CHARTING THE EPHEMERAL
Sound Installation as Embodied, Synsonic Mapping

by

José A. Rivera

B.S. Architecture and Environmental Design
Kent State University, 2011

Submitted to the Department of Architecture
in partial fulfillment of the requirements for the degree of

Master of Science in Art, Culture and Technology

at the

Massachusetts Institute of Technology

June 2017

© José A. Rivera. All rights reserved.

The author hereby grants MIT permission to reproduce and distribute publicly paper and electronic copies of this thesis document in whole or in part in any medium now known or hereafter created.

Signature of Author: ________________________________________________________________

Department of Architecture
May 12, 2017

Certified by: ________________________________________________________________

Renée Green
Professor, Program in Art, Culture, and Technology
Thesis Supervisor

Accepted by: ________________________________________________________________

Shelia Kennedy
Professor of Architecture
Chair of the Committee on Graduate Students
COMMITTEE

**Thesis Advisor**
Renée Green
Professor, Program in Art, Culture, and Technology

**Thesis Reader**
Gediminas Urbonas
Associate Professor, Program in Art, Culture, and Technology
Director, Program in Art, Culture, and Technology

**Thesis Reader**
Ernst Karel
Lecturer in Anthropology
Harvard University
abstract // This thesis examines the ways in which sound installations aesthetically provide spatial encounters with a location, emphasizing ephemerality, multiplicity, and relationality. Informed by experimental sound practices, spatial studies, and theories in critical cartography, current conceptions of the sound map are challenged. Though the origins of the sound map date back to the 1970s soundscape movement, modern sound maps are online repositories of location recordings that are geo-referenced and navigated with the use of a digitized, aerial map. A critical analysis of sound maps argues for a more embodied, sociocultural, and dynamic spatio-sonic experience. Through lenses of sound, space, and cartography, this thesis interrogates such topics as: attentive listening, the notion of “sound art”, location recording and phonography, acoustic ecology, the soundscape, resonance, the relationship between inscription, vibration, and transmission, site-specificity, map making and map use, bioregionalism, meteorology and the history of weather maps, radar, spaces of representation, proxemics, architecture, and embodiment. Through these different interrogations, the sound installation is understood as an aural cartographic process that suggests a multi-layered way of knowing about a location through sound. The organized, spatio-sonic encounter is an embodied synsonic mapping in practice — a constant, fleeting, and relational process that engages the shifting circumstances of the world.
table of contents

[8] Acknowledgments

[10] Introduction

chapters

[22] 1 What I Mean When I Say Map or What Is a Map?

[27] 2 Plural Fields and Listening Self

[46] 3 Space, Proxemics, and The Striving for Querencia

[57] 4 Charting the Ephemeral

[79] 5 Sounds From Nowhere : rethinking the sound map

[97] Conclusion

[99] Illustrations

[101] Bibliography
Acknowledgements //

THANK YOU

To my fellow explorers in ACT. To Second Years: Alan Kwan, Gedney Barclay, and Ursula August, and to the First Years: Angel Chen, Jessika Khazrik, Joshuah Jest, Neil Sanzgiri, Raafat Majzoub, Rainar Aasrand, Ron Martin, Yusef Audeh. — You all have motivated me to think outside of my comfort zone. I’ve always been amazed with your ideas, energy, and sensitivity. It’s been a humbling experience to learn alongside all of you.

To Arindam Dutta, Kelly O’Neill, George Lewis, Tod Machover, Kelly Nipper, and everyone that I’ve had to pleasure of studying with.

To the Council for the Arts at MIT for the support and funding.

To the MIT Radio Society for being such a help.

To facilities manager Jim Harrington for giving me permission to hang speakers from weird places, and being excited about it.

To Ernst Karel, Jan St. Werner, and Sam Auinger. I’m extremely lucky to have taught alongside you. I am still learning from you.

To the ACT tech and media associates: Seth Avecilla, Madeleine Gallager, and John Steiner. Without your encouragement and energy, I’d be swimming in cable spaghetti.

To the Non-Event/music community: Susan Bolle, Kevin Micka, Andy Graydon, and the rest for the love and acceptance.

To Team ACT Communications: Marion Cunningham, Amanda Moore, Jessica Anderson, and Sally Hughes for holding down the fort.

To my Committee: Renée Green, Ernst Karel, and Gediminas Urbonas. or always reminding me that there is more to do, more to learn, and more to explore…and more to edit.

To my family: Oz, Edna, Gretchen, Michelle, and Eddie. Your thoughts, patience, understanding, and unending love.
This thesis interrogates the ways in which sound installations aesthetically provide spatial encounters with a particular location, emphasizing ephemerality, multiplicity, and relationality. Informed by experimental sound practices, spatial studies, and critical cartography, the sound installation is an aural cartographic process that suggests a multi-layered way of knowing through sound. While music traditionally organizes sound and experience in time, sound installations generally organize sound with and in space. When the spatial sounds of an installation are perceived through attentive listening, embodied knowledge about a particular location is attained. With regard to sound installations, each sound, space, place, and method offers different information and thus, presents different possibilities for experience. Depending on the specific sounds being used, where, and how they are diffused, sound installations engage the manifold ways that sounds operate on phenomenological, sociocultural, physical, and aesthetic levels.

Sound in this thesis will primarily be addressed from a spatial angle. Though amorphous, the experience of space through sound has, at its center, an engagement with what sounds do, are, and can be. For example, as young children play, they shout to one another in a forest. Ethnomusicologists study recordings captured from other lands that offer insight into how cultures celebrate, mourn, pray, and communicate. Speech pathologists record spoken syllables that can monitor irregularities in language. Musicians use tones, rhythm, and often the narrative voice to provoke emotional experiences in audiences. A radio broadcaster

---

transmits her voice over miles to communicate the correct method for baking a casserole. A sound designer provides a felt, and at times, barely noticeable sonic environment to accompany the visual component of a film or a video game. Acoustic engineers use the mathematical properties of sound that can be measured, analyzed, and utilized to design for a successful concert hall. Urban designers hire consultants to address and minimize noise in the city. Individuals who are blind, tap their canes and respond to the sonic reflections. The National Weather Service provides automated radio streams that include information on the variability of weather conditions. Artists use sound as raw material and a perceptual medium to emphasize its physical or cultural characteristics. In each case, because sounds originate, exist, operate, and respond in a space, it’s as if the surrounding spatial environment is the other half of a constantly fluctuating auditory dialogue.

Ephemerality is defined as something short-lived or lasting for a very short time, which suggests a lack of permanence. In contrast to notions of permanence with impermanence, or being with nonbeing, here, I am emphasizing ephemerality as a varying, conditional quality of experience. In other words, although the constitutive nature of something in question may be altered over time, the experience of something may be regarded as persistent in some way. The sun’s electromagnetic energy persists twenty-four hours a day, though the amount of light that permits us to see in fluctuates with the rotation of Earth. Our position and the time of day make the optical variability entirely relative. Similarly, the flow of a river is constantly changing,

---

but we often regard a river as the same river we perceiving. Weather, too, though occurring continuously, is different from day to day, and hour by hour. It is rarely ever isolated from time, geographical location, or the inhabitants of a particular place. Humans have always attempted to gain a better understanding of seasonal shifts to more accurately plan for harvests and protection from the elements. Like sound, the perception of weather and the means by which information is captured and understood, is inherently embodied and spatial, but not at all fixed.

To chart means to make a map of specific location. Also thought of as a graph, diagram or a table, a chart not only presents stored information in a graphic manner, but can also record or trace a process. With the early weather observations that attempted to depict wind direction and seasonal patterns, or the common top-100 lists that reflect a song’s popularity, the procedural aspect of charting suggests an active recording of things that are in continually changing. Charting, in the case of this thesis, is less about the representation of what is observed, and more about experiencing a process. Experience here is not defined only in terms of perceiving a specific object or thing, but as embodying a dynamic, spatial situation that exists in relation to the perceiver(s), providing some information about the particular place. By charting the ephemeral, I argue for enacting an active and attentive process of perceiving and recording various processes of becoming.

---

3 The Greek philosopher, Heraclitus, (500 BC) is quoted with the aphorism, “No man ever steps in the same river twice, for it’s not the same river and he’s not the same man.” Panta rhei, is roughly translated as “everything flows”.

4 Recording, has obvious ties to both the processes of the capturing and subsequent playback of audio.

5 Embodiment relations thus are inherent throughout certain trajectories of phenomenology, especially by Heidegger and Merleau-Ponty.
The impetus to draw a link with the experiences of sound, space, and maps emerges in this thesis for several reasons. My approach stems from an analysis of my trajectory as a musician, a student of architecture and environmental design, a map enthusiast, an architectural designer, and most recently as an artist probing the co-constitution of sound and space. This examination is as much about retrospection as it is about imagination and conjectural analysis that invokes the future possibilities. The sonic experience relates. A sonic event has a history. As we hear, feel, and experience this history and are affected by its many qualities, whether spatial, tonal, textural, semantic, or phenomenological. The encounter provokes our memories and provides an opportunity to conjure up a future — our own, subjective, and constantly evolving future. In other words, what is particularly interesting to me about the sonic experience is the ability for sound to generate the moment from memories of what was, and through an expectancy of can be, allows us to inhabit what is.

During my studies as an undergraduate architecture student, my awareness of the experience of space through sound evolved from attempts at representing sounds in maps, to understanding sound installations as an embodied, relational sound map. One of my first occupations after graduating was at a landscape architecture firm where I spent many hours drafting, following the lines of contours and marking the details involved in maps. Not only sensing the layers of representation, I also noted the power embedded in maps to create our notions of space. At that time, I was living in Brady Lake, a small area within Kent, Ohio. It was then when I began to make sense of where I lived through location recording, taking georeferenced soundwalks around the lake, sketching, taking photos, and learning about the history of the place, and its inhabitants. I wanted to better understand my experience of the
Brady Lake_ac5, José A. Rivera, (2011)
land. The early aural cartographic experiments evolved into experimental music notations that suggested how a sound piece was composed, or could be composed.

It became of interest to me to begin working with sound and space on a more constructive, physical, and experiential way. How could I learn about a particular space while providing an experience that incorporates experimental sound and mapping practices? What questions emerge from an experience of provoking an auditory imagination in mobile subjects interacting within physical environments? How can contemporary understandings of a sound map be challenged to generate a more dynamic and embodied encounter with sound in space? My current artistic practice of producing sound installations that incorporate electroacoustic methods are synsonic mappings in practice. Here, the chapters within this thesis are broken down to provide some idea of how I proceed:

1 / / What I Mean When I Say Map or What Is a Map?

This is a smattering of “yes, and” connections that I’ve come across over the years. Do they include common ideas and practices? “Yes, and,” ideas that challenge contemporary notions of what maps are and what they do. It is to be used as a primer.

2 / / Plural Fields and Listening Self

By enacting creative processes of sounding that include recordings, compositions, and sound installations, the relationship of sound to location is interrogated in order to engage shifting notions of the self. I argue the production and experience of sound installations aesthetically alter the character of physical spaces, providing encounters that probe knowledge
of a place, an architecture, and the beings that interact within it. To support this claim, this chapter will focus on historical and contemporary trajectories in experimental sound practices, which often include the use sound as an art form. Notions of space, place, and relationality are also presented which provide context for my artistic practice in the production of sonic works and installations.

I continue with notions of sound by drawing on the experimental music tradition inspired by John Cage which includes an openness to all sounds. Sound art is introduced in order to trace the developments in technology, which explores methods for sounds to be removed from their sources. This allows new ways to think about sound and place. Acoustic ecology is presented to examine the role of sound to affect social relations between humans and the environment.

Engaging architecture and landscape through sound is an attempt to examine the relationship between physical and emotional understandings of environments. Here, the writings of Salome Voegelin provide a thoughtful sensitivity to the sonic experience. The work of Xenakis and Maryanne Amacher demonstrate how spatial orientation occurs differently with the eye and than the ear, and creative processes of sound spatialization are presented. Here, I included a personal project, Reflections of a Thousand Faces.

Marc Augé’s notion of non-place aligns with liminality and loss of identity, topics that are considehese non-places are not concerned with identity, and are void of relational and historical notions of definition.
In contrast with Cartesian space, and through the lenses Henri Lefèbvre, Maurice Merleau-Ponty, and Edward T. Hall, alternative notions of space and relationality are explored. The production of a sound installation and perception of spatial sound breaks the monotony of everyday, and one is more able to relate to her environment. The proxemic studies of Edward T. Hall demonstrate how humans in different cultures relate to one another in space. Our spatial interdependence with one another is constantly flexible.

