform a final work. In addition, with the accompaniment of resonance, her sound installations re-contextualized matter and changed listener's perceptions of materiality's capabilities. In Gordon's installations sound led participants to unsuspected qualities and behaviors of materials such as nylon, cement, and wool through their unlooked-for abilities to resonate. In addition, their various forms, in resonance, worked with bodies of listeners to draw attention to their co-constituting influence. But how can we understand this intimate entanglement and co-construction between Gordon and materiality. How can we make sense of resonance's revelation of material

[146] Bennett, 99.

perspective, affect and interconnectedness? How can we propose that Gordon's work, and mine, are co-productions of impactful materiality, human and non, that emerged because of knowledge conveyed in resonance? One way is to characterize knowing as bodily interaction with environment, with the inclusion of resonating sound as a contributing component of that environment.

Agent-environment Cognition

{Invitation to Practice}

"Take a walk at night. Walk so silently that the bottoms of your feet become ears."
– Pauline Oliveros, *Native,* 1973

Let's imagine that we've accepted Pauline's invitation to listen with our feet. Perhaps we've walked through a pile of leaves. Do we know the leaves as an image? A representation of the real thing? Or do we know them through our interactions, sensing their dry, brittle, crunchy state (if it's Fall), or their slippery, pliable, squeakiness (imagine Spring rain) as we meander among them. If I listen deeply to my experience it tells me that I know leaves through our active engagement, which points to an expanded, participatory, experiential model of knowing their distinct qualities.

In recent years a handful of cognition theories, including embodied, ecological, enactive and distributed modes, have proposed that our knowing is a

matrix of interactive construction. Collectively these theories locate mind as body, not as the brain: “The mind works through the body. To localize it exclusively within the brain is not strictly correct.”[147] They also propose that our knowing extends beyond our physical selves in an entanglement of mutual dependence within the elements of a cognitive ecosystem. The intracranial process, as cognitive archeologist Lambros Malafouris puts it, is but a constituent in the “broader cognitive process that exist as a relationship among brains, bodies and things.”[148]

Agent-environment models of knowing are different from classic cognitivist theories of mind that posit that cognition occurs in the brain somewhere between perception and action. Cognitivism theorizes the brain as a repository and manipulator of representations; mental symbols of the external world conveyed via sense data gathered by the body. It is a computational mode of mind that emerged out of mid-20th century attempts to model human conceptual architecture in parallel with computers, that can be found to at the Macy Conferences.

[A Little Bit of History]

The Macy Conferences were think-tanks composed of interdisciplinary researchers that met annually in NYC, 1941 – 1960. Between 1944 – 1953 the meetings generated what came to be known as first-order cybernetics (FOC), a

[147] Lambros Malafouris, *How Things Shape the Mind* (MIT Press, 2013), 33.
[148] Malafouris, 56.

theory of complex systems and their methods of control and communication. The group was comprised of neurophysiologist Warren McCulloch, mathematician John von Neumann, anthropologist/linguist Gregory Bateson, social anthropologist Margaret Mead, physics/philosopher Heinz von Foerster, Lawrence Frank, psychologist Heinrich Kluver, information theorist Claude Shannon, psychologist Lawrence Kubie, among a few others, with mathematician Norbert Wiener as their director. Together they researched similarities between autonomous living systems and machines, as well as self-organization, or homeostasis. They also focused on emergent properties between systems and the role of feedback.[149]

Many in the group, including Wiener, Shannon, and von Neumann had a background in machine learning which they applied to living structural and behavioral analysis is if it were analogous. This practice produced a problematic culture of thought that rendered a material body, and its effects, insignificant. It reduced the substrate of being to a centrally controlled information-processing system that could function regardless of its embedded and contextualized parts. This effectively denied the particularity of matter's make-up and its contingent significance, and became a schema for biological, social and technical systems. This version of systems thinking reified what is framed as Cartesian dualism, or bifurcation of mind/body, which is also a binary needed to develop machine learning that relies on a structure's central control. Perhaps ironically, as it is the

[149] C. Francis Heylighen and Cliff Joslyn, "Cybernetics and second order cybernetics." *Encyclopedia of Physical Science & Technology* 4 (2001): 155-170.

result of a group of embedded bodies generatively cognating together, this framework evolved into a brain-centric representational and cognitivist model of cognition. However, a few members of the research group questioned material erasure, which lead to second-order cybernetics (SOC).[150]

SOC reintroduced the importance of bodies in a given system, including that of the observer. It emphasized the impact of the media of forms, and their necessary contextualization. Humberto Maturana had established the influence of a body's media on its perception and cognition in his 1959 paper "What the Frog's Eye Tells the Frog's Brain." In his research, Maturana proposed that perception is individually constructed, and dependent on the unique biophysical characteristics of the perceiver. His findings pointed to the role of body's materiality in constructing reality, which eroded components of representational models of cognition. For Maturana, it also pointed to self-organizing systems of a body. He advanced theories of self-organizing bodies in his work with biologist Francisco Varela, and together they adopted the term autopoiesis to describe the self-maintenance of living cells, which they identified as a process of openness from closure. They published their findings in 1971's *Autopoiesis and Cognition*, which illustrated their theory of autopoiesis, and its role in cognition.[151]

---

[150] For a detailed critique on the social, cultural and political effects of cybernetics, which provides the foreground for practices of data extraction and material separation, see N. Katherine Hayles *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*, (University of Chicago Press, 2010).

[151] N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*, 1 edition (Chicago, Ill: University of Chicago Press, 1999), 134.

The concept of autonomous systems and autopoiesis has been controversial, and where a great deal of critique has been focused concerning second-order cybernetics. The critique centers around the missteps and effects of FOC and their transfer to SOC, as well as emphasis on closed systems. FOC diminished the significance of bodies and materiality, and denied the importance of embedded, contextualized dynamics. The same frameworks and belief systems that informed FOC, and lingered in SOC, solidified narratives of autonomous individualism that still influence critical and popular theories of intelligence, artificial and otherwise, and social systems. This is similar to the impact of theories of romantic-era physicists Johann Ritter and Johannes Muller. Ritter and Muller, through their self-conducted experiments on audition, proposed a distinction between the inside and outside in the mechanics of sound and hearing. Through their distinctions in the auditory process what Veit Erlmann calls an "absolute I" evolved that led to narratives of absolute autonomy. For instance, in his discussion of music perception, Ritter proposed that "tones are no longer a matter of the external ear; one does not hear them as one hears any other thing; we ourselves are the string that, set into motion, perceives its own sound from inside; perceived itself."[152] And Mueller, similarly, proposed that sense organs produced sensations that are peculiar to themselves. Much like SOC, both recognized the importance of a media's form, however they emphasized the internal experience to such a degree that it allowed a discount of the continuum of living and a plausibly

[152] Veit Erlmann, *Reason and Resonance: A History of Modern Aurality* (New York: Zone Books, 2014), 199.

empirical subjective element. Autopoiesis has similar potential to fortify concepts of autonomous individualism and binary systems. However, if we reframe a critical interpretation of autopoiesis we can trace Varela's progression to a third wave of cognition.