The notion of querencia is explored through Adair Landborn’s review of the Spanish Traditions of Bull-fighting and Flamenco dancing. I suggest they are both embodied presences of cultural experience. Similarly, the notion of querencia with regard to bioregionalism refers to an a deep felt embodiment with the land. If we are to take notions of querencia and understand them through the lenses of sonic and spatial studies, the core of my approach lies in embodiment. My early cartographic experiments emerge from a striving for querencia, a Spanish word reflecting a deep felt sense and engagement with an environment. It’s an inner well being that comes from knowing a particular place on earth. Like focused listening, this querencia is felt in the pause, long and silently enough to let our minds align with and in place. Perhaps it is in these moments where we can begin to more fully integrate with the deep workings of the environment and ourselves as relational beings.
Charting the Ephemeral

I begin with a personal project proposal, Electric Streams of Wind, a site-specific project that incorporates environmental sound, electroacoustic processes, weather data, and spatialized sound. Like weather, sound is a perceptual medium that shapes our cultural environments and physical spaces. Here, sound is understood not only as the result of variations in air pressure as physical phenomena, but as an embodied presence that emphasizes relationality within a particular space. Synoptic maps arrange multiple relational ideas onto the same plane in order to provide a specific reading of a place. I use the term synsonic to situate my mapping process in the realm of the sonic. Here, sound operates as a sensorial conduit for multiple instantiations of places and times, being carriers of past and future and amplifying collective complexities.

By tracing the development of weather maps, I discuss how various technologies promoted a shift from individual accounts to collective empiricism, how synoptic maps emerged, and how a networked infrastructure of electronic communication set the groundwork for radar and modern data streams. Overall, the role of the weather map evolved from a tool of science to a medium of sharing information across space and time. Like sound, weather is an inherently embodied and spatial — but not at all fixed.
I begin with an introduction into maps and cartography as a field. I examine the theoretical discourse of maps and situate this research within the context of sound and spatial studies. I continue with modern notions of the sound map, defining them as online repositories of location recordings geo-referenced to a Google-style arial map. I draw on the ideas of Jacqueline Waldock and John Kannenberg to provide historical basis for sound maps, and I criticize sound map’s claims of interactivity, suggesting they are static, less about providing any significant information about how the sound relates to its location, and more about the technology of archiving sounds. Following critical cartographic approaches, John Corner is introduced because he argues for the agency of maps, emphasizing a map’s capacity to transcend conventions of depiction and instead, affect actualization. Tim Ingold stresses the idea of process cartography, describing a constantly mutable practice of acquiring spatial knowledge. Post-Structuralist theories are introduced that suggest a non-dualistic view of maps, producing new knowledge with each encounter as a process of becoming.

I suggest a rethinking of the sound map phenomenon, and instead suggest an alternative aural cartographic approach that emphasizes relationality, multiplicity, and embodiment. A sound installation is a synsonic mapping that co-creates space, encouraging the act of listening as a practice of process cartography.
Overall, I aim to better understand how my artistic work is situated within the artistic practices of sound and space, with all the relatedness and divergences. A lot of ground is covered, as if one is traversing unknown territories, with all the necessary influx consisting of memories, doubts and speculations. As mobile subject whose identity is constantly negotiating with the moment, I aim to tackle sound and the relationality with a geographical location, an architecture, its history, and those that inhabit it.
What I Mean When I Say Map or What Is a Map?

An aggregate of meaning, a combination of significant information

A historical object, a physical artifact

An artistic depiction, an expressive rendering that shows some imaginative skill

A layering of multiplicities, strata of various temporal situations and occurrences

A tool, a device serving a certain function

An idea, a conceptual thing enabling cognitive processes

A point of view, location of production

A conversation, a discursive transference of information

A compromise,
an agreement with the limitations of physical material
A series of choices, assertions / what to include, what to exclude

A production of knowledge, process of meaning-making

A method of orientation, way-finding procedural enabler

A spatial reading, an analysis of physical attributes

A geospatial linkage, a binding of landscapes

An inquiry into identity, an attempt at description

A constructed reality, an assembled glimpse of existence

A practice, a method of application

A social construction, interplay of power and knowledge

Information design, aesthetic and purposeful decisions

An interaction of figure and ground, a perceptual interaction
A document of representation, a record of particularities

A model, not the thing, but its own thing

A process of becoming, a combination of states that accepts change

A reference, not its own thing, but allusion to an assemblage of ideology

A system of relationships, interweaving processes that influence one another
Reflections of A Thousand Faces, José A. Rivera, (2015)
2 / / Plural Fields and Listening Self

The ability for sound to provide a multitude of sensory engagements with the physical world is one of the reasons why sound is valued as a perceptual and phenomenological experience. Sound is an ongoing presence shapes the world, contributes to understandings of our environment, our relationship to each other, and our understanding of ourselves. By enacting creative processes of sounding that include recordings, compositions, and sound installations, the relationship of sound to location is interrogated in order to engage shifting notions of the self. I argue the production and experience of sound installations aesthetically alter the character of physical spaces, providing encounters that probe knowledge of a place, an architecture, and the beings that interact within it. To support this claim, this chapter will focus on historical and contemporary trajectories in experimental sound practices, which often include the use sound as an art form. Notions of space, place, and relationality are also presented which provide context for my artistic practice in the production of sonic works that installations.

Ocularcentrism, or privileging vision over the other senses, is deeply rooted in the development of Western culture. As described by architect Juhani Pallasmaa, a more complete awareness is aligned with modern critiques of the highly hierarchical structure of

---

6 For example, Plato, Aristotle, and Descartes, among many others, theorized and argued for the primacy of vision.
contemporary perception that is biased toward vision.\textsuperscript{7} Though the debate over whether the visual dominance enhances or stifles our perception of the world is wide-reaching, for the purposes of this thesis, I draw upon perspectives from architects that engage with the phenomenology of architecture, who argue for a more comprehensive experience of the senses when designing environments. By provoking aural imagination in listeners, I suggest that an articulation of a more balanced perspective of sensorial experience provides an understanding of new ways of interacting within the varied spaces of the everyday. As we gain a fuller sense of where we are in space, we may begin to further understand who we are as relational beings. Environmental sound, signal processing techniques, and spatial practices inform my work in the production of spaces that emphasize knowing the world through sound. By exploring techniques of sound spatialization, aesthetic encounters are created which not only change how the physical environment is perceived, but also call into question the idea of the subjective listening self. In what ways can concepts of the self be explored through the temporary dissolution of place?

With a background music and architecture, I draw on experimental sound processes where the everyday is recorded and utilized as a perceptual medium to generate possibilities of extending the physical environment to an artwork. The environment transformed into an augmented space, mediated by the processes of recording, editing, and \textit{spatial diffusion}.\textsuperscript{8} By


\textsuperscript{8} Here, I use the phrase \textit{spatial diffusion} to refer to producing a sound installation and projecting sound into a space.
changing the character of space, it is rendered either imaginative, virtual, or hyperreal. In the production of sound installations that invite attentive listening, I question the concept of the self in relation to its environment. In order for us to function in space, conceptions of space need to be present. What occurs when we lose our conceptions of space? If sound is used as a primary medium and utility, what happens to the self when space is dramatized? To explore these questions, sound, as it relates to my practice, will be examined with regard to historical and contemporary trajectories of experimental sound practices and sound art. Additionally, this chapter interrogates particular spatial understandings as expressed within multiple disciplines such as architecture, geography, sociology, and anthropology.

Sound is defined as physical vibrations in air pressure that require a medium such as air or liquid in order to propagate. Sound also occurs physiologically, referring to how it is received by the body, or psychologically, referring to how it is perceived in the brain. My use of the term incorporates the physical, mental, and bodily understandings of sound with particular regard to the acoustic ecology and experimental music traditions. Composer, Jennie Gottschalk writes that experimental music is often difficult to define and claims it does not belong to an establish

---

9 For example, Barbara Tversky, a professor of Cognitive Studies at Stanford University, researches how individuals understand physical space and how they structure mental or virtual space.

10 The term sound art is a contested. Max Neuhaus (1939-2009), an artist and avant-garde musician that worked with sound as a primary medium, compared the expression to a ludicrous notion of “steel art.” In other words, sound art as a phrase privileges material over medium, which emphasizes the autonomy of sound, rather than the relationality of sound with the broader aspects of perceptual and cultural experience.

11 Kendall Wrightson (2014) defines acoustic ecology as a discipline studying the relationship, mediated through sound, between human beings and their environment. Since its initial conception in the 1970s with R. Murray Schafer, the field has grown to encompass other disciplines such as bioacoustics (the study of animal sounds) and oceanic studies.
school of thought, trend, or even aesthetic. Instead, experimental music is more aligned with a position of openness, of questions, of uncertainty, and of discovery. Artist, composer, and one of the most influential experimentalists of the 20th century, John Cage considered definitions of experimental music to include sounds that are notated, and those that are not. Those that are not notated are written music as silences, opening the doors of the music to the sounds that happen to be in the environment. This openness exists in the fields of modern sculpture and architecture.

Spaces, physical phenomena, circumstances and materials are investigated for their sonic potentials. These investigations exist across a range of practices such as performance, composition, installation, recording, improvisation, and listening. Experimental music is frequently situated in the unknown and often against what is known on the basis of established musical scales, instruments, rules, performance techniques, progressions, or spatial diffusions.

*Indeterminacy*, a characteristic of experimental music, provokes circumstance and fosters openness through uncertainty and risk. Prevalent in the work of John Cage, among others, indeterminate sounds heard during a performance or a composition are open-ended, changed, and contingent to the moment. Often, unrepeatable outcomes result from accidents

---

12 Gottschalk does provide a incredibly expansive description of work by many artists and composers, but fails to place the experimental music tradition in the larger contexts of the avant-garde, counter-cultural, or specific social milieu’s in which the work was created.


15 Ibid., 2.
and coincidences, which give a uniqueness to the sonic experience. New experiences emerge from chance and unforeseen occurrences.

Another aspect of experimental music is that of change. Gottschalk notes that real change in experimental music occurs in the realm of human thought and experience.\textsuperscript{16} Though change is not exclusive to the musical experience, the change can offer a rethinking of particular space, societal issue, or offer a shift in the listener's perspective. As Christian Wolff describes:

[experimental] music becomes a kind of metaphor, if you will, for a social situation, that it suggests a way of organizing your thinking, your attitude towards the world, which suggests the world could be different…providing a kind of model, an incentive for the notion of change.\textsuperscript{17}

In the creation of an experimental music composition, performance, or installation, one particular approach may be to avoid including personal tastes or emotions from the process of making the piece. The removal of subjectivity marks a shift away from 19th century notions of emotion and narrative, and alternatively shifts the focus to sound's materiality, the act of listening, the perception of the environment, or socio-political engagement.\textsuperscript{18}

In the process of creating an experimental sound work, on-going research is often carried out within the realm of realities external to composer's subjectivity. The term

\textsuperscript{16} Ibid., 2.


“experimental”, in this sense, is more aligned with science in that an experiment often leads to questions being answered, more questions being asked, and more experiments being introduced. This process characterizes the rich, experiential quality of the sonic experience.

Gottschalk describes it as:

…about the time and place in which it occurs. It is transparent to it, and frames it in a way that makes the familiar seem very special.

When experimental music is effectively made and presented, it speaks to our integration with the world. It goes from the center — what we already know — to the margin — what we don’t know — and back again, so that new realities present along with, or sometimes even in place of, our previous perceptions of our own lives.\(^{19}\)

But what is the use of experimental music? What does it purpose? Perhaps, as the answer lies in the “sounds and not purposes,” and is characterized by a paradox Cage described as “a purposeful purposelessness or a purposeless play.”\(^{20}\) The play, according to Cage is:

an affirmation of life – not an attempt to bring order out of chaos nor to suggest improvements in creation, but simply a way of waking up to the very life we’re living.\(^{21}\)

Sound art is also an expansive field of different practices that often defies generalizations. Among others, Douglas Kahn has attempted to trace a history of the discipline.\(^{22}\) Though hard to define, sound art includes a host of different practices, from noise

---


\(^{20}\) Cage, *Silence*, 12.

\(^{21}\) Ibid., 12.

and installation to plunderphonics, which is the sampling of various sound sources for audio collage. While sound art as a field originated in the first half of the 20th century, it developed due to advancements in recording technology and the changing character of sound in everyday life. With the advent of the phonograph, reel-to-reel recorders, the radio, and affordable tape recorders, sound was removed from the boundaries of a fixed place and time. Temporal and spatial separation of sound from its source allowed for new ways of creating and experiencing music. For example, in France in the 1940s, Pierre Schaeffer, one of the pioneers of musique concrète, utilized the term acousmatic sound to refer to “a sound that one hears without seeing the causes behind it.” Composer, filmmaker, and critic, Michel Chion theorizes acousmatic sound in his Guide des objets sonores:

Acousmatic listening is the opposite of direct listening, which is the “natural” situation where sound sources are present and visible.