Critical articulations of autopoiesis frame a thing, or system, as either independent *or* attached: can a system maintain itself independently? Or is it dependent? Put this way, in an either/or framework, autopoiesis does indeed reify bifurcations, and infers a concept of autonomy. However, what if we approach autopoiesis from an understanding of multiplicities and simultaneity: a belief that two truths (or more) can exist at once. Gregory Cajete identified a similar concept to autopoiesis in Native Science that effectively conveys seemingly contrasting notions: "The survival of any self-organizing system depends on its ability to keep itself open to the flow of energy and matter through it."[153] In Native Science's version, an understanding of a self-organized system co-exists with the assumption that all things are themselves because of a combination of exchangeable energy within an interconnected system: self-maintenance is enabled *because of* interconnectedness. Through his study in Buddhism, Varela adopted a similar sensibility of simultaneity that Native Science purports. For Varela consciousness became a process that took place within a heterogenous

[153] Gregory Cajete, *Native Science: Natural Laws of Interdependence*, 1st edition (Santa Fe, N.M: Clear Light Publishers, 2016), 18.

field of dynamic self-organized structures.[154] This led him toward a third wave of cybernetic theory which frames cognition as an extended and embedded agent-environment activity that includes a multiplicity of self-organized systems. This current third wave evolved in part due to Varela's research into one of these modes: enactive cognition.

Enacting Enactivism

An enactive approach to cognition features an active, embedded and embodied form of knowing that arises in context with environment, and it is through this theory of mind that I trace Gordon's material knowing in resonance. Enactive Cognition was introduced by Franciso Varela, Evan Thompson and Eleanor Rosch, and was a synthesis of concepts from biology, cognitive science, phenomenology, Buddhist philosophy and psychology. Enactive cognition theory recognizes that a body, and its parts, has autonomy in its maintenance and meaning making, and at the same time, that same body's self-organization is realized through enactment with its surroundings: "the human mind is embodied in our entire organism and embedded in the world, and hence is not reducible to structures inside the head."[155] In the case of cognition, how and what we know is relationally brought forth by a being's enjoinment with the environment through sensorimotor patterns of perception and action. Knowing is situational, and

[154] Hayles, *How We Became Posthuman*, 157.
[155] Evan Thompson, *Mind in Life* (Harvard University Press, 2010), 409.

relationally derived through the affordances in a given moment and environment, not a series of representations to assess. Cognition is a sensorimotor engagement in which sense, perception, action and conception are inextricably linked and mutually informative.

Embodied, ecological, and distributed theories of cognition also situate emergent perception-environmental engagement as prominent, with various emphasis on the roles of bodies and environmental contingencies. Collectively I refer to these relational forms of cognition as agent-environment cognition, though I highlight enactive cognition because it strongly figures the active body as site of knowing. However, Gordon's process of knowing *with* materials in resonance draws attention to Malafouris' emphasis on our co-construction with things. As he reminds us "the hand is not simply an instrument for manipulating an externally given objective world by carrying out the orders issued to it by the brain."[156] Or rather, the hand is but one way through which the world touches us, and together bodies come into being. Gordon's body, in resonance with sound, nylon, felt or plexiglass, moved according to affordances and together they formed new bodies that continued to affect each other. In resonance Gordon experienced perspectives that pointed to material ability and being, and they co-constituted each other.

[156] Malafouris, *How Things Shape the Mind*, 60.

Resonant Spines

To further support my inclusion of resonance in my analysis, I begin with propositions from theorists Wayne Bowman and Eric Clarke, who theorize through agent-environment cognition, and work my way towards speculations from electronic music composer Daphne Oram. Bowman attributed cognition in musicking environments to a relationship between music and bodies that "involves a kind of sympathetic reaction, or resonance, of experienced similarity between beat's imagined movement and those of the body."[157] He continued to posit that, if it is the case that "rhythmic/temporal features in musical perception/cognition arise from activation of substantial parts of the same neural circuitry involved in bodily movement and action, the bodily dimension so often evident in acts of musical listening (and music making) is not just a function of fortuitous resemblance, representation, or association."[158] Bowman's statement puts forward perception and cognition of music as the result of the sensorimotor engagement of listeners and performers embedded in a musicking environment of rhythmic and resonant features.

Like Bowman, Eric Clarke focused on the rhythmic aspects of music, and proposed that subjective experience of music emerges out of an embedded

[157] Wayne Bowman, "Cognition and the Body: Perspectives from Music Education," in *Knowing Bodies, Moving Minds*, ed. Liora Bresler, vol. 3 (Dordrecht: Springer Netherlands, 2004), 44.
[158] Bowman, *Cognition*, 44.

sensorimotor perception of motion in music. Clarke arrived at this concept through ecological theory's suggestion that every perception bears the trace of an action component.[159] He proposed that the cognitive action component of musicking was the effect of mirror neurons, and that the cognitive impact of musicking, and its contributions to subjectivity, are physical derivatives. Mirror neurons fire while we are active *and* while we observe action, and both have the effect of lived experience. They can also be activated by sounds that accompany motor action, which suggests that listening induces perception-action coupling. This occurrence has also been called a motor resonance, an amplification of activity from body to body.[160] But what of the slower cycles of frequency, and their emergent effects on the body? Can they have the same effect as beats? Or are they, as Bowman first proposed, imagined? To sound out this question, I turn to resonating spines.

Body Organs	Frequency Range (Hz)
hips	2 to 8
arms/shoulders	2 to 8
chest	2 to 12
abdomen	2 to 14
lower back	6 to 12
head	8 to 27

Figure 4.5: Resonant frequency ranges of bodies when standing. From "Fundamentals of Mechanical Vibrations," by M. Hussey, 1983.

[159] Eric Clarke, *Ways of Listening: An Ecological Approach to the Perception of Musical Meaning* (Oxford University Press, 2005), 62.
[160] Giacomo Rizzolatti and Laila Craighero, "The Mirror Neuron System," *Annual Review of Neuroscience* 27, no. 1 (July 21, 2004): 169–92.

Studies on the vibrational effects on the human spine have concluded that sustained exposure to subsonic frequencies, such as those felt from the constant thrum of a factory floor, resonate the spine at a rate that can cause detectable damage. Researchers came to this conclusion through their determination that points of the body resonate at a range of low frequencies (featured in Fig. 1), such as 2 - 12 Hz in the chest, or 8 - 27 Hz in the head.[161] If this is true, then we can propose that a body with this capability has the potential to sympathetically resonate at these frequencies and/or their harmonics. In addition, another study points to our biophysical capabilities of sympathetic resonance, one led by bioelectronics researcher Steven Birch of Monash University. Birch researched the therapeutic effect of dolphins on humans through shared resonances. In his study, he and his team observed that mechanical vibration rates on the biological systems of rabbits produced evidence of neuro-chemical release in the spine. This led to a hypothesis that a similar vibratory mechanical resonance phenomenon could increase neurochemical (endorphin) release in humans. The findings of the study, coupled with previous research on vibrational effects on the spine, allowed Birch to propose that biosonar signals could activate piezoelectric collagen molecules within the body and generate a whole-body electric field pulsation. This could lead to a whole-body entrainment of the receptive nervous system, in resonance. States Birch, “such a mechanism could result in

[161] D. G. Wilder et al., “Vibration and the Human Spine,” *Spine* 7, no. 3 (June 1982): 243–54.

entrainment of the brain to produce *specific low frequency components in conjunction with the previous mechanism* (italics mine)."[162]

With these findings in mind, Bowman's hypothesized resonances between bodies emerge as an even greater possibility. The studies on spines and their resonant features also conduct my attention to electronic music composer Daphne Oram's often discounted speculations about the human body, and mind, in resonance:

> "We wondered whether the human body consisted of thousands upon thousands of tuned circuits, each energized into resonance. We might now perhaps wonder further- wonder whether the human body is one vast 'tuned circuit' embodying within it all these millions of smaller tuned circuits. (Maybe the spinal column is the coiled wire; maybe the brain ... (the frontal lobes?) ... and the solar plexus (with the sexual organs?), are the plates of the capacitor?)" [163]

Now, if we situate Oram's a*muse*ments, as she called them, with Birch's theory of resonating spines, Oram's imaginative musings become robust proposals. They evolve into experientially informed, body-bound cross-modal mappings that led Oram to propose that the we could know ourselves, and our environment, through resonance. With these situated knowledges, the hum of industrial damage to the body rings true, as does the salve of song. And, if we continue to gather our partial knowledges, and situate agent-environment based

---

[162] S. Birch, "Dolphin Sonar Pulse Intervals and Human Resonance Characteristics," in *Proceedings of the 2nd International Conference on Bioelectromagnetism (Cat. No.98TH8269)* (2nd International Conference on Bioelectromagnetism, Melbourne, Vic., Australia: IEEE, 1998), 141–42.

[163] Daphne Oram, *Daphne Oram: An Individual Note of Music, Sound and Electronics*, ed. Matt Price (London: Anomie Academic, 2016), 121.

theories of mind in conversation with the known effects of vibration on the body, they emerge into an understanding of how resonance amplifies the hidden vibratory nature of other forms around us, and shares a perspective of their qualities.

Gordon knew the materials she worked with in resonance. Focused on the combined effects of sound and material, she learned about cement's unlooked-for complexity and rockwool's surprising capacities for reflection. In resonance with sound she carefully shaped nylon blankets to divulge theretofore unheard qualities. Suddenly, what was considered soft and absorbent had a measure of density and reflection. Her exhibit Noise Blankets also offered participants new conceptions of sound and material from places never considered before. While engaged with Noise Blankets, listener's concentration unexpectedly tuned to sound's resonances from the corner of a blanket, or the middle of a cape. In "It only Happens All the Time" Gordon intentionally positioned contrasting textural structures back to back to mimic a yin-yang symbol, the contrast of which exposed their variant qualities. With one side constructed of thick felt and plaster and the other of plexiglass, listening participants were placed in a fluctuating negotiation between strikingly different materials amid sound's resonances. Similarly, Gordon's "Cold War Cycles Warm" provocatively asked listeners to reconsider their concepts and relationship to wool. The surprising possibility of resonating wool textures conducted listener's attention to its complexity and the unexpected

features they afforded. In relationship with these unlikely sounding materials, I can't help but dwell on wool's resemblances to my own hair or skin, or other unlooked for places where sound may also resonate. In my contemplation new ideas and sensations of what a material is form. In resonance with Gordon's work, I imagine new metaphors and evolved stories, that reframe relationships with materials through a fresh perspective of their qualities and behaviors.

Towards Resemblance

To address a concept of resemblance, and its relationship to resonance, I again reflect back to Bennett's text and her very brief foray into anthropomorphism, our tendency to attribute human characteristics to the non-human. In this short section of *Vibrant Matter* she hinted that anthropomorphism shouldn't be discounted in our relationship building with the nonhuman world. Though we may have anxieties about this behavior as we address anthropocentrism and colonialist tendencies, she proposed that, paradoxically, a little anthropomorphism may enable our gaze to lift beyond ourselves to more fully encompass the complex world we're in. With a dash of anthropomorphism Bennett posited that "we at first may see only a world in our own image, but what appears next is a swarm of talented and vibrant materialities (including the seeing self).[164]

[164] Bennett, *Vibrant Matter*, 99.

Bennett continues to propose that anthropomorphism can lead us to perceive shared resemblances, which I frame as reminiscent suggestions that resonate. Resonances created by anthropomorphism reveal similarities that cross categorical taxonomies and effectively communicate parallels between material forms. From this experience of resemblances, we gain a foothold from which to recognize nonhuman agency. In addition, this pivot point of resemblance can catalyze metaphor, allegorical resonances that support an embrace of a broadened sense of material community, contemplate interdependency, and new concepts of what is.

Native Science precedes and corroborates Bennett's short mussing about anthropomorphism with a cultural practice that specifically relies on metaphor and anthropomorphism. It engages anthropomorphism to develop metaphor as a way in which to understand self as part of a broad and heterogeneous community, as well as a manner in which to think through how environmental elements work together. In Native Science, mind has two qualities: metaphoric and rational mind. The metaphoric mind precedes the rational and language-based aspect of mind, which is known as metaphoric mind's little brother. Because metaphoric mind is not beholden to rational limits it is expansive and inclusive, and reveals itself through stories, dance, music and images. Metaphoric mind works to counter cultural alienation and is particularly supportive of schema that positions humans as part of a complex environment. An example is a Pueblo emergence story of a

Spider Woman who mixed earth, saliva and creative wisdom to harden the earth and animate it with vibration and sound. Out of this she formed plants, animals, minerals and people, all of which resonate with the same energy as the world from which they emerged.[165] This story established resonance as a manner through which Native American culture understands human resemblances with the natural world. Resonance creates a cross-modal mapping with the nonhuman world that enables a cultural understanding of material interrelatedness. In addition, because metaphor is not restricted to rational thinking, the similarities hinted at in the story become the province of both body and mind. In metaphoric mind resonances can bloom beyond the restrictions of the physical world.