The acousmatic situation changes the way we hear. By isolating the sound from the “audiovisual complex” to which it initially belonged, it creates favorable conditions for reduced listening which concentrates on the sound for its own sake, as sound object, independently of its causes or its meaning...

23 Ibid., 102.


25 Musique concrète is an experimental music form that emerged with magnetic tape recorders in the 1940s. Literally meaning “concrete music,” it is classified by using recorded sound from the environment, voices, musical instruments. In opposition to the established musical practices of the time which focused on harmony, timbre, melody, and rhythmic structures, the materiality of the recorded sounds dictated how the musical piece was constructed and understood.


Incorporating sounds that were recorded as well electronically generated, *Electroacoustic* processes emerged that combined the tape-music of musique concrète with the electronic music of the mid-20th century. As recording technologies became more affordable, recording, sampling, and editing techniques were brought out of the conventional music studio. A greater number of people in the general public began experimenting and capturing sounds from their environments, developing the art and study of phonography. Thriving communities that included professionals and amateurs were established, as seen by the World Soundscape Project of the 1970s, and more recently, international groups like the Disquiet Junto and Framework Radio.

Musicians and artists have produced work that reflects the rapidly changing character of everyday life. In early modern Europe, auditory communities created by the church bell helped to structure relationships and construct identities. This has been overthrown by the noise of the factory whistle, engines, the TV, radio, car stereos, sirens, and various mechanical systems. Today buildings serve as structures keep the sound out. This is detrimental to our

---

28 One of the pioneers of this movement is Luigi Russolo (1883-1947), an Italian composer who embraced the noise of machines and championed it as an form of art. For more on this, refer to his Futurist manifesto, *The Art of Noise* (1914).

ability to holistically experience architecture and urban spaces. In the 1970s, R. Murray Schafer criticized the modern age of noise and its effect on architecture:

The modern architect is designing for the deaf. His ears are stuffed with bacon. Until they can be unplugged with ear cleaning exercises, modern architecture may be expected to continue its same rotten course... The study of sound enters modern architecture schools only as sound reduction, isolation, and absorption.  

To this day, in places such as restaurants, bars, theaters, and concert halls, acoustic treatments are necessary to combat an increased noise floor, denying the particularities of a specific space, masking important information of a building’s material, shape, and size. As Emily Thompson notes, there is also a creative side to this process, where musicians, engineers, and artists create new cultures out of the noise of modern world inside offices, music halls, cinemas and across radio waves. Unlike Schafer, I do not regard the historical changes in sound of the everyday as merely a destructive process that threatens a traditional urban harmony.

Artists Sam Auinger and Bruce Odland (O+A), also observe how the modern urban experience of sound is progressively transformed by the multi-sensorial bombardment of

---


31 Noise floor is the sum of all the sound sources in a particular space outside the sound that is being measured or analyzed. Frequently at a bar, for example, due to a higher noise floor that results from loud music and increased conversation, personal conversations need to adjust in volume relative to the background sounds.


33 Emily Thompson, The Soundscape of Modernity, 196.
engines. They approach their critical practice from a *hearing perspective*, described as a way of engaging with the world and our urban environment through sound. O+A’s practice utilizes the noise of urban environments, attaching tuning tubes to facades of buildings. Resonating in these tubes, urban noise is transformed. Their process generates discussion about the consequences of modern sonic realities, ultimately proposing that “we will not know ourselves until we understand our noise.”

As an artist creating electroacoustic compositions that include locations recordings, I often use noise, digital manipulation, and dramatizations of space to emphasize place or illustrate displacement. Yi-Fu Tuan, the humanist geographer, describes the difference of place and space.

If we are to think of space as that which allows movement, then place is pause, each pause in movement makes it possible for location to be transformed into place.

Space, a central idea to the fields of architecture and geography, can be measured in absolute and physical terms, such as feet, miles, and acres. In contrast, place occurs when people make sense of and attach meaning to a geographical area. Place is then defined as being more important than its surroundings. Tuan also considers place to be an emotional, bounded area wherein humans often derive personal identity. By creating environmental audio


35 “Hearing Perspective (Think with your Ears).”

works that change the character of a physical space, I provide opportunities for auditory experience that present and question a sense of place, informed by what architect Steven Holl calls **acoustic intimacy**:

One who has half risen to the sound of a distant train at night and, through his sleep, experienced the space of the city with its countless inhabitants scattered around its structures, knows the power of sound to the imagination; The nocturnal whistle of a train makes one conscious of the entire sleeping city. Anyone who has become entranced by the sound of water drops in the darkness of a ruin can attest to the extraordinary capacity of the ear to carve a volume into the void of darkness. The space traced by the ear becomes a cavity sculpted in the interior of the mind.\(^{37}\)

Steven Holl suggest a deeper awareness of sound integrates the individual with everyday experience. Following composer Barry Truax and much of the ideas pertaining to acoustic ecology, Holl rightly regards that hearing has the power to create a sense of connection and solidarity in the formulation of an acoustic community.\(^{38}\)

Engaging architecture and landscape through sound is an attempt to examine the relationship between physical and emotional understandings of environments. Although this has been the subject of work by many anthropologists, geographers, and phonographers, theorist and writer Salomé Voegelin has observed that engaging practices of field recording, does not record the field but produces a **plurality of fields**:

It neither abandons the reality of the recorded, nor does it take it for granted, but works with it, responds to it, understands it as one imprint in the landscape made by the body of the recordist and retraced tentatively by the listener.\(^{39}\)


\(^{38}\) Ibid., 30.

The listener Voegelin refers to generates a new relationship between what is heard and recorded, observing the “authenticity of a particular rendition rather than its source, and embracing interpretation as part of the actuality of the real.” Following Cage, a greater number of people today are experimenting with environmental sound where the aim is not necessarily music, but sound and the act of listening.

The compositional practices of field recording which include instrumental, electroacoustic, and digital manipulation of the environmental material, are determined neither by conventions music, nor by those of art. Instead, the sonic works of Buddhaditya Chattopadhyay and Francisco Lopez, among others, use the “possibility of the real through interpretations of the actual,” and provide opportunities to perceive sound itself rather than to music or art. For example, Chattopadhyay creates a field from digitally processed archive footage and life recordings and Lopez blindfolds the audience to achieve a heightened and active listening experience.

---

40 Ibid.
41 Ibid.
As previously mentioned, much of the electroacoustic music of the 20th century emerged out of new recording technologies that allowed for one to decide what sound and at what time a sound could be reproduce. Additionally, being able to choose where and how a sound could be reproduced aligns with the practice of spatializing audio. One of the earliest examples of a spatialized audio occurred at the 1958 Brussels World Fair. As a collaboration between Iannis Xenakis, Edgar Varèse, and Le Corbusier, a spatial distribution of sound sources was applied as a means to generate novel aural experiences. Xenakis used a three dimensional acoustic grid to create a homogenous space of sound, immersing the audience members. Sound emanated from multiple points the architecture; emanating from the floor, walls, and ceilings.

Maryanne Amacher also experimented with spatialized audio systems to investigate the relationship of sound and location. Entitled City-Links, she produced over 20 projects between 1967-1981 that included Buffalo, Boston, MIT, and New York Harbor, and others. The sonic environments of multiple parts of a city were linked together with the use of microphones and analog phone lines. According to Amacher, live transmission allowed “remote sonic environments” to “enter our local environments and become part of our rooms.”

Xenakis, Amacher, and many others have demonstrated how the spatial orientation that results from our sense of hearing occurs very differently than from our sense of seeing. As I

---


continue to experiment with the multichannel experience of sound, techniques of sound spatialization are used to build upon the formal qualities of space in order to generate unique sonic experiences. One particular project, Reflections of A Thousand Faces (2015), is a site-specific work created to understand and dramatize the sense of space and its relation to the content being produced from and within it. Located in the E15 staircase in the Wiesner Building at MIT, 12 speakers were suspended from individual railings in an upward, spiral-like fashion. The vertical experience of dynamic sound utilized the open cavity of the stairwell as a resonating chamber.

44 The notion of site-specificity appeared in the 1960s as a desire to transcend notions of commodification, universality and autonomy of art.
During the opening of the installation, listeners were invited to engage with the space while I performed. Because the stairwell is a public and liminal space, digital signal processing techniques were used to transform recorded sound in unexpected ways, reflecting the ever-changing mobility of passersby. With Ableton Live 9 and the Max/MSP programming environment, spatial indeterminacy was incorporated in the sonic diffusion across the 12 channels. In order for the focus to be on the sonic content, I designed the speaker mounts and wiring system to be as minimal as possible. Running the wire along the railings also helped ensure building occupants could egress without difficulty in the event of an emergency.

The differences of now and then, here and there, and the beyond imply temporal movement, passage, and a notion of progress. Thus, the resonant space of a stairwell is explored, evoking ideas of evacuation, journey, and transition. This liminality refers to what anthropologist, Marc Augé called, a non-place. These non-places are not concerned with identity, and are void of relational and historical notions of definition. As such, the spectator-traveler experiences a disorientation that occurs throughout the journey of moving from floor to floor. *Reflections of A Thousand Faces* investigates the notion of subjective identity and prompts a possible spatial reorientation. Experiencing sound in a liminal space creates a tension, and the suspension of time through sound is a momentary detour that relocates a new experience, expands present circumstances of the space, and attempts to create a deeper relationship between listeners and their environment.

---

In order to amplify real-time events, sounds were sourced from the stairwell where the piece was located. Audio recordings from similar mechanical and electrical equipment of the underground tunnels of MIT were also incorporated. I used a contact microphone, also known as a piezo transducer, to absorb peculiar vibrations through various pipes and surfaces. Dynamic and binaural microphones were used to capture sounds of water rushing through pipes, noise from exhaust fans, temperature meters, various buzzes from fluorescent lights, and the drone of elevators. Mapping of the tunnels of MIT and diffusing the sounds in the service space of a stairwell creates layering of perceptual experience with the vast network of energy. A spatial linkage incorporates sounds from multiple sources, where the map connects various building systems that contribute to and shape our experience of a space.
Installation view, Reflections of A Thousand Faces, José A. Rivera, (2015)
Reflections sources sound from multiple sonic environments. The sound is then projected back into the space of the stairwell, free to become infused with existing sounds of the stairwell. At times, listeners could not distinguish from sounds which were a part of the piece, or the existing activity audible from pipes, doors, footsteps, and sounds from a nearby elevator. This served as an opportunity for listeners to confront and question the ambiguities of perception and identity.

With regard to sound recording, it is possible that the problems of identity and source recognition exist at the intersection of the global/local — the here/there — which suggests potential hybrid identities. The use of environmental sound in composition does not demand identification. Though there may be some particular spatial or geographical sonic information present, sound as an art form can provoke a sense of identity that is abstracted, embodying a potential to transcend its origin by taking on an emancipatory form. Location-based recordings can then be freed from the burden of identity, having emerged from the local to shed their association with place during the compositional, spatial diffusion, and listening processes.

In addition to an experimentation with spatialized sound installation, the engagement with environmental sound and imagined notions of site transcend physical aspects of locale. Through the listening process, a more holistic understanding of ourselves emerges as spatial beings. If one cannot identify sound sources in sonic experiences, a sense of being is called into question where being itself is not just self, nor is it just the world; it is an individual relationship of self within a lifeworld comprised of existence and experience.\(^\text{46}\) With an aural

\(^{46}\) Voegelin, *Listening to noise and silence*, 5.
cartographic installation, sound is thus free to play with various states of attention of the listener, and the emotions that come to signify feelings in a condition of increased awareness or spatial confusion. In this sense, when we engage in active listening, we are not simply designing and creating a world in constant flux, we are continuously designing ourselves.
Sounds operate throughout our daily lives and shape our cultural experiences and physical spaces. Space is not merely a container in which human behavior emerges, but is simultaneously a product and producer of action. Similarly to a map that can be a representation of space, but also serve as a reference for how space should be created, here the co-constitutive nature of culture and space will be explored to contrast an absolute, Cartesian notion of space. More specifically, the spatial studies of Henri Lefèbvre, Maurice Merleau-Ponty, Edward T. Hall, and notions of querencia are examined as a means to inform the production of a spatialized sound installation as a relational process of cultural embodiment.