Agent-environment cognition also frames intersubjectivity, or how we know each other, and metaphor as an embedded and dynamic process that emerges out of environmental interaction. Neuroscientist Hanne De Jaegher and psychiatrist/philosopher Thomas Fuchs combined their efforts to propose that how we understand others is an evolving process of participatory sense making and mutual incorporation. They address their theories from two axis: from an agentive systems perspective of interaction and coordination of two embodied agents, and the phenomenologically based concept of mutual incorporation, a process in which two bodies extend and form a common intercorporality.[166] De Jaegher and Fuchs

[165] Cajete, *Native Science*, 32–33.
[166] Thomas Fuchs and Hanne De Jaegher, "Enactive Intersubjectivity: Participatory Sense-Making and Mutual Incorporation," *Phenomenology and the Cognitive Sciences* 8, no. 4 (December 2009): 465–86.

argue that intersubjectivity is not an isolated task but an embodied interaction that generates common meaning. How we know another is through an intercoporal sensing of resemblance. However, how do we manage instances where common meaning has to be extrapolated, such as with a thing? The embodied perspective reveled that in cases such as these we access an extensive system of metaphoric mapping. For proponents of embodied mind, metaphor is central to the human cognitive landscape. As Malafouris summarized, in so doing "the ontological nature of metaphor as a fundamentally cognitive phenomenon" is prioritized. The term metaphor is then used to refer to cross-domain mapping in the conceptual system as constituting understanding and meaning construction.[167]

To my ear, De Jaegher and Fuchs' explanation of intersubjectivity rings remarkably similar to the experience of sonically resonating bodies: the simultaneous (or as they frame it, intercorporal) amplification of shared qualities by embedded bodies. From this similarity I can't help but speculate that, in a cross-modal intercorporal experience of resonance, we have access to resemblances and perspectives through metaphor. And, as both Native Science and embedded cognition propose, metaphoric mind provides the opportunity to broaden our capacity for knowing. With a bit of metaphor there is an occasion to move past the conditioned horizon around materially that purports a separate self, and expand into a broad sense of an active, diverse and entangled environmental community.

[167] Malafouris, *How Things Shape the Mind*, 62.

With the juxtaposition of resonance *and* resemblance I point to the perception of reminiscent suggestion in my critical inquiry. I do this to avoid privileging the quantifiable and physical, and challenge the nature/cultural divide to recognize all of the connected impacts of living. In tandem with a felt sense of resonance, the metaphor of resonance recognizes that the immaterial aspects of our worlding is also constitutively impactful. Resonances, resemblances and their contingent metaphors, have a weight that is inseparable from each other. With the acknowledgment of resemblance in the phenomenon of resonance a full-bodied knowing arises. Knowing in resonance *and* resemblance addresses the nature/cultural binary and accounts for social and cultural facets. In this way, resonance becomes the provenance of matter *and* mind. The quickening we point to as substantive and vital can be brought on from the palpable and the impalpable. From this understanding is the opportunity to experience perspective from a multiplicity of resonant qualities in simultaneity and recognize their combined existential significance.

Knowing Manitoga in Resonance and Resemblance

{Invitation to Practice}

Breathe In, Breathe Out

Listen to your environment, in its entirety

Breathe In, Breathe Out

Focus on a sound as it meets your ears

Breathe In, Breathe Out

Focus on a sound a sound as it meets your mouth

Breathe In, Breathe Out

Focus on a sound a sound as it meets your shoulders

Breathe In, Breathe Out

Focus on a sound a sound as it meets your abdomen

Breathe In, Breathe Out

Focus on a sound a sound as it meets your thighs

Breathe In, Breathe Out

Focus on a sound a sound as it meets your knees

Breathe In, Breathe Out

Focus on a sound a sound as it meets your feet

Suzanne Thorpe, 2017

On September 10, 2016 I began a series of soundwalks, walking excursions focused on listening, within Manitoga's miles of trails. I find soundwalks to be a highly somatic manner of listening, and in Manitoga's woodland I found it easy to open up to this form. Away from the intensity of urban environments I shed the habit of closure that protected my body from environmental sounds. As I ambled around the woodland, I was aware of my listening body in its entirety as it encountered sounds around me. A somatically sensed pace was understood through the implicit feedback system of the ongoing milieu of the setting I walked within. With my attention tuned to sound, I perceived the ongoing relationships in the transforming environment and attended to resonances and their resemblances as they came about with my own body's dynamic arising.

It was a blisteringly hot day, which encouraged a rich insect drone that was thick and dreamy, though sometimes annoying as bugs buzzed around my head. As I walked, I heard sonic differences as the terrain changed under my feet. There was a soft swish of grass as I moved through a clearing, and the scrape of stone against stone as I scaled open rock face. There was also the crunch of fallen leaves as I worked my way across a plateau, or a thud as I occasionally landed on a fallen tree.

As I wove in and out of open fields and densely wooded areas, I became aware of contrast in ecotone which was accentuated at their edges. An ecotone in

landscape ecology is a sound quality that is the result of the confluence of various types of vegetation. The vegetation of the woodland consisted of a complex system of branches, foliage, water, soil, air and tree trunks that produced reverberation, absorption and scattering. An ecosystem's complex makeup definitively affects temporal and spectral characteristics of sonic ambience. Listening while walking, one heard the significant differences when ecotones met, such as at the perimeter of a clearing on the edge of the forest. At this juncture was an "edge effect," the place where environments meet and become more complex.[168]

[168] Almo Farina, *Soundscape Ecology: Principles, Patterns, Methods and Applications* (Dordrecht: Springer, 2014), 20.

Figure 4.6: Listening in Manitoga's forest

As I moved around the forest, around tree trunks and leaves, sound moved with unexpected fullness and liveliness in such complex density. This was due in part to what is known as a ground effect. A ground effect is a scatter of echoes from objects that intercepts signals. It has been linked to tree trunks and their branches and is known to increase with higher frequencies.[169] The leaves of trees also played a role in sound propagation. Some of sound's energy is converted into heat in a tree's leaves, which, given the number of leaves a tree has, can account

[169] Farina, 32.

for some sound attenuation. However, low-end, unexpectedly, moves. Leaves act as a low-pass filter, allowing lower frequencies through while blocking higher frequencies. Leaves are composed of mid-vein, minor vein and interspaced homogeneous regions. The mid-vein's diameter has been shown to function like the 'q' on a noise filter, which is the component which determines the spread of filter capabilities. The larger the diameter, the more low-end frequencies pass through.[170]

But let me return to walking and the ground beneath my feet. Soil, too, carries acoustic information. It doesn't transduce airborne sound well but does communicate seismic information clearly. Sounds are generated by stridulating animals, the shrill noise made by rubbing body parts together (think of crickets and ants) or sounds of animals digging (moles and chipmunks). Sounds in soil alert some to the presence of others, and lets predators know when their prey is within reach. Asian elephants use foot stomps and rumbles to communicate through the soil. They, too, are listening as if their feet were ears. Sound is also generated by vegetation: such as the acoustics vibrations of wind-swept grasses. For example, in the Namib desert lumps of grasses emit low-amplitude vibrations when moved by a light wind. The local golden mole listens for these rumblings to guide it towards a bounty of invertebrates that live around grass clusters.[171]

[170] Ibid. 36.
[171] Ibid. 122.

Wandering, listening, somatically hearing, I acquainted myself with the sonorous qualities of Manitoga. As I walked the paths metaphoric ghosts of low-end resonated through my feet up my spine to hint at the machinery that once tore up the site. Or perhaps that was the soil commuting the subsonics of a nearby train as it rolled by. A crack of a broken twig echoed its tale as it reflected off nearby tree trunks, as did the labor of woodpecker as it penetrated one of the very same sound propagating trees. At one point I rounded a curve on a path to find two twenty-foot granite boulders sitting side by side, left over from the quarrying days on Manitoga. They had a gap between them big enough for a person (or two) to fit between, which provided an intimate experience of their immense presence. I initially stood quietly in the opening and listened to their impact on my body. I noticed the way they directed bird calls around our bodies. Surrounded by their mass, it seemed as if birds hovered close to my shoulder between my ear and the rock. I then sang strong ahhs and oohs, to hear how they interacted with my calls. Through the feedback of our interactions, in resonance, I began to understand granites behaviors, and how we co-conducted an experience in resonance.

Figure 4.7: Granite boulders at Manitoga

Wind made its presence known in a multiplicity of ways. It carried sound away and brought it to us. It masked other sounds but contributed with its own timbre. If the wind was strong, sounds we played disappeared and then reappeared in unexpected places. And there were times when wind's white noise absorbed all of our sound, so we could only hear its strident tones. Its presence composed subtler experiences, too. Surface waves generated by blowing wind have a frequency range of 1 to 50 kHz.[172] As we played in kayaks, on the water of the pond, this behavior held the potential to add a quiet, cycling hiss. An unexpected quality was its ability to softly rotate the kayaks we performed in. As we slowly circled, our tones swept the length of the quarry pool. At times, as we spun, our tones crossed, and in our slow-motion movement exquisite dissonances

[172] Ibid. 157.

appeared through interactions with each other, wind, water and granite. Wind also brought sounds from afar to play with us. During our performance, wind blew the sound of an announcer from a nearby football game into our quarry, inserting an unexpected sonic mirage into our mix.

My ambulatory and somatic listening continued in the quarry pool. Drifting in a kayak I listened and played with my recorder to hear water's sonorous teachings. Sound travels fast in aquatic mediums, as its velocity propagates sound faster than its airy counterpart. Depth, temperature and salinity matter, as does the structural makeup of its basin. Embedded in the granite quarry, the pool dispersed sound when its surface was choppy, as little waves seemed to reach up and grab a sound out of the air. In contrast sounds slid and bounced across water's surface when it was smooth. Water also had sonic contributions of its own: the pond lapped rhythmically against our kayaks with its own waves and sent out a slap and sizzle like sound when it met the pebbly shore. The stream that fed the quarry pool sounded a loud rush when it was running with fresh rain, clearly indicating its gathered forces. I also heard the resonances of water meeting rocks and logs as it moved down the mountain. In stretches without rain a thin, highly pitched rivulet meandered among rocks and dropped over boulders to remind us of its source further up.

As I played in the quarry pool a significant amount of chatter from the local bird population emerged. When we played our recorders, they became very animated. The group found us focused on the birds, and we mimicked their short, melodic motifs and rhythms. Their increased activity as we played suggested a playful call and response, but also led me to wonder if we interrupted their communication channel, so to speak. Acoustic ecologist Bernie Krause hypothesized that in the wild, each species evolved to occupy a specific frequency and temporal range on the sound spectrum. This phenomenon, which Krause called the Acoustic Niche Hypothesis, avoids sound masking and ensures that communication among a species remains audible.[173] This has been found to be particularly true in birds, bats, frogs and insects. However, the spatial and temporal character of a site can modify the responses and integration of specific or acoustic cues. I consciously chose instruments with low amplitude, so as to respect the local sound threshold. Also, the birds occupied a stratum of at least 50 feet above us. Though there was some crossover, the topographic differences and our location in the basin of the quarry limited our propagation and prevented direct interference.[174]

The recorders were also close in frequency to the insect population in the area. Specifically, the suggestion of difference tones, characterized as a third tone which emerges from the combination of two similar frequencies, directed my

[173] Ibid. 54.
[174] Ibid. 56.

attention to existing frequencies produced by cicadas. Playing long tones against their drone, I asked myself if there could be enough similarity in our sounds to trigger a perception of third tones. Most likely not, given the physics required for this phenomenon, and the diffused nature of the cicada's sounds, but the suggestion was enough to encourage a metaphor that promised the possibility of interplay. Playing with cicadas I had greater access to a perspective of their texture, rhythm and circulation. In contrast to my singular and localized sound, theirs was a constant propagation that seemed to emanate from every surface of the quarry. Their integrated sonic complexity created a sound floor of sorts, one from which all other sounds seemingly played against.

Conclusion

Manitoga's sonic milieu was a complex soundscape that I learned as an embedded listening body. This process was very similar to Gordon's, whose work developed out of a recursive relationship with materials that emerged from her full-bodied listening. Though the material construct of Manitoga was much more diverse, there were many opportunities to know resonant perspectives. Listening within the woodland I heard sounds as they scattered within the forest in my skin. As I walked the forest floor, I felt the deep resonances of soil through my feet. And as I floated within the quarry pool a lively play of acoustics played within my ears and around my head. In addition, as I played sounds with the recorder, the instrument's waveform engaged with other sounds to reveal environmental

qualities and characteristics. The exchanges of geophonic elements, such as wind or rain, with biophonic beings, such as birds or insects, and anthrophonic sounds, such as airplanes or trains, along with my own, created a complex of generative meeting grounds and flowing engagements in simultaneity. Within the sonic milieu I experienced perspectives of elements, resonances that led to a deeper knowing of the vast variety of beings and things I was immersed in. In resonance I also knew resemblances, brief little correspondences that brought about new imaginaries of what we could be. In resonance Gordon and I both developed meeting grounds in which to experience a diverse world of agential beings and their perspectives.