The work of Henri Lefèbvre serves as a significant resource for understanding space in a sociological framework, claiming that “social space is a social product.” In the Production of Space, Lefèbvre presents a relational concept of space that is influenced by a his critique of capitalism. Drawing on Karl Marx, Lefèbvre analyzes space as a product of society, arguing that the place of everyday life is affected by the conditions of capitalism, and thus transformed into a state of everydayness. As a result of capitalist structures, highly developed exploitation and monitored passivity characterize everyday life.

---


48 Lefèbvre, The Production of Space, 30.

Lefèbvre formulates a conceptual framework of spatial practice/perceived space, representations of space/conceived space, and spaces of representation/representational space/lived spaces. By spatial practice, he describes modes of behavior that are space-related, informed by the everyday practices reinforced by routines and routes for the production and reproduction of spaces.

By representations of space, Lefèbvre describes conceived space; the space of urban planners, architects, scientists, and technicians. It is the ideological, cognitive aspect of space, its representation, mathematical and physical models and plans, which enable space to be read. Spatial practices take place in these representations of space, and although everyday users may not be conceptual aware of this experience, Lefèbvre notes that “the user’s space is lived — not represented (or conceived).” The experience of this space, however, is still marked by a monotonous, alienating, repetition.

Lefèbvre emphasizes the significance of the role of symbols in experiences and in determining space. For Lefèbvre, spaces of representation stand for spaces of expression that employ symbols and various imagery. Spaces of representation influence spatial practices and and how we think about space, making it possible to envisions other spaces. Perhaps the production of spaces of representation can call given societal conditions into question, and provide aesthetic experiences in the “locus of possibilities.”

---

50 Lefèbvre, The Production of Space, 38.
51 Ibid., 362.
52 Ibid., 191.
Space is simultaneously a collection of objects, things, tools, and the use of tools. Space is also a field of action and thus makes action possible. Lefèbvre presents an idea of space that is both structuring form and structured form. Above all, he seeks ways to think about space beyond the container image, while considering the way a society forms, and the potentials that originate within it. Can his notion of *spaces of representation* be activated by bringing together bodies in space, and thus create a social space of cultural embodiment?

Along with Lefèbvre’s notions of representations of space, I situate my work within the theoretical framework of Merleau-Ponty. More specifically, an analysis of the relations between the living organisms and their environment appears in Merleau-Ponty’s reading of Jacob von Uexküll’s theory of the *umwelt*. For Merleau-Ponty, the umwelt demonstrates that there is a true reciprocity, a “cohesive bond”, between the living organisms and their environment. In other words, Uexküll shows that the environment compels the organism to behave in particular ways, but only inasmuch as the milieu is also already created and developed by the preceding behavior of the organism. This notion is “destined to connect what we usually separate.”

It could also be said that in the corresponding relations between organism and environment, there is something like an area of cohesion with its the exterior world, which, in the unfolding of a common texture that binds together, produces the organism as a whole throughout the whole of the milieu.

---


55 Ibid., 228.
Merleau-Ponty suggests organicism was developed as a response to the Cartesian dichotomy of reality, which presents the world in a dualistic fashion. For Uexküll, human beings operate in a construction of three spaces that overlap; the visual space, the tactile space, and the space of action, or behavior. According to Descartes, reality is reducible to two fundamental types of substances, minds and bodies. The realm of the mental includes all thinking, sensation and consciousness. The umwelt, in contrast, is a situation prior to that of the invention or occurrence of consciousness and is not reduced to a sum of exterior events or to a relation to the interior which is not taken in the world. For Descartes, the realm of the body includes all things physical and spatial. When the mind and the world are held as totally distinct, the mind becomes conceived of being enclosed within the body, unable receive information except through a causal interface at the sensory surfaces. In other words, Cartesian thinking makes distinctions between matter and consciousness relevant and recognizes these “substances” are operated by different principles. From the Cartesian position, the connection between matter and consciousness cannot be explain — the substances are different to correspond with one another but through the senses. In contrast, as Merleau-Ponty suggests, the idea of umwelt no longer applies if we consider the organism in its relation to the outside

---

56 Ibid, 227.


58 Ibid.
world as “an effect of the exterior or as a cause.”\textsuperscript{59} Instead, the umwelt is an open field where we can no longer distinguish between where “behavior begins and where mind ends.”\textsuperscript{60}

This open field is the location of a situated sound installation that operates where conceptualizations of space, culture, place, and embodiment are engaged. Overall I’m interrogating how the complex, dynamic networks of sound, space, place, and embodiment can be understood to produce and constitute one another. I consider space to be the multiple and hybrid settings—whether physical, cultural, social, personal or political—of production; while I imagine place as the moment-to-moment relationships between different elements of a spatial network. Sound installations take into consideration aspects of the built environment, social spaces, and embodied cultural presences; all of which are perceived at the intersection of sound, space, and the body.

\textsuperscript{59} Merleau-Ponty, Nature, 177.
\textsuperscript{60} Ibid., 178.

The Spanish word \textit{querencia} comes from the verb querer, which means to love, like, wish, desire, and prefer. Dancer and researcher, Adair Landborn, notes that it can apply to both Spanish traditions of flamenco dancing and bullfighting.\textsuperscript{61} Querencia of a bull is that preferred

space where the animal feels “a strong sense of belonging, security, and ownership.” At the outset of a bullfight, a bull chooses its querencia in a physical location as its base of defense or attack. When a bull storms into the arena, it is initially stunned by the glaring light and huge crowd. It makes a few ill-planned, abortive attacks, which evidently prompt it to seek a querencia, a space approximately the size of the bull’s body. Within this space, the bull can react with lightning speed as quickly as it perceives the bullfighter’s movements. This mode of operation makes the bull close to invincible.

Though seemingly arbitrary, the preferred space of the bull is particular territorial identification that establishes a security with its back towards the wall. The querencia is often understood in the realm of animal preferences, but can also refer to the tendency to become attached to a particular area as a “home base.”

But outside this preferred space there is always a tiny time interval between perception and action, lessening the bull’s chances for a successful attack or defense. An experienced matador will therefore entice the bull out of its querencia before undertaking, in relative safety, the various suertes that are part of his choreographic repertoire.

Cultural anthropologist, Edward T. Hall, is notable for his work with proxemics and thoughts on spacing mechanisms in animals. He says two distances, “flight distance and critical

---

62 Ibid., 114.
63 Ibid., 117.
64 Ibid., 111.
65 Suertes are translated to steps, or sequences.
distance,” are present when members of different species encounter one another. Here, both querencia and jurisdicción can help demonstrate what Hall calls “interspecies spacing mechanism.” Jurisdicción, in this case, refers to “a dynamic and invisible boundary around the animal, a line that when crossed causes the animal to attack”.

Proxemics is the study of how humans in different cultures use space the interpersonal communication that arises from body movement, cultural behaviors, and social interactions. Proxemics vary across cultures and are characterized by invisible spheres of distance. Public distance is the largest as it defines a circular area of relation within 12-25 feet. Public distance incorporates to public speaking, musical performance, and much of our experience in architecture and at the scale of the city. Social distance is the next sphere, which describes interactions among acquaintances, which occur between 7-12 feet. However, personal distance is engaged when good friends or members of a family meet. Interactions within these distances occur anywhere from 1.5 feet to 4 feet. Lastly, the intimate distance defines a space where touching, embracing, and whispering occurs anywhere from 0-18 inches.

Each human carries around his or her own personal space wherever they go. According to Hall, body space, and posture can be unconscious reactions to sensory fluctuations, particularly regarding volume or pitch shifts that often occur during a conversation. Hall’s measurements are not strict and do not offer a complete picture of the behaviors between humans by any means. Rather, the study of proxemics here is understood as system to estimate

67 Landborn, Flamenco and Bullfighting, 112.
68 Hall, The Hidden Dimension, 16.
or determine the impact of distance (space) on communication (sound), how interactions vary by cultures and other environmental factors.

Like querencia, an animal’s sense of jurisdicción is “flexible over time.” Like our direct experience, the amorphousness of jurisdicción changes depending on the situation, fight conditions, and the animal’s past or present experiences. Matadors study querencia and jurisdicción carefully, attempting to register how these “virtual spaces” exist within each animal’s particular behavioral patterns. The matador begins to know when the bull is dangerously defensive by speculating a bull’s querencia. Additionally, if the matador is able to judge the bull’s spatial jurisdicción, he can urge the bull to offensive action.

Flamenco dancers also embody querencia when he or she is at the center of the social circle. The dancer’s territory is defined by this social circle. As Landborn describes, “the dancer has a sense of security and belonging, of being supported equally from all sides by the attention of the cultural group.” The energy of the performance also creates a participatory space that may inspire the next performers. From the same social circle, all those that are a part of the experience may emerged transformed and invited to participate. The porous boundary between and among individuals is emphasized. Thus, the participants are rendered temporary and flexible. The social circle also supports social cohesion, as participants in the circle not only

---

69 Ibid., 112.
70 Ibid., 114.
71 Ibid., 114.
72 Ibid., 114.
see and interact with the dancer, but with one another as well. Thus, community is formed, querencia is shared, and the performance provides a spatial opportunity to socialize as an embodied presence of cultural experience.

As Landborn suggests, both bullfighting and flamenco manifest “an embodied nature” of “cultural practice” that is “always present within daily life experiences.” Whether obvious or subtle, the cultural values that these two practices embody are dynamic reflections of the postures, gestures, and movement patterns of the performers and audiences.

What other implications can the notion of querencia have for human beings? The notion of comfort and knowledge conjoined to ideas of personal, embodied space, can also be applied to another understanding of querencia. Bioregionalism, a concept that unites culture, environment, and economy, is described by environmental writer, Kirkpatrick Sale, as a “self-reliant, social, economic, and political system” that is adapted to and shaped by its “natural setting.” At the heart of this bioregionalism, which also includes the place’s geography, geology, climate, flora, and fauna, a long-term commitment to place exists as an embodied presence with the land. Querencia, here can be thought of as a inseparable link between land and its culture, whereby adaptations made by inhabitants help the land evolve in a way that sustains the land. Deeper than a mere “love of home,” Sale describes querencia as:

73 Ibid., 114.

a deep quiet sense of inner well being that comes from knowing a particular place of the earth, its
diurnal seasonal patterns, its fruits and scents, its history and its part in your history...where,
whenever you return to it, your soul releases an inner sigh of recognition.\textsuperscript{75}

Similarly, the poet, Juan Estevan Arellano notes querencia as that which gives us a
"sense of place, anchors us to the land, and makes us a unique people."\textsuperscript{76} \textsuperscript{77}

With regard to the experience of sound in space, how can interdependency between
humans, place, and notions of embodiment be experienced? Can the notions of proxemics and
querencia be applied to the sonic experience? Although Hall does make reference to the way
sound operates in proxemics, his analysis does not move beyond the phenomenon of the voice
in communication. However, with regard to this thesis, sound is related to physical distance on
a number of levels,\textsuperscript{78} and has a significant effect on the way we as relation beings operate
within a culture. Auditory proxemics, for example, refer to the physical distance between
different sonic presences and the listener.\textsuperscript{79} Additionally, sound designers for video games and

\textsuperscript{75} Ibid., 42.

\textsuperscript{76} Juan Estevan Arellano, "La Querencia: La Raza Bioregionalism, " New Mexico Historical Review, 72

\textsuperscript{77} The term comes from the verb aquerenciarse, which means “to become fond of a place.”

\textsuperscript{78} For example, the speed of sound (340 m/s) and the way it interacts within a space determines such
things as resonance, phase shifting, and the doppler effect, sonic reflections, among others.

\textsuperscript{79} Allan Moore, Patricia Schmidt, and Ruth Dockwray, A Hermeneutics of Spatialization for Recorded
S1478572210000071.
film use the notion of sonic envelopment, spatial sound, and Hall’s distance spheres to create a sense of intimacy.\textsuperscript{80}

If we are to take notions of \textit{querencia} and understand them through the lenses of sonic and spatial studies, the core of my approach lies in embodiment. Additionally, useful knowledge can be gained from the field of human geography, which as a social science, studies how people, communities, cultures, and economies interact with the environment by studying their relation with and across space and place.\textsuperscript{81} Human geography attends to human patterns of social interaction, as well as spatial interdependencies, and how they influence or affect the earth’s environment.\textsuperscript{82} An aspect of human geography has been the creation and interaction with maps, however, the weather map, being a tool of meteorology, is an expression of physical geography. In contrast to urban, cultural, or human geography, physical geography studies natural processes and patterns in the environment such as the atmosphere and hydrosphere. But since humans’ experience of weather is embodied and inseparable from our spatial interaction with the environment, can a point of intersection be found with with an interrogation of the weather map?