Conclusion: Resonant Resemblances in a Material Milieu

My theory of resonant materialism was inspired by the slap of beaver's tail in water, a sound that buoyantly ricocheted across the water's surface. The sound announced the drenched, fat tail of my river companion and proceeded to morph as it encountered other elements in the river basin. As I listened, I heard wet fur, small moving waves of water and the slow diligence of stone in an entangled evolution with each other. Listening into the resonances and resemblances I experienced a concentrated moment of a dense and lively milieu, and a hint of the river basin's characters and their impact. This experience fluently conveyed the vibrancy of materiality and its processing. In listening, there was an instance where aspects of matter were accessible and knowable, which in turn revealed its presence and significance. In addition, as I heard this instance in and around me, it was impossible to separate it from me. I was part of the milieu and a participant in the animated, dynamic and relationally ongoing entanglement of this complex becoming.

It is tempting to assign the knowing of this experience to an ontology of sound and stop there. After all, sound is a continuum of vibrant energy that is relationally engendered, which Christoph Cox and Solome Voegelin, for instance, call a sonic materialism.[175] However, there are two deficits to this proposition: it

[175] Cox, *Sonic Flux*, 31; Voegelin, *Sonic Possible Worlds*, 123.

emphasizes the physical properties of sound to the point of singular significance and, in so doing, risks stripping sound of qualities and contingencies such as social and cultural attributes. Sonic materialism, thus far, has been featured with a propensity to extract sound's physical properties and feature them as if they are sound's entirety. Alternatively, resonance offers a more inclusive orientation.

Resonance is an active expression that particularly exaggerates the qualities of a body. However, where sound emphasizes movement, resonance stresses an amplified expression of current conditions that allow it to be. In this way it is notably tied to its contextualized contingencies. Yet, it doesn't disclose its entirety. A resonating body conveys an aspect of itself that is only possible because of a body's entirety. It is a perspective. This quality acknowledges *a* way of knowing, not *the* way of knowing, which in turn recognizes the complexity of a thing.

Sympathetic resonance is a consortium, a quorum of situated knowledges that together bloom into an articulation. It is also a cross-modal phenomenon, an experience that can occur across forms to convey a shared perspective. A vibrating string can activate the resonant frequencies of a box as well as another string, which blooms into an amplified expression of shared and entangled attributes. In this way resonance is a possible interbeing that denies separation and discrete binaries.

In addition, in the experience of shared perspective is an opportunity for metaphor. In the perception of the reminiscent suggestions and resemblances of resonance is an occasion to expand beyond the physical associations of vitality. Metaphorically we can build associations that enable recognition of similarities across categorical divides of nature and culture. Social and cultural aspects emerge as connected, impactful, and constructive. And, resonating in metaphoric mind, we can access a continuum of existence that challenges perceived restraints of physical boundaries. From the springboard of cross-modal resonances we can metaphorically leap to expanded understandings of existential possibility.

The creative space of musicking effectively performs resonant materialism, which was cogently demonstrated by electronic music composers Maryanne Amacher, Jacquline Kiyomi Gordon and Pauline Oliveros. The work of each of these artists stressed material impact and interconnectedness as well as contextualized contingencies through resonance. Amacher provocatively situated a myriad of bodies in her work *Living Sound, Patent Pending*. She speculatively performed resonant meetings of walls, archways, and floors with people, their molecular constituents and participant's own sonic bleed. In the fully immersive environment of LSPP was the possibility to oscillate between self-dissolution and

formation. And as forms converged and diverged, brief moments of shared resonant perspectives became available.

Gordon also relied on material resonance to co-construct her work. In sound installations such as *Noise Blankets* and *Cold War Cycles Warm,* Gordon engaged resonance as a guidepost that informed new imaginaries of what a material could be. She followed moments of conscious experience of what she called a localized and specific sound that occurred between her and material to pull her into inter-material relationships that led to fresh formations. For Gordon, the felt sense of shared resonances made material possibility available to create new metaphors of material understanding.

Through Oliveros' work and methods I learned that resonance was a way to perceive environmental presence through somatic listening. As I performed the inaudible frequency rise in Oliveros' *Primordial Lift* I listened with my full body to know resonant effects. In *Primordial Lift*, I listened outward to sound's meetings to understand the relational evolution and impacts of resonant change. Listening outward to our combined resonances, I deeply knew that our ongoing constitution was the result of dynamic contextualized interactions.

My work with Oliveros also contributed to the structure of *Resonance & Resemblance*, the critical inquiry I developed to query the effects of resonance on

our environmental situating. With *Resonance & Resemblance* I thought through resonances capability to reveal a sensibility of material impact and interconnectedness. To create *Resonance & Resemblance's* framework I learned the resonant features of Manitoga, the woodland and quarry pool where the event took place and featured them as the basis of the meditation. I also created a musicking structure that adopted listening and improvisation as strategies to promote ecocentrism. These musicking strategies challenge normative hierarchical structures by emphasizing complex behaviors, animating collective action and social identity formations. They have been leveraged historically to challenge hegemonic power dynamics around race and gender by musicians and composers Oliveros and George Lewis. In *Resonance & Resemblance* I mapped these strategies to support a non-hierarchical position of the human that emphasized generative, complex behaviors and interconnectedness in our musicking event, a methodology I termed eco-logical musicking.

However, *Resonance & Resemblance* was not a solo experience. Besides the birds, bugs, trees and moss; airplanes, trains, and rain, there were over 130 people participating in the event. The group was a mix of ages and came with a variety of experience regarding listening and sound art. They, too, slowly soundwalked within the echoing forest. They perched themselves in an around the quarry's edge, on the resonating granite and seismically sounding soil to listen to our interactions.

Figure C.1: Listening bodies in *Resonance & Resemblance*

After the performance I distributed a qualitative survey to inquire about the group's experience (See Appendix A). The following questions were answered anonymously:

1) Did a focus on listening change how you experience the environment? If so, how?
2) Did the music affect how you experienced the environment? If so, how?
3) Did your experience of your body in the environment change during the event? If so, how?

Out of the 130 participants approximately 20% responded. In response to question 1, 100% moderately or strongly agreed that a focus on listening changed how they experienced the environment. In response to question 2, 100% also stated that they moderately or strongly agreed that sound produced by music affected how they experienced the environment. In response to question 3, 66% said that they felt a moderate to strong change in how they experienced their body in the musicking environment. A few of the more informative descriptive responses to the questions include the following:

Did a focus on listening change how you experience the environment?

“In a little time, sounds all around, near and far, became inter-connected and seemed to respond to each other.”

“I was more aware of not only the external environment but my internal and their interplay”

Did the music affect how you experienced the environment?

“The music provided a center around which the environment became a constellation of sounds.”

“I felt that it (the music) added to the experience, becoming part of the external & internal, playing off one another”

Did your experience of your body in the environment change during the event?

“There was a sense of the body losing itself in the music and sound then coming back to itself with more focus and attention than before”

“I could feel the sensation of sounds within me and my breath became a collaborator”

“I heard my own body vibrate”

Taken in totality, the consortium of embedded experiences featured in this dissertation render an intertextual reading of resonance. This reading points to resonance as a phenomenon that enables a relational, situated and embodied knowledge production of an environment and its inhabitants. Through the situated knowledges of this text, resonance has emerged as a cross-modal experience that serves as a catalyst of metaphor in intermaterial negotiations. In this text a variety of perspectives have converged to reveal resonance as a praxis to know feminist concerns of plurality, difference and material effect without separation, or in other words, resonant materialism.

Appendix A: Resonance & Resemblance Questionnaire

Resonance & Resemblance Questionnaire

1. **Did a focus on listening change how you experience the environment?**
   Mark only one oval.

	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	Absolutely

2. **If so, how?**

3. **Did the music effect how you experienced the environment?**
   Mark only one oval.

	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	Absolutely

4. **If so, how?**

5. **Did your experience of your body in the environment change during the event?**
Mark only one oval.

	1	2	3	4	5	
Not at all	◯	◯	◯	◯	◯	Absolutely

6. **If so, how?**

7. **Feel free to share more about your experience here:**

Bibliography

Amacher, Maryanne. “Psychoacoustic Phenomena In Musical Composition: Some Features of a Perceptual Geography.” In *Arcana III: Musicians on Music*. Ed. John Zorn. First Edition edition. New York: Hips Road/Tzadik, 2008.

Bailey, Derek. *Improvisation: Its Nature And Practice In Music*. Reprint edition. New York: Da Capo Lifelong Books, 1993.

Bennett, Jane. *Vibrant Matter: A Political Ecology of Things*. Durham: Duke University Press, 2010.

Birch, Steven. “Dolphin Sonar Pulse Intervals and Human Resonance Characters.” 2nd International Conference on Bioelectromagnetism. 1998. Melbourne.

Blair, Dane P. “A Direct Comparison between Vibrational Resonance and Pulse Transmission Data for Assessment of Seismic Attenuation in Rock.” *GEOPHYSICS* 55, no. 1 (January 1990): 51–60.

Blesser, Barry, and Linda-Ruth Salter. *Spaces Speak, Are You Listening?: Experiencing Aural Architecture*. Cambridge, Mass.: The MIT Press, 2009.

Born, G. After Relational Aesthetics: Improvised Musics, the Social, and (re)Theorising the Aesthetic. *Improvisation and Social Aesthetics*. Ed. G. Born, E. Lewis and W. Straw, 33 – 58. Durham, NC: Duke University Press. 2017.

Borgo, David. *Sync or Swarm: Improvising Music in a Complex Age*. New York, N.Y; London: Bloomsbury Academic, 2006.

Bowman, Wayne. “Cognition and the Body: Perspectives from Music Education.” In *Knowing Bodies, Moving Minds*, edited by Liora Bresler, 3: 29–50. Dordrecht: Springer Netherlands, 2004.

Bowers, John. Improvising Machines: Ethnographically Informed Design for Improvised Electro-acoustic Music. Master’s thesis, University of East Anglia, Norwich, UK. 2003. ISSN 1403-0721.

Braidotti, Rosi. *The Posthuman*. Malden, MA: Polity Press, 2013.

Braxton, Anthony. “Introduction to *Catalog of Works*” in *Audio Culture: Readings.* In *Audio Culture: Readings in Modern Music*, ed. Christoph Cox and Daniel Warner, 272 - 284. A&C Black, 2004. 202.

Coole, Diana H., Frost, Samantha. *New Materialisms: Ontology, Agency, and Politics*. Durham: Duke Univ. Press, 2010.

Candy, Linda, and Ernest Edmonds. “Practice-Based Research in the Creative Arts: Foundations and Futures from the Front Line.” *Leonardo* 51, no. 1 (February 2018): 63–69.

Cajete, Gregory. *Native Science: Natural Laws of Interdependence*. 1st edition. Santa Fe, N.M: Clear Light Publishers, 2016.

Clarke, Eric. *Ways of Listening: An Ecological Approach to the Perception of Musical Meaning*. Reprint edition. Oxford: Oxford University Press, 2011.

Cox, Christoph. *Sonic Flux: Sound, Art, and Metaphysics*. First edition. Chicago ; London: University of Chicago Press, 2018.

Curry, Patrick. *Ecological Ethics: An Introduction*. Malden, MA: Polity Press, 2006.

Durner, Leah. “Maryanne Amacher: Architect of Aural Design.” *Ear Magazine*, February 1989.

Emeterio, San, and José Luis. “Resonance-based Acoustic Technique Applied to the Determination of Young’s Modulus in Granites.” Proceedings Paper, 19th International Congress on Acoustics Madrid, 2 – 7 September 2007. Accessed August 2019.

Erlmann, Veit. *Reason and Resonance: A History of Modern Aurality*. New York: Zone Books, 2014.

Farina, Almo. *Soundscape Ecology: Principles, Patterns, Methods and Applications*. Dordrecht: Springer, 2014.

Fox, Warwick. “Deep Ecology: A New Philosophy of our Time?” In *Environmental Ethics: An Anthology,* ed. Andrew Light and Holmes Rolston, 252–261. Malden, MA: Blackwell Publishing, 2003.

Gray, Carole, “Examples of Practice Led Research,” 1996, 28.

Grumet, Robert S. *Manhattan to Minisink: American Indian Place Names of Greater New York and Vicinity*. Norman: University of Oklahoma Press, 2013.

Gunden, Heidi Von. *The Music of Pauline Oliveros*. First edition. Metuchen, N.J:

Scarecrow Press. 1983.

Handelman, Elliot “Maryanne Ammacher.” *Mondo2000 Magazine*, 1991. [Unpublished but accessible at https://raraspeaks.tumblr.com/post/316070088]

Haraway, Donna J., and Bruce and Elizabeth Dunlevie Professor Cary Wolfe. *Manifestly Haraway*. 1 edition. Minneapolis: Univ Of Minnesota Press, 2016.

---------. “Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective.” *Feminist Studies* 14, no. 3 (1988): 575.

Harding, Sandra. “From the Woman Question in Science to the Science Question in Feminism.” In *Knowledge: Critical Concepts*, edited by Nico Stehr and Reiner Grundmann, 327--342. Routledge, 2005.

Hayles, N. Katherine. How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics. University of Chicago Press, 2010.

Hendy, David. *Noise: A Human History of Sound and Listening*. Reprint edition. Ecco, 2013.

Khan, Hazrat Inayat. *The Mysticism of Sound and Music: The Sufi Teaching of Hazrat Inayat Khan*. Revised edition. Boston New York: Shambhala, 1996.

Kirk, Jonathan. “Otoacoustic Emissions as a Compositional Tool,” Proceedings Paper, International Computer Music Association, New York, 2010. Accessed July 2019.