Charting the Ephemeral

Now the mundane term for what I have called the fluxes of the medium is weather. So long as we are - as we say - 'out in the open', the weather is no mere phantasm, the stuff of dreams. It is, to the contrary, fundamental to perception. It is not so much what we perceive as what we perceive in.\(^{83}\)

Like weather, sound is a perceptual medium that shapes our cultural environments and physical spaces. Here, sound is understood not only as the result of variations in air pressure as physical phenomena, but as an embodied presence that emphasizes relationality within a particular space; the space uniquely coloring the variability of auditory perception.\(^{84}\) My project entitled *Electric Streams of Wind (Silvering the Edges of Broken Clouds)* (2017) is a site-specific audio work and multichannel installation. The purpose of the project is to chart, and so better understand through experience and relationality in space, the multiplicity of everyday life. By implementing a building’s history, trajectories of weather research, location recording, and technological transmissions of both sound and space, I posit that the spatial diffusion of audio presents a multi-layered, embodied way of knowing the world through sound. Questions\(^{85}\) emerge from the process of changing the presence of a specific space through sonic means. How can ephemeral qualities of weather and sound be integrated with physical phenomena, history, and architectural space? How can contemporary notions of a sound map be challenged? How can site-specificity inform an audio work? How can the relationship of


\(^{84}\) Discussed in other parts of this thesis, the embodied presence of sound and space is elaborated through Merleau-Pontys notion of the organism and its relation to its specific milieu.

\(^{85}\) As a proposed work to take place between May 22-29, 2017, this writing occurred before the completion of the installation. Any solutions or results must be expounded upon at a later date.
vibration, inscription, and transmission be utilized in the re-construction of sonic experience? In order to probe these questions, I will first present the many facets of Electric Streams of Wind, followed by a brief history of meteorology and weather mapping which will contextualize my work.

To investigate the different qualities of sound from, in, and around the building, the installation and audio work explores the relationship between transmission, inscription, and vibration. Live transmission is used as both a source and a method, implementing wind data from an anemometer, or device used to measure the wind speed and direction, and automated weather radio forecasts. With the use of the visual programing environment, Cycling 74’s Max7, and unique script written in Java, real-time data are acquired from the MIT’s personal weather station, KMACAMBR9. Located on the roof of MIT’s Green Building, the anemometer transmits wind speed, gusts, and direction to Weather Underground, a commercial weather service that provides real-time weather information. Accessed over the Internet, a unique API key was generated and serves to monitor in what ways and how often I am using the data. The information gathered from the anemometer is then data mapped to various parameters in a Max7 patch, enacting a process of sonification. Multiple EQ bands of a white noise generator are affected by real-time gusts, wind velocity roughly corresponds to amplitude, and the

---


87 An application program interface (API), is a set of protocols, and tools for implementing software applications.

88 Sonfication is a technique that utilizes non-speech audio to render or make data perceptual. A common use of sonfication occurs when the variability in clicks of a Geiger counter detects levels of radiation in a specific location.
direction of the wind is mapped to a 360° stereo field. In other words, depending on how hard the wind blows and from what direction, the volume of a filtered white noise will be softer or louder, and perceived in a specific location within the multichannel speaker array.

Recording the rooftop of the Green Building, José A. Rivera, 2017
Provided by various stations across the US and Canada, the National Weather Service (NWS) and National Oceanic and Atmospheric Administration automated weather radio forecasts are transmitted from KHB35 Boston. I use programmed volume adjustments to cause the audio to fade in out. The use of NWS transmission not only provides an aesthetic contrast with the location recordings and various ambiences, but attempts to draw a link to the history and ubiquity of modern forecasting methods.

A historic radar antenna remains on the roof of MIT Green Building. It is enclosed in a Radome, a 25’ spherical dome that allows the Radar antenna to rotate and be protected the weather. The antenna is still operable today, however, it is no longer used for weather radar research. The antenna is a technological artifact, whose purpose and structure is enlivened by specially designed mechanical devices attached the to antenna. Running on Arduino micro processors, each device implements communications over radio frequency that employ a tiny solenoid mechanical arm to gently tap the historic antenna at different times. Vibrations made by these devices create a peculiar resonance within the Radome, enacting movements that unfold in a sympathetic response with the structure of the antenna. Sound is used to illuminate the history of the space, while the live transmission of that resonance is wirelessly made available over a wifi internet protocol. A microphone is connected to a USB Audio Interface, which is connected to the Raspberry Pi3 microprocessor. The RP3 utilizes Gstreamer, an open-source multimedia framework that enables information to be shared across networks, thus making it possible to transmit in real-time, various presences of different spaces. Provoking a

---

89 After multiple meetings with MIT’s Radio Society, I learned that the current radar antenna is occasionally utilized for experimental EME (Earth-Moon-Earth) communications.
sonic imaginary in listeners, the resonant, interior space of the Radome is made accessible on the ground floor loggia through sound.

Location recordings made from the roof of the building capture surrounding urban ambiences of Cambridge and Boston. Wind causes the many rooftop radio antennas to shake and rattle. Distant sirens, honks, airplanes fly overhead, and the roar of motors from cars below all color the sky. When inside the Radome, these sounds are filtered by the Radome's deteriorating fiberglass material, which contributes to a unique drone-like characteristic that surrounds one from all sides. I recorded sounds from the various stairwells, elevators, floors, and basement niches full of electronic and mechanical equipment. The language of the building became known through the clamoring pipes, buzzes, whistles, and incessant whirs. Additionally, electromagnetic signals made audible with the use a special field recorder, and are recorded from different parts of the building such as the roof’s weather station, hallways, stairwells, and elevators. As radar uses various radio frequencies that all exist on the electromagnetic spectrum, the usage of EM signals not only offer a conceptual link with the technologies employed in weather research, but also capture a facet of experience that remains largely out of our human perceptions without the aid of specific technologies.⁹⁰

On the receiving end, a laptop running Max 7, Ableton, and Gstreamer, incorporates various generative techniques that ensure most of the audio portions of the project will never repeat. A constantly evolving auditory situation is presented, however, within the timeline of

---

⁹⁰ Christina Kubisch is a German composer and artist working with sound and has done extensive research with electromagnetic signals. Her work includes many installations, customized headphones, performances, and the design of sound walks that explore the electromagnetic fields in various cities. Her work is undoubtedly an influence for this project.
the composition, location recordings made days earlier in the area are inscribed into the audio work. The opening or revolving of doors, various footsteps, birds, or ground-level ambience of the site serve as backbones that help ground the piece and provide perceptual ambiguities between the recorded or the actual to arise. Additionally, as a method of inscription, a recorded electroacoustic album will be created as a document, allowing the project to be experienced after the installation is completed.

The original impotence of the work was born out of the desire to explore different technologies related to mapping. As an artist working primarily with sound as a medium, the realm of the visual is often purposefully downplayed in order to emphasize the auditory dimension. When working with or listening to sound, I feel it is not always easy to distinguish what I am experiencing. Often, “I am lost and safe,” stimulated in perceptual field of intensities, fluctuating with each second, breath, movement, or sound. Without knowing what will come next or the origins of a sound, the listening experience can promote a sense of openness, imagination, and dynamic engagement with the moment.

Moreover, sounds dissipate, modulate additional sounds, become infused with other sounds, become incorporated and reflected by actual objects, and pervade and surround spaces. The physical characteristics of sound are observed as wave phenomena. Don Ihde describes sounds are often “translated into various visual forms through instruments” and these

---

91 Although inscription typically refers to physical carving or trace, as in the early methods of audio recording technology like vinyl records and magnetic tape, I use this term to suggest a fixed document. For more on the history of recording technologies, consult Jonathan Sterne’s *The Audible Past: Cultural Origins of Sound Reproduction* (2005).

92 This is a reference to the Book’s 2003 album, Lost and Safe.
instruments are “extended embodiments” of the “scientific enterprise”. The modern form of weather mapping — radar, or RAdio Detection And Ranging — illustrates one of the many ways that wave phenomena are translated into the visual patterns. Like an oscilloscope, the translation of sound to vision aids in the technical understanding of the physical qualities of sound. However, radar uses a process of radio echo-location to monitor various materials in the atmosphere. Initially radar was not used for meteorological purposes but for the detection of obstacles and targets in navigation. In the 1930s, radar efforts were applied for aircraft detection, extending the predominant military situation that already demonstrated practical experience with radio technology.

During WWII, MIT played a crucial role in the development of radar technologies. By the early 1940s, much of the military use of radar occurred at the Radiation Laboratory, formerly Building 20. Throughout the research, interference complicated accurate read-outs of enemy and allied ships and planes. It was later discovered that the unexpected echoes that populated the radarscope were in fact due to meteorological phenomena, birds, and insects. In 1946, the Weather Radar Research Project was initiated in the Meteorology Department at MIT. The rising skyline of Cambridge caused interference, and as response, Building 54 (The Green Building) was designed and built in 1946. The creation of the new building was a response to the growing need to support research of the Earth Sciences; one of the key

---


aspects being implementations of a radar antenna and a weather station situated on the building’s roof.

Originally anticipated as a temporary meteorological laboratory, the roof still supports a wide range of research through various apparatuses. These include a platform for radiosonde deployment, a theodolite, an anemometer, rain gauges, and various radio equipment. There are two spherical Radomes, the largest being 25 feet tall which encloses the long distance weather radar antenna. To minimize interference with radio signals, other buildings within MIT’s campus are less than half the height.  

Standing at 295 feet, The Green Building is currently the tallest building in Cambridge. To maximize height while circumventing city ordinance, the design incorporated a 2 story raised walkway at the ground floor, with the first occupied floor nearly 30 feet above grade. The exterior walkway created strong wind-tunnel effects, and as a result, revolving doors were later installed. This loggia is the site of the sound installation.

---

95 The towers of Eastgate, Westgate, and Macgregor House, are exceptions as they are required to be at least 1470 feet away due to their height.
Ground Level walkway of the Green Building, 1964. credit: MIT Facilities Archive
Fourteen weatherproof speakers are arranged to incorporate the building’s architecture in various ways. Four speakers are located on each of the four main concrete columns with a system of pipe clamps, u-bolts, and welded support plates. Two speakers are attached to the East and West curtain walls, and two attached to an overhead beam at the North and South entry ways. Four additional speakers are placed out of sight and sit on top of the revolving door. One main speaker placed in the center of the walkway, suspended from the ceiling at four points, while a smaller speaker is directed at the ceiling and rests on the backside of the larger. While many students, researchers, and various MIT personnel pass through this space daily, I observe it to be an opportune space to provide a sensitivity and awareness of the architectural experience by deploying a creative use of sound.

Multiple dynamic aspects of the building, and its operations, both human and technological, are brought into relation in order to learn more about the detailed simultaneity of daily life. Like a synoptic weather map, the work aims to encompass the language of the building while changing the presence of a space through sound. In contrast to synoptic, I use the synsonic to situate the mapping process in the realm of the sonic. Here, sound operates as a sensorial conduit for multiple instantiations of places and times, being carriers of past and future and amplifying collective complexities. Salomé Voegelin says that the notion of time in sound is neither time plus space, nor time opposed to space:

Sound prompts a re-thinking of temporality and spatiality vis-a-vis each other and invites the experience of ephemeral stability and fixed fluidity.\(^{97}\)

---

\(^{96}\) The etymology of the work synoptic comes from the Greek words “syn,” meaning “the same” or “together”, and “optic” meaning “visible,” literally meaning, “together visible”.

\(^{97}\) Voegelin, *Listening to Noise and Silence*, 124.
Synoptic maps arrange multiple relational ideas onto the same plane in order to provide a specific reading of a particular time. The reading helps to determine how meteorological phenomena like air pressure, wind, and temperature are in balance, and helps to anticipate inclement conditions when the variability of the atmosphere is out of sync.

While I enact a process of charting the building through ephemeral qualities of history, time, and sound, the continual process coheres a broad range of scattered ideas and events. I avoid a narrative cohesion in order to emphasize multiplicity. Upon spatial audition of the audio, we as listeners are constantly and intersubjectively enacting a process of mapping, of being aware and sensitive to the on-going, ephemeral unfolding of existence.

_Ephemeral_ is defined as something short-lived or lasting for a very short time. In contrast to notions of impermanence with permanence, and non-being with being, here, I am emphasizing ephemerality as a conditional quality of experience. In other words, although the constitutive nature of something in question may be altered over time, the experience of something may be regarded as persistent in some way. The sun's electromagnetic energy persists twenty-four hours a day, though the amount of light that permits us to see in fluctuates with the rotation of Earth. Our position and the time of day make the optical variability entirely relative. The flow of a river is constantly changing, but we often regard a river as the same river we perceiving.98 Weather, too, though occurring continuously, is different from day to day, and hour by hour. It is rarely ever isolated from time, geographical location, and especially the

---

98 The Greek philosopher, Heraclitus, (500 BC) is quoted with the aphorism, “No man ever steps in the same river twice, for it’s not the same river and he’s not the same man.” _Panta rhei_, is roughly translated as “everything flows”.
inhabitants of that place. Humans have always attempted to gain a better understanding of seasonal shifts in order to more accurately plan for harvests and protection from the elements. Perception of weather and the ways we experience it, is inherently embodied and spatial, but not at all fixed.

Synoptic diagram, José A. Rivera, 2017
To chart means to make a map of specific location. Also thought of as a graph, diagram or a table, a chart not only presents stored information in a graphic manner, but only records or traces a process. In the case of early weather observations that attempted to depict wind direction or seasonal patterns, or the common top-100 lists that reflect a song’s popularity, the procedural aspect of charting suggests an active recording\(^9^9\) of things that are in continually changing. Charting, in the case of this thesis, is less about the representation of what is observed, and more about experiencing procedural change. Experience here is not defined only in terms of perceiving a specific object or thing, but embodying a dynamic spatial situation that exists in relation to the perceiver(s).\(^1^0^0\) Thus, by charting the ephemeral, I argue for enacting an active and attentive process of perceiving and recording various processes of becoming.

The wide ranging proposal of Electric Streams of Wind (Silvering the Edges of Broken Clouds) employs many technologies and brings into relation multiple fields of inquiry. However, with an interest in cartography, sound, and the site-specificity of MIT’s Green Building, radar and the history of weather mapping immensely influenced how I understand my project. In addition to the technological dimension, the desire to incorporate a dynamic, collective, and experiential listening opportunity is informed by historical trajectories of cultural and scientific

---

\(^9^9\) Here, I’m drawing a link between recording as a noun and as a verb, similar to the act of capturing and listening to audio.

\(^1^0^0\) Embodiment relations are inherent throughout certain trajectories of phenomenology, especially in the work of Heidegger and Merleau-Ponty.
research. How, then, can inquiries into the history of weather mapping and its tools help us understand the way we perceive our environment spatially and temporally?

From texts and hand-drawn observations, to live streamed data representations and the instruments that made them possible, weather maps tell a story of interaction with space, time, people, and environment. By tracing the histories of mapping weather that include specific technological advancements, I will chart out how cartographic depictions of weather were created, understood, and shared. With a focus on the Western world before radar, other topics covered here include thematic and synoptic maps, the shifts from retroactive readings to forecasts, and personal observations to collective empiricism. In order to encounter the history of weather maps and contextualize their purpose and meaning, the history of meteorology must first be explored.

Although there are records of ancient civilizations observing and recording weather, it wasn’t until approximately 350 BC when Aristotle first arranged the first major systematic treatise on weather. Consisting of four volumes, his Meteorologica brought together his own theories with earlier observations from those of the Ancient Egyptians, Babylonians, and Greeks.101 Meteors, from the Greek meteors, meaning “high in the air”, described anything...
that fell from the sky or viewed in the air. This is where the science of meteorology its name.\textsuperscript{102}

In essence, \textit{Meteorologica} attempts to present natural philosophy as natural science, claiming knowledge of the atmosphere, the interaction of elements, and other meteorological phenomena such as rainfall, tornados, lightning, and thunder.\textsuperscript{103} Although the text includes many errors due to the lack of accurate measuring practices of the time, \textit{Meteorologica} remained the most authoritative reference for weather research until the 17th century.\textsuperscript{104}

During the centuries after the fall of Rome, the center of culture and civilization shifted to the Far East to places like India and Arab lands. In fact, recently recovered Iraqi writings dated as far back as 816-1009 AD, document abnormal weather during social and religious events.\textsuperscript{105} Despite similar resources, the available literature on systematic information from Eastern lands regarding weather remains vaguely unavailable and fragmentary. For the purposes of this thesis, the development of weather maps with a focus on the Western world and radar will be explored.

Although there were no significant contributions to the development to meteorology during the Middle Ages, there was an interest in observation demonstrated by individual

\begin{flushleft}


\end{flushleft}
journals and chronicles intended to anticipate weather. It wasn’t until the Enlightenment when discoveries and inventions helped to define the start of the modern era of human history by bringing about an advancement in the natural sciences. For example, the discoveries of new lands and the revelation of a spherical world offered a deeper understanding of the diversity of climates. The exploration demanded considerable progress with regard to astronomy, optics, navigation principles, winds, and the currents of the sea. During the 17th and 18th and into the 19th and 20th centuries, the techniques of collective observation posed interesting questions of spatial and social organization. Inevitably, something had to be synthesized from the multiple observations, and standardization had to be exercised to integrate a collective understanding of multiple observers and experimenters.

The shift from largely text-based observation to visual representations of weather was a result of measurements taken by technological advancements. It was only until the 17th century when the first weather maps were created as products of the tools constructed to measure natural phenomena. The most significant early instruments applicable to the development of meteorology at this time were arguably the thermometer, the barometer, the anemometer and wind vane, the hygrometer, and the rain gauge. In Europe at this time, The Royal Society was formed in London and Oxford which included people like Robert Hooke, Christopher Wren, Robert Boyle, Edmund Halley. One the most notable members was Robert Hooke.

---


108 Khrgian, Meteorology, 35
with making significant refinements to the meteorological instruments such as the anemometer, in 1663 Hooke published his *A Method for Making the History of the Weather* which contained the first comprehensive instructions on weather observing using scientific measurements. \(^{109}\) It also argued for the need for consistent results and that a network of observing locations would be necessary.

Edmund Halley, was well-known for developing methods of reducing large amounts of measured data to meaningful order. As a reflection of his marine observations as well as those by other English Navigators, his collected data enabled him to create what is now regarded to as the first meteorological map in 1686. One of the first contributors to what is known as thematic cartography, Halley’s geographical map covers the tropical and subtropical regions of the world, and depicts directions of prevailing trade winds and monsoons. \(^{110}\) Distinct from general reference and synoptic maps, which show a variety of spatial and geopolitical information at the same time, thematic cartography’s focus is to depict one specific theme or element on a base layer. \(^{111}\) Halley’s words very much affirm the early use of quantitative thematic cartography:


\(^{110}\) Ibid., 106.

To help the conception of the reader in a manner of so much difficulty, I believed it necessary to adjoin a Scheme, shewing at one view all the various Tracts and Courses of these Winds; whereby ‘tis possible the thing may be better understood, than by any verbal description whatsoever.  

As Halley would develop this use of thematic maps and between 1668-1700, he created another map to depict the variability of measurements by magnetic compass over the Atlantic ocean. Along with the comet that bears his name, Halley is widely recognized as key figures of early weather mapping. It would be another 150 years before the drawing of weather maps was a common practice.

Nevertheless, the early 18th century also proved significant as meteorological instruments were still being developed enabling breakthroughs that would affect how weather was understood and depicted. Even with these technological advancements, the early measurements were nearly useless unless the instruments and their data were interconvertible and comparable. The imprecision and unreliability of devices, lack of agreement among scales, and an inconsistency among published collections all limited the understanding of weather in the early 18th-century.

The dry spell of visually mapping weather following Halley’s first meteorological map was broken by H.W. Brandes. Built largely upon the work of Halley, in 1820 H.W. Brandes published the first daily weather maps depicting deviations from mean air pressure changes for

---


the entire year of 1783. Though it took 37 years to compile all the data, his work marks a significant point in cartographic history for being the first depiction of atmospheric pressure with isolines and a juxtaposition of wind and air pressure on the same map. By associating wind and air pressure, this map was a precedent for other synoptic composites that would later include temperature, cloudiness, pressure fronts, precipitation, and air masses.

Concurrently, Alexandre Humboldt’s chart of average temperatures was the first to depict isotherms, a term Humboldt coined for lines of equal temperature. By 1823, following the work of Humboldt and others, W.C. Woodbridge’s Isothermal Chart or View of Climates and Productions clearly shows the relationship of world climates and crops to mean annual temperatures. In his 1833 lecture Woodbridge states:

The foundation of geographical knowledge must be laid in a knowledge of the relative situation of places, and this, the pupils of our schools must acquire chiefly through the medium of maps. Indeed, it is only by this process of comparison, that the great objects of geography—the expansion of the mind, and the discipline of the reflective powers—can be attained.

In 1842, Elias Loomis created the first synoptic map which brought together air pressure data, temperature, wind direction, atmospheric conditions and precipitation. As a series of 13 hand colored, lithographed maps, his research especially integrated Espy's work with the

114 Mark Monmonier, Air Apparent: how meteorologists learned to map, predict, and dramatize weather (Chicago: University of Chicago Press, 1999), 20.


117 W.C. Woodbridge, The Introductory Discourse and the Lectures Delivered before the American Institute of Instruction, in Boston, August, 1833 (Boston: Carter, Hendee and Co., 1834), 212, 231.

readings of over a hundred observers to discover winds are neither wholly inward nor entirely directional. Loomis’ maps demonstrate a careful consideration for contrast, cartographic agency, and graphic knowledge.

The work done in the first half of the 19th century is marked by a significant shift from theoretical to empirical weather mapping and the desire to compare collective observations over greater areas of space. Though at that time in weather mapping history, observers were still using the post office to exchange information. However, during the 1840s, one of the most important discoveries, the telegraph, was being developed. By 1845, the first commercial telegraph initiated a shrinking of time and space that made it even more possible for meteorological data to be shared and transmitted across the country. Soon after, telegraphed weather data was used produce the first daily weather maps which, allowed for the earliest weather forecasts to take place. Physical infrastructures and organizing agencies began to emerge to address the growing the amount of synchronous weather data and the speed at which this data was collected. As a result, the purpose of weather maps shifted from individual and collective efforts in the sciences, to the operations of the government weather agencies.

---

119 Nebeker, *Calculating the weather*, 30.


121 Nebeker, *Calculating the weather*, 30.

At first, in 1870, the meteorological offices located in different cities were a part of the U.S. Army’s Signal Service. The first official United States weather maps were large charts plotted by hand and posted at War Department’s Signal Service meteorological offices in major cities. Though clearly for military research, the offices were nodes of communication, employing a connective, social framework that proved useful for warning the public of potential hostile weather conditions.

As accurate reporting and forecasting became increasingly necessary, the application of the airplane also brought specific benefits to scientific meteorology. The Weather Bureau could now map weather conditions in the sky, particularly benefiting the atmosphere sciences. As a result, airport stations became equipped with radio airways and teletype; the technologies that would eventually set the ground work for radar and the modern day data streams.

To sum up, charting the ephemeral suggests an active approach to experiencing and recording various processes that are in constant flux. Within this chapter, I have attempted to demonstrate how my site-specific sound installation, Electric Streams of Wind (Silvering the Edges of Broken Clouds), is a synsonic mapping, and brings into relation multiple dynamic systems of a location, its architecture, history, and technologies through sound. I have provided significant historical context with regard to MIT’s development of radar technologies, and MIT’s Green Building. Also, by tracing the development of weather maps, I discussed how various technologies promoted a shift from individual accounts to collective empiricism, how synoptic maps emerged, and how a networked infrastructure of electronic communication set the

---

123 Ibid., 20.

124 Mark Monmonier, Air Apparent, 74.
groundwork for radar and modern data streams. Overall, the role of the weather map evolved from a tool of science to a medium of sharing information across space and time. Like sound, weather is an inherently embodied and spatial — but not at all fixed.

View from the Green Building Rooftop, José A. Rivera, 2017
As we have seen, the embrace of science and technology, often reflects a god-like view of nowhere, total, and uniform. On the other hand, if geographic knowledge can assume a unity and body and mind, an embodied knowing focuses the attention on different, hybrid, and subjective qualities of mapping that render distinctions between the observer and observed. 125

As ways of thinking about space and technological advancements have evolved, so too have notions of how humans come to understand and map the world. Perhaps best understood as visual representations, maps provide a spatial understanding of things, concepts, conditions, processes or events in the human world. 126 A pictorial artifact facilitating spatial coordination tends to emphasize distance, direction, scale and shape. This allows geography to be known in some way for the purposes such as navigating seas, fighting wars, tracking famines, designing a city, or resolving property disputes. Maps are products of cartography, which is the academic and scientific quest that attempts to theorize how best to depict and communicate the value-laden information that exists within maps. Methods of production, intended usage, impact, and philosophies of maps have evolved throughout the span of human history. As extensive histories of cartography have been provided by JB Harley


and David Woodward, among others, my aim here is to examine the theoretical discourse of maps and situate this research within the context of sound and spatial studies.