Kluver, Billy, Julie Martin, and Barbara Rose, eds. *Pavilion: Experiments in Art and Technology*. Dutton, 1972.

Kopnina, Helen, Haydn Washington, Bron Taylor, and John J. Piccolo. “Anthropocentrism: More than Just a Misunderstood Problem.” *Journal of Agricultural and Environmental Ethics* 31, no. 1 (February 2018): 109–27

Kozinn, Allan. "Maryanne Amacher, 71, Visceral Composer, Dies." *New York Times (1923-Current File),* Oct 28, 2009.

Lähdeoja, Otso. “Structure-Borne Sound and Aurally Active Spaces,” Proceedings Paper, NIME, 2016. Accessed March 2018.

Landgraf, By Edgar. *Improvisation as Art: Conceptual Challenges, Historical*

Perspectives (New Directions in German Studies) (Hardback) - Common. Continuum Publishing Corporation, 2011.

Leopold, Aldo. “The Land Ethic.” In *Environmental Ethics: An Anthology,* ed. Andrew Light and Holmes Rolston, 38–46. Malden, MA: Blackwell Publishing, 2012.

Lewis, George E. *A Power Stronger Than Itself: The AACM and American Experimental Music*. Reprint edition. University of Chicago Press, 2008.

Lewis, George. "Improvised Music after 1950: Afrological and Eurological Perspectives." In *Audio Culture: Readings in Modern Music*, ed. Christoph Cox and Daniel Warner, 272 - 284. A&C Black, 2004.

Lings, Martin. *What is Sufism?*. Lahore: Suhail Academy, Chowk Urdu Bazar, Lahore, Pakistan. 2005.

Malafouris, Lambros. *How Things Shape the Mind: A Theory of Material Engagement*. Cambridge, MA: The MIT Press, 2016.

Matthusen, Paula. “Deep Listening Deep: On the Pursuit of *Acoustically* Unique Spaces.” In *Anthology of Essays on Deep Listening*. Eds. Monique Buzzarte and Tom Bickley. Ministry of Maat, Inc, 2012.

Matyja, Jakub Ryszard, and Andrea Schiavio. "Enactive music cognition: background and research themes." *Constructivist foundations* 8, no. 3 (2013): 351-357.

McHarg, Ian. “A Temple to Ecological Design.” In *Russel Wright: In His Own Words*, 104 – 105, New York: Universe Publishing, 2001.

Müller, M. E. *Relational Knowledge Discovery*. 1 edition. Cambridge University Press, 2012.

Nancy, Jean-Luc. *Listening*. Translated by Charlotte Mandell. 1 edition. New York: Fordham University Press, 2007.

Næss, Arne. “The Deep Ecological Movement: Some Philosophical Aspects.” In *Environmental Ethics: An Anthology,* ed. Andrew Light and Rolston Holmes, 262–274. Malden, MA: Blackwell Publishing, 2012.

Oram, Daphne, and Sarah Angliss. *Daphne Oram: An Individual Note of Music, Sound and Electronics*. Edited by Matt Price. London: Anomie Academic, 2016.

Oliveros, Pauline. *Deep Listening: A Composer's Sound Practice*. New York, NY: iUniverse, Inc., 2005.

----------. *Software for People*. 2 edition. Kingston, NY: CreateSpace Independent Publishing Platform, 2015.

Pickering, Andrew. "Ontological Theatre Gordon Pask, Cybernetics, and the Arts." Cybernetics & Human Knowing, Volume 14, Number 4, 2007.

Provost, Eddie. "The Discourse of a Dysfunctional Drummer: Collaborative Dissonances, Improvisation, and Cultural Theory." In *The Other Side of Nowhere: Jazz, Improvisation, and Communities in Dialogue*. Ed. by Daniel Fischlin and Ajay Heble. Middletown, 353 – 366. Conn: Wesleyan University Press, 2004.

Rice, Timothy. "Listening." In *Keywords in Sound*. Eds. Novak, David, and Matt Sakakeeny. Duke University Press Books, 2015.

--------. "Toward a Mediation of Field Methods and Field Experience Ethnomusicology," In *Shadows in the Field: New Perspectives for Fieldwork in Ethnomusicology*, eds. Gregory Barz and Timothy J. Cooley, 42-61. New York: Oxford University Press, 2008.

Reason, Dana. "Listening From the Inside Out: Pauline Oliveros and Deep Listening." In *Anthology of Essays on Deep Listening*. Eds. Monique Buzzarte and Tom Bickley. Ministry of Maat, Inc, 2012.

Rolston, Holmes. "Value in Nature and the Nature of Value." In *Environmental Ethics: An Anthology,* ed. Andrew Light and Holmes Rolston, 143–153. Malden, MA: Blackwell Publishing, 2012.

Silver, Micah, ed., *Maryanne Amacher: City-Links* New York: Ludlow 38 Goethe Institute, 2010. Published following the exhibition *Maryanne Amacher: City-Links* at Ludlow 38 Goethe Institute, New York, NY.

Small, Christopher. *Musicking: The Meanings of Performing and Listening*. Middletown, CT: Wesleyan University Press, 1998.

Smith, Hazel, and Roger Dean, eds. *Practice-Led Research, Research-Led Practice in the Creative Arts*. 1 edition. Edinburgh: Edinburgh University Press, 2009.

The, Robert, Bill Dietz and Micah Silver, ed. *SUPREME CONNECTIONS LABORATORY READER*. Kingston/Berlin. 2012.

Tinkle, Adam. “The SAG Representative for the West Coast: Pauline Oliveros’s Resonance Aesthetics in Context, 1964–1970,” *American Music Review* 47, no. 1 (2017): 1- 6.

Thompson, Evan. *Mind in Life: Biology, Phenomenology, and the Sciences of Mind*. Cambridge, MA: Belknap, 2010.

Varela, Francisco J., Evan Thompson, Eleanor Rosch, and Jon Kabat-Zinn. *The Embodied Mind: Cognitive Science and Human Experience*. 2 edition. The MIT Press, 2017.

Voegelin, Salomé. *Sonic Possible Worlds*. New York: Bloomsbury Academic, 2014.

Westerkamp, Hildegard “Soundwalking.” Sound Heritage, Volume III, no. 4 (1974)

Wright, Russel. “Philosophy of the House.” In *Russel Wright: In His Own Words,* 66 – 69. New York: Universe Publishing, 2001

--------. “Designing with Nature” in *Russel Wright: In His Own Words*, 121 – 129. New York: Universe Publishing, 2001.

Wrightson, Kendall. “An Introduction to Acoustic Ecology.” *Soundscape—The Journal of Acoustic Ecology* 1, no. 1, (Spring 2000): 9–13.