By applying critical cartographic theory, the 21st century practice of sound maps will be analyzed from a historical perspective, highlighting contemporary reflections and criticisms. Finally, I will suggest a rethinking of the phenomenon of modern sound map and present an alternative understanding of an aural cartographic approach that emphasizes relationality, multiplicity, and embodiment. It is first necessary to define sound maps, and explain the cultural and cartographic milieus that allowed contemporary sound maps to emerge as a popular form of sonic investigation.

The contemporary notion of a sound map is an Internet-based, geographical platform that operates as an open archive format. In the past 15 years, sound maps have become an increasingly prevalent means of collecting sounds from the environment and allowing them to be publicly available for listening. Almost exclusively utilizing a point-and-click visual interface, modern sound maps include sounds that are marked with pins denoting the particular geographical location of the recorded sound. Unlike historical map making where maps were the products of a single cartographer, 21st century sound maps allow for multiple


128 In this thesis, “contemporary,” “modern,” “online,” and “21st century” are used interchangeably to describe the practice of sound maps that is closely associated with the rise of digital technology and the Internet.

recordists to upload and contribute sound files openly. These numerous geo-referenced sounds are typically unedited sonic snapshots of particular events, at particular locations in time. In a practical sense, sound maps are databases of recorded locations and provide some insight into the acoustic history of a place, with the potential to capture political, artistic, cultural, historical, and technological aspects of experience.

Jaqueline Waldock's research on the phenomenon of 21 century sound maps presents a thorough examination of many contemporary platforms.\textsuperscript{130} The motivations behind sound maps vary, as evident from the information available on each site. For example, the following description is from New York's Sound-Seeker:

\begin{quote}
Sound-Seeker is a map that privileges the ear over the eye. The project reaches across the city's geographic, economic, educational, cultural and racial divides. It is at once a historical record and a subjective representation of the city. It is what each user wishes it to be and it is ever growing, ever changing and totally interactive.

While acknowledging that the visual sense often dominates, and conscious of the fact that the internet is largely a visual interface, we strive to create spaces that engage ALL the senses, and the mind, in a truly interactive way.\textsuperscript{131}
\end{quote}

Sound-Seeker's claims of total interactivity and complete engagement with the sense is overstated. In contrast, sensorial engagement is limited engagement the zoom feature, which when activated by the ubiquitous scrolling action, reformats a satellite image, and populates a scaled view with additional sounds. Perhaps what is meant by interactivity relates to the user's ability to point-and-click, and so choose, which sounds and locations to be heard. Though


\textsuperscript{131} “About,” Sound-Seeker, accessed November 16, 2017, \url{soundseeker.org}. 
some amount of agency is necessary for a user to hear something, albeit the same amount required for online-shopping or a “like” on Instagram, the interactivity championed in most sound maps falls flat. The power to choose is different from the dynamic engagement that typically occurs during an interactive experience. How do certain sounds relate? What can this platform actually offer to the senses? It seems modern sound maps are less about interaction and more about being available as a sonic archive. Artist and researcher, John Kannenberg, expands on this point:

Sound maps based upon a point and click interface emphasize the importance of the archive over the importance of the cartographer’s relationship to the material. In their obsession with integrating user choice, these types of sound maps abandon the tradition of cartographic interpretation. The archive is the thing, instead of a specific interpretation of the material via a cartographer who seeks to communicate the sonic relationships that exist within the place being mapped.132

He continues by noting that if a user is asked to read a series of lists, search for a link, click, or adjust the scale in order to listen to the audio file, the experience is built upon the interface as a technology that “illustrate[s] another form of interpreting the world,” such as the clicked the image or text.133 Sound are removed from context, disrupting any meaningfully devised relationship between the captured recording and a particular place. Instead, the focus is on the individual sound as an isolated depiction as some segment of place. This does not mean that the sounds are any less interesting to hear, but any interactive notion of cultural, economic, or political relationality that sounds in space actually provide is lost and rendered to remain an archival document.


133 Ibid.
Though, like most online platforms, Sound Seeker does provide an open and semi-democratic environment, and is useful to allow people to understand that soundscape recordings are markers of place. However, as a result of lacking any coherent perspective of time, or any interpretive analysis of the selected sound file, listeners are often left to imagine what has been recorded and to speculate about its relational meaning. Sound Seeker’s claim that their platform is “reaching across the city’s geographic, economic, educational, cultural and racial divides” is over-arching and unfounded as it offers nothing beyond clicking on a geo-located image that triggers a sound.

In contrast, the Glasgow 3d Sound Map is a research project that attempts to make “sophisticated environmental sound maps which communicate both location-specific noise information, and the subjective effect of noise upon the listener.” They providing three aims of operation:

Aim 1 — Measure and analyse the emotional effects of noise sources upon listeners, including common individual stimuli and urban soundscapes.
Aim 2 — Develop a reliable means of automatically classifying urban soundscapes in terms of their emotional effect. Identify suitable sound descriptors in order to build robust method of classification from audio recordings.
Aim 3 — Develop a system of communicating information on environmental noise to the public using sound spatialisation techniques, based on audio recordings at a local level.

Instead of making overarching claims, this platform offers a novel approach to the intent behind its creation, and the goals are quite clear. However, like most Internet-based sound

---

134 The notion of the soundscape and of soundscape recordings are expounded upon in later pages.

maps, I believe this particular platform suffers from the Google-API map syndrome, which Kannenberg calls as “boring”.136

Interacting with a map has the potential to be much more of an engaging process of interacting with the environment through sound. Take the map as a physical object; it is a sensorial experience. When one holds a map, an awareness of touch is present due to the thickness in paper, and folds. Perhaps the age of the map suggests a certain delicacy is required for handling. It may also include the smell of the ink and discoloration of paper. Due to the visuality inherent in a material map, users simultaneously see particular locations as individual but also in relation to other locations illustrated in the map. As eyes scan across the map, possible handwritten type, color, and traces of production become apparent. The legend and scale are located, the lettering is translated, an intention of the cartographer is perceived, interpreted, and over time the interactive experience with the map reveals an embodied intimacy that often characterizes engagements with place.

But how and why did modern sound maps originate?137 Geographer, Chris Perkins, has noted that in the 1960s and 70s, scientific cartographic exploration was primarily focused on an empirical communication of information.138 By the 1980s, the authoritative method was threatened at a time when data were becoming much more readily available. Technologies greatly influenced the creation and disseminations of maps, allowing the public to have unique control over map production. The rise of digital mapping techniques replaced the printed page


137 Here, I draw a link with developments in cartography more generally.

138 Perkins, “Rethinking Maps.”110
by the display and freed the visual process of mapping from being constrained by material specifications. Furthermore, the rise of GIS increasingly replaced the mechanical aspects of cartographic production, such as lithographic or engraving methods, the use of color and specific inks, and durability concerns around particular papers. Imagery could be generated to provide frequent updates to changing contexts which animated maps. From the late 1990s, the Internet has enabled the widespread use of maps to be created and disseminated at low cost.

Perhaps, in conjunction with the rise of widely available personal recording devices, and a new generation influenced by the teachings of acoustic ecology, a suitable stage facilitated the modern production of sound maps to become a common method to collect, store, and geo-reference recorded sound.

The origins of sound maps have roots in the acoustic ecology tradition that emerged in the 1970s. Initiated by Canadian composer and researcher, R. Murray Schafer, many keen observations, concepts, and methods sought to critique what was understood as a diminishing acoustic environment. His impact traces a few key concepts that include a critique of the ocularcentrism of modern culture, the advocacy for a heighten awareness to combat urban noise pollution, and the soundscape. Through writings, curriculum outlines, ear-cleaning exercises aimed an increasing auditory perception, and the creation of a lexical framework for heuristic research, The World Soundscape (WSP) project was formed. As a collective of like

139 Schafer, “The Soundscape.”

140 Ibid., Analogous to the visual landscape, the soundscape is intended to privilege the auditory qualities of an environment through focused attention. Insisting that these sonic characteristics be considered as regular organizing components for how the environment is defined and perceived, the deep engagement with the soundscape provides insight into historical and persistent social relations between humans and the environment.
minded sonic researchers that included Hildegard Westercamp, and Barry Truax, among others, published audio recordings and books framed the group’s intentions and strategies aimed at increasing the public’s sonic sensibility. Such strategies included soundscape and oral history recording, listening exercises suited for children, ethnographic field notes, auditory charts of specific locations, and various types of sound maps.

Consistent with the ideologies practiced by the WSP, the early mapping investigations of the soundscape emphasized the sonic experience of a place and were not in fact visual. Truax, a prominent member of the WSP and notable for his ideas with regard to acoustic communication, calls these mappings *soundscape compositions*. Soundscape compositions are characterized by recording and organizing pre-recorded environmental sound in a way that communicates a unique understanding of a soundscape based on the listener’s past experiences. Soundscape compositions are social, political, and artistic endeavors that aim to preserve context of recordings and to change a listener’s relationship to the environment. *Soundwalks* are a type of soundscape composition, but defined by dynamically engaging oneself in space by moving through it. *Soundwalks* may or may not include the act of recording, and often take shape as public events to a particular place, or along a particular path. A map is created in the mind of the listener, simultaneously becoming composer, performer, and audience. Truax, along with other practitioners such as Westercamp, published many recordings labeled as soundscape compositions. One of the more well known of these

---


142 Ibid., 7.
works is Westercamp’s 1989 piece entitled *Kits Beach Soundwalk*. She describes the piece on her website:

> The original recording on which this piece is based was made on a calm winter morning, when the quiet lapping of the water and the tiny sounds of barnacles feeding were audible before an acoustic backdrop of the throbbing city. In this soundwalk composition we leave the city behind eventually and explore instead the tiny acoustic realm of barnacles, the world of high frequencies, inner space and dreams.¹⁴³

The ephemeral delicacy of the Vancouver shoreline are, as Salomé Voegelin describes, “at first explained, and then heard.”¹⁴⁴ Westercamp’s work provokes a particular kind of focused listening that Voegelin describes as “a microphonic bracketing of the Vancouver shoreline.”¹⁴⁵ Beginning with soundscape research and proceeding through soundscape composition and into fictional narrative, listeners are invited to construct personal fantasies of the environment. Westercamp removes aspects of the sound by use of various filters, simulating a sense of silence in the absence of city noise. Her narrative method guides us to particular sounds and thus is full of intention. Consistent with the theories pertaining to soundscape compositions, there is meaning that suggests something larger than the nonsensical qualities of the listened piece. An educational endeavor, the fantasy provokes the auditory imagination, but as listeners we are left with the full implications of sound and its relation to site.


¹⁴⁵ Ibid.
Annea Lockwood, a New Zealand sound artist, created a sound installation commissioned by the Hudson River Museum, entitled *A Sound Map of the Hudson River*. Created in 1982, the work provides additional historical context to the modern day sound map, consisting of a two hour aural journey of 15 recorded locations along the Hudson. The sounds of the river are mixed with recorded oral histories from the inhabitants along the riverbanks. This work suggests cartographic agency is closely aligned with the field of human geography in that Lockwood is presenting her own edited, lived experience of a particular traversal of geography. Kannenberg describes the piece as “linear and foregrounding sound as the primary user experience.” Even though it was accompanied with small visual map, the audio was the focus of the work emphasized by the duration of the recorded piece and multiple channels of diffusion.

Like many new technologies or practices, 21st century sound maps owe much to previous research. More specifically, modern Internet sound maps are laden with the attitudes and intentions reflected in the historical traditions of the WSP’s soundscape mapping studies and development of *acoustic ecology*. According to Jaqueline Waldock, modern sound maps must “tackle the hierarchies and assumptions that are carried forward by such developments.”

The developments Waldock speaks of refer to the soundscape work of the 20th century. I consider the soundscape movement to be outdated and am critical of how the movement advocates for an aesthetic moralism that enforces dichotomies between the rural and the

---


147 Waldock, “Soundmapping.”
urban, between pre-industrial and post-industrial sounds, and the conceptual spectrum of hi-fi and lo-fi. Furthermore, Andra McCartney’s paper, “Ethical Questions About Working With Soundscapes” critiqued the relationship between the rural and ecological. She notes that in both the act of recording and of that of acoustic ecology more broadly, the utopian notion of the hi-fi landscape suggests a close relationship to ideas of “authentic experience, of solitude, and of control of the environment.” The ideal hi-fi soundscape, such as an isolated rural prairie or a mountain top, includes discrete sounds that can be heard clearly due to a positive signal-to-noise ratio. In other words, sounds heard from near and far are experienced without obstruction. By contrast, sounds in a lo-fi landscape are more difficult to distinguish from one another due to a high amount of competing sounds, often resulting in noise. McCartney problematizes this duality, questioning the tendency to privilege the hi-fi soundscapes. Following McCartney, I believe privileging certain sounds and deeming others as bad or negative wrongly encourages that one must retreat away from urban domesticity to isolated areas to encounter ecological environments.

Described as a “beauty bias”, the embrace of the pristine is as Waldock notes, a reflection of a “strong appeal” towards “conservatism” and the “aesthetic temptation of the natural.” The attraction to the natural has manifested itself in countless soundworks situat


\[149\] Schafer, Tuning of the World.

\[150\] Waldock, “Soundmapping.”
in remote villages and rural areas. Though city based projects are increasing in number, the projects’ intentions are often to highlight and address the negative qualities related to urban noise pollution. More and more researchers and artists are seeking to address this beauty bias, but Waldock rightly questions whether or not the historical aesthetic moralism of acoustic ecology is being replicated within modern sound maps. Interestingly, though I observe that urban sounds seem to dominate sound maps across multiple platforms, it is unclear if the intent of the recordist is to capture a particular element of the soundscape deemed an important, interesting as a specific event, or the subject of critique in the case of urban noise.

Overall, Kannenberg argues that in order for 21st sound maps to become relevant again and break free from the “tyranny of the visual,” the linear time based soundscape compositional approach of Annea Lockwood should be once more embraced. Though there is some merit to this argument in that it touches on aspects of spatial mobility and direct experience, I believe Kannenberg's argument is overly limited in its conceptions of the ontology and possibilities of maps, map making, and map use. There is much to learn from the field of critical cartography that can inform the practice of sound mapping with an aim for the

151 The Five Villages Soundscape (1977) produced by the World Soundscape Project is perhaps the most well known of these particular type of sound works. The accompanying site research that included diagrams, maps, and photography can be found here: https://www.sfu.ca/~truax/FVS/fvs.html.

152 Waldock, “Soundmapping.”

153 In her article, Waldock expounds upon additional “ruptures” that the sound map may engender, including critiquing what can be seen as a male-dominated archive of sound, racial divides, issues of public/private, age, and questions concerning democracy and access of technology.
sound map to be redefined as a more embodied, and dynamic instantiation of aesthetic and cultural experience.

As I have previously illustrated, contemporary online sound maps are extremely limited in their approach to engage listeners in dynamic and provoking ways. Informed by historical and contemporary studies in critical cartography, experimental sound practices, spatial studies, I seek to problematize the static notion of a sound map. By emphasizing embodiment, relationality, and multiplicity, a sound installation is as synsonic mapping that co-creates space, encouraging the act of listening as practice of process cartography.\textsuperscript{154}

Critical cartography is a growing philosophical field of analyzing maps and how they are created, perceived, viewed, and used.\textsuperscript{155} The focus of study is maps themselves, as an expression of the personal experiences and philosophical thoughts of their viewers and creators. Some subjects of academic study of critical mapping theory explore the practice and existence, hermeneutics, performative and embodied notions of maps.\textsuperscript{156} While maps may be common and user-friendly tools of interaction, maps are never simply objective reflections of

---

\textsuperscript{154} Blurring the line between map making and map use, \textit{process cartography} is a term used by Tim Ingold (2000) to stress the dynamic nature in which human beings come to know and be in the world. I use it here to draw a link with the act of listening as a way of knowing, and the constant mobility of sounds that are never fully formed, but emerge in a process.

\textsuperscript{155} Denis Wood provides a further analysis of the field in his text co-authored with John Krygier, “\textit{Cartography: Critical Cartography}” (2009).

\textsuperscript{156} Matthew Rangel, \textit{Journeys beyond the neatline: expanding the boundaries of cartography} (Alberta, NM: University of Alberta Press, 2010), 8.
the places they record, but are complex manifestations highly colored by the political, social, and cultural conditions, by the intentions of the makers. Though generally regarded as objective representations, it is important to note that maps do not always provide the most reliable means of measuring or marking position. 157

Philosophical thought pertaining the nature of maps is valuable because it frames how humans produce, understand, and utilize maps. It helps to determine our assumptions of how we measure and know the world, and reveals mapping as both epistemological and ontological.158 Cartography is method by which knowledge can be produced, and a set of assertions about the environment and our relationship to, with, and in it can be put forth. New ideas mapping emerged in the 1980s, that began to view maps as a discursive process as a shift from the more technical search for generalizing and ordering the environment. The novel theoretical ways of addressing mapping embraces the power and communicative value of the medium, emphasizing deconstruction and the socio-cultural impact of cartography. 159

Cartography as a science seeks to present truth about a location with a degree of precision. A pioneering figure in challenging an objective, map as truth perspective, was JB Harley. In the New Nature of Maps, Harley's collected essays challenge how mapping operated as a scientific convention of cartographic research. Emphasizing power and intent, Harley illustrates the roles that maps played in different societies, describing a process that often perpetuated an agenda of the State, and reinforced the status quo or interests of the powerful.

157 Ibid., 9.
159 Ibid., 4
Following the poststructuralist theories of Derrida and Foucault, Harley argued for the need to position maps in their social and historical context so to better understand or exert the forces at play.¹⁶⁰

Though farming, wars, constructing buildings, paving roads, fishing, and drilling for oil are well understood ways in which humans affect the environment, making maps not only provide a record of these processes, but also provide a way of navigating this affected space. Additionally, places are planned and built on the basis of maps. This challenges the common held belief that maps are representations of space by suggesting that space itself is a manifestation of the map. Thus, as landscape architect James Corner notes, “differentiation between the real and the representational is no longer meaningful”.¹⁶¹ In other words, maps and territories are co-constructed; maps are not a reflection of the world, but a recreation of it. Here, the territory is activated by the map. Additionally, Corner argues that maps are unfolding potential, and operate as conduits of possibilities — as imaginative sites of action in the world:

The function of maps is not to depict but enable….mappings do not represent geographies of ideas; rather they effect actualization.¹⁶²

Mapping is an active process of gathering, working, reworking, assuming, relating, sifting, and speculating…in order to allow certain sets of possibility to become actual.¹⁶³ If a territory is remade over and over again with a new map, multiple outcomes emerge. Maps are


¹⁶²Ibid., 225.

¹⁶³Ibid., 228.
re-territorializations and operate as a double projection, both capturing elements from the world and also returning a variety of effects through their use. The agency of maps as Corner suggests, does not lie “in thick reproduction of imposition, but in the uncovering realities previously unseen or unimagined”. Furthermore, he argues that cartographic research and practice ought to focus on how maps perform and how they are used rather than solely on how maps are made. Mapmaking and map use are procedural in nature, being both embodied and dynamic. Following Corner, I view maps as a set of cultural practices that exert actions and affects, and embrace performance and mobility over essence and static objecthood. 

Also regarding cartography as embodied cultural practice, anthropologist Tim Ingold makes a further distinction between mapping, mapmaking and map-use. He explains map-use as navigation by way of plotting a course from one point to another. On the other hand, the practice of mapping, or the act of way-finding, involves moving from one place to another in a region. He claims mappings refer to itineraries of the inhabitants rather than to detailed locations of places, and therefore operate as condensed histories of activity rather than representations of spaces. Western cartography, according to Ingold, “transforms everywhere-as-region, the world as experienced by a mobile inhabitant, into every-where-as-space, the imaginary ‘bird’s-eye-view’ of a transcendent consciousness.” In other words,

164 Ibid., 213.


167 Ibid., 220.

168 Ibid., 203.
people’s experiences are erased from the map, and the structure of the world is fixed without regard to the movements and actions of its inhabitants. This leaves cartography “still and silent”—not a world in the making, but one that is “ready-made for life to occupy.”  

Western maps made during the Middle Ages transcended the depictions of expressions of paths and focused on representations of space. According to Ingold, people live in everywhere-as-region and create reality as they go. They are constantly mapping as they move through places, employing a form of process cartography.

Poststructuralism greatly affected the ways in which cartography could be understood and utilized. As previously mentioned, Harley drew on the theories of Foucault and Derrida to question and deconstruct the power relations laden in maps. Following Deleuze, Guattari and Judith Butler, Vincent Del Casino and Stephen Hanna argue that maps are mobile subjects, whose meaning emerges through socio-spatial opacities of use and mutate with context. As a process of becoming, the map in this sense is not fixed. Instead, it is constantly modified where each encounter with the map produces new meaning and engagements with the world. Del Casino and Hanna claim maps simultaneously operate as both representations and

---

169 Ibid., 242, 235.


171 Ingold, Perception of the Environment, 242.

practices and are never fully “inscribed with meaning” or “acted out”. In this way, one can begin to understand maps as:

...not simply visual objects ripe for deconstruction, but as tactile, olfactory, sensed objects/subjects mediated by the multiplicity of knowledge we bring to and take from them through our everyday interactions and representational and discursive practices.

The embodied, multimodal experience of a map is the object of my current artistic practice. Sound maps, as a means to provide embodied information of an environment, should be rethought as a process — a multichannel audio installation that provides a dynamic spatial experience. Deep listening is a performative act that produces meaning upon engagement, and as a result, re-situates listeners’ attention to the present moment. Like sound and weather, maps are seen as transitory and fleeting. Thus, the sound installation is considered an aural cartography in practice, a synsonic mapping, an embodied spatio-sonic process enacted to address relationality with an architecture, its history, and the bodies that occupy it.

---

173 Ibid., 36.
174 Ibid, 37.
Conclusion

Throughout this thesis, I have attempted to show that how I have understood maps marks a shift from representation, to experience. Informed by spatial studies, I’ve examined how sound’s physical operations shed light on how we, as social beings, relate to others and know about the world. I’ve introduced certain experimental sound practices as a means to include positions of openness, of questions, uncertainty, and of discovery. By tracing the development of weather maps, I discussed how various technologies promoted a shift from individual accounts to collective empiricism, how synoptic maps emerged, and how a networked infrastructure of electronic communication set the groundwork for radar and modern data streams. I’ve illustrated the role of the weather map evolved from a tool of science to a medium of sharing information across space and time. Like sound, weather is an inherently embodied and spatial — but not at all fixed.

And finally, I’ve interrogated the sound map in its historical and contemporary forms, and suggested that the static nature of the online platform undermines a map’s capacity to engage one with place. A critical analysis of the sound map was put forth and I argued for a particular cartographic process as an interactive, multichannel audio installation.

I have shown that mapmaking and map are procedural in nature, being both embodied and dynamic. Such a position also embraces maps as set of cultural practices enacting actions and affects, and embraces performance and mobility as opposed to essence and material stability.
Charting, in the case of this thesis, is less about the representation of what is observed, and more about experiencing a process. Experience here is not defined only in terms of perceiving a specific object or thing, but embodying a dynamic spatial situation that exists in relation to the perceiver(s). Thus, by *charting the ephemeral*, I argue for enacting an active and attentive process of perceiving and recording various processes of becoming.

An embodied, multimodal experience of a map is the object of my current artistic practice. I argued that deep listening is a performative act that produces meaning upon engagement, and as a result, re-situates listeners’ attention to the present moment. Like sound and weather, maps are seen as transitory and fleeting. Thus, the sound installation is considered an aural cartography in practice, a *mapping*, an embodied spatio-sonic process enacted to address relationality with an architecture, its history, and the bodies that inhabit it.
illustrations

14 // Brady Lake_ac5, José A. Rivera, (2011)
40 // Installation view, José A. Rivera, Reflections of A Thousand Faces, (2015)
43 // Installation view, José A. Rivera, Reflections of A Thousand Faces, (2015)
59 // Recording the rooftop of the Green Building, José A. Rivera, (2017), 1
     // Recording the rooftop of the Green Building, José A. Rivera, (2017), 2
65 // Ground Level walkway of the Green Building, MIT Facilities Archive, (1964)
68 // Synoptic diagram, José A. Rivera, (2017)
78 // Image from the rooftop, José A. Rivera, (2017)


Halley, Edmund. “An Historical Account of the Trade Winds, and Monsoons, Observable in the Seas between and near the Tropicks, with an Attempt to Assign the Phisical Cause of the Said Wind.” 183 (1686) of the Philosophical Transactions of the Royal Society. French Translation of Bibliothèque universelle et historique. 4 (1687): 66-93. [Rare Books Division].


