Hearing Motion in the Moment: New Approaches to Sound-based Mapping

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ABSTRACT

Hearing Motion in the Moment: New Approaches to Sound-based Mapping

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This dissertation frames and describes my research-creation project, which involved building three interactive sound-based mapping interfaces that challenge how we listen to and make meaning from urban sounds. *Old Montreal's Acoustic Labyrinth* is a marble-maze game that allows listeners to explore a simultaneous recording of the Basilica Notre Dame's bells from six different locations. *Street Ears*, a GPS-enabled smartphone app, gives listeners the opportunity to navigate the acoustic environments of two Montreal neighbourhoods—from anywhere in the world. Finally, *168 Hours* is a large clock-like interface that encourages listeners to remix time by playing with snippets of a continuous, week-long recording from a single location in Montreal's Milton Park. Each of these interfaces draws listeners' ears to a different aspect of the aural environment: how sound is shaped by architecture, how space creates points of sonic transition, and how durational listening reveals unexpected patterns and textures that give new meaning to familiar sounds.

My project makes contributions to theories of mobility, space, and place by developing an approach to listening that challenges presumed hierarchies surrounding "good" and "bad" sounds. I interrogate institutional representations of urban sound as they relate to questions of power and authority, advocating for more grassroots

approaches to sound-based mapping. The introductory sections to this document establish the theoretical and methodological frameworks for the project as a whole; the three main chapters detail the conceptual and practical aspirations of each mapping interface. In the conclusion, I consider the relationship between maps and stories and encourage my readers/listeners to embrace a new approach to urban sound. Drawing from the fields of Sound Studies, Cultural Studies, and Critical Cartography, this dissertation refigures the role sound has in shaping our sense of place and demonstrates how the acoustic environment structures our daily lives.

Most importantly, thank you to my supervisor, Kim Sawchuk. This journey has not always been easy, and I could not have done this without your support—not only by constantly introducing me to new ideas, authors, and methods—but also for creating opportunities both inside and outside of academia that allowed me to further my research and share my work with others (literally) around the world.

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Introduction

> "The acoustic city transcends the limitations of the human ear;
> its full resonance eludes even the most ardent of listeners."
>
> -Matthew Gandy, *The Acoustic City*

How does a city represent itself through sound? The year-long series of

arts-based programming surrounding Montreal's 375th anniversary in 2017 garnered

extensive media hype, so it is important to consider the sounds they included (and

excluded) as part of this celebration. Public sound-art and musical performances are a

common feature of Montreal life. There are seasonal installations downtown that

feature interactive sound-making devices—seesaws in the winter, and swings in the

summer—that invite Montrealers to engage with space physically to create a shared

aural experience.[1] There are also public concerts and open-air festivals held year-round,

such as Picnique Electronique in the Summer or IglooFest in the Winter. There is also

the informally organized 'Tam Tam' drum circle held weekly on the Eastern side of

Mount Royal, and the seemingly inexhaustible cycle of concerts and events held almost

every month in the Quartier de Spectacles. All of these events contribute to our aural

understanding of Montreal, but do they really represent the 'sound' of the city? Where

are all the sounds we experience as part of our day-to-day life in Montreal?

The City of Montreal released a short promotional film called *This Year's Recap*

summarizing the 375th anniversary celebration. This video features images of at least 15

different musical performances intercut with dancing crowds and other artistic and

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[1] The Quartier des Spectacles is committed to presenting interactive public art, with their Winter *Luminothérapie* installations (which in 2017/18 featured see-saws), and the swing-based *21 Balançoires* each Spring.

cultural events, all of which are silent behind the upbeat electronic score. This video

seems to say: "This is Montreal!! Home of live music, happy audiences, and amazing

public art." However, outdoor musical performances and festivals are not the only forms

of sonic cultural production that people associate with Montreal. For example, the

recent Leonard Cohen retrospective (*A Crack in Everything*) at the Musée d'Art

Contemporain points to Cohen's status not only as a musical icon, but also one whose

catalogue has become part of the cultural identity of Montreal.[2] Of course, Montreal's

high per capita population of artists means there are a large number of musical groups

that call this city home, such as Arcade Fire, Godspeed You! Black Emperor, and

Chromeo, to name just a few off the top of my head, but the sonic identity of a city is not

defined by music alone.

    Who decided that these particular sounds and events would represent Montreal?

There is a dynamic of power at play here. This video is an attempt by the City to brand

the city, and solidify a single point of entry for Montreal's cultural identity. The City is

clearly trying to promote an idealized version of Montreal.[3] Fun, flashy concerts with

happy fans dancing along—it doesn't even matter who the performer is, thanks to the

upbeat music in the background. However, this representation does not fully reflect the

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[2] The Cohen retrospective had one piece in particular that most interestingly reflected his ties to Montreal. Candice Breitz's *I'm Your Man (A Portrait of Leonard Cohen)* featured the cantor and choir from Cohen's synagogue alongside 18 local fans (sourced from a public call to all men of roughly Cohen's age) singing their own interpretations of songs from Cohen's 1988 album, *I'm Your Man,* all playing simultaneously on individual video screens. By including regular Montrealers, this collaborative installation highlighted the ways in which Cohen's status as a musical icon affirms his impact on the sonic identity of the city. That said, the artist's decision to only include participants that closely matched Cohen's age/race/gender raises concerns which tie in with my concerns surrounding the limitations of institutionally sanctioned representations of Montreal identity.

[3] The sanctioning of 'official' representations of Montreal sonic identity by the city is echoed in the 2017 unveiling of a nine-storey mural of Cohen in the heart of downtown, overlooking the tourist bar strip along Crescent and Bishop Streets.

day-to-day experiences of people living in Montreal. Where is the traffic? The crush of pedestrians along a busy street? Pealing of bells from local churches? Ice floes crunching along the Saint Lawrence? Or even the beeping, clanging, and pounding of never-ending urban construction? What I believe to be *the* or even *a* notable sound of the city is different from what someone else may think. Not surprisingly, how we define the importance of any particular sound is an individual choice, and a rather subjective one. In a conversation with Stuart Fowkes, founder of *Cities and Memory*, he remarked on how he loved listening to binaural recordings from the Formula One races. I was struck by this comment. For him, this was *the* quintessential sound of Montreal: powerful cars speeding past the ear. However, this was a sound I had never experienced directly (in fact, for me, the sound of the Formula One is the rowdy street fair held on Crescent Street). Personally, I never tire of hearing the bells from several parishes ringing out around my apartment. Some closer and more present, others wafting in across many blocks—sharper and more distinct on a cold winter day, swept further away from the ear by wind, or shimmering in new ways during a light rain or snow shower. Each person has their own favorite sounds, and these sounds shape our understanding of place.

However, the meaning behind an understanding of place is shaped by an individual's positionality and personal experience.[4] They may share one level of constructed meaning (identifying as a member of a particular community, or public), but part of the multiplicity of place is its multiplicity of interpretations. Any 'sense' of place is constructed through individual interrelationships with layers of meaning, that

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[4] I understand that this is an overgeneralization, but this notion of positionality and experience constructing individual meaning is an important one, particularly as I move into the development of place attachment later in this chapter.

are not necessarily available to all—by choice or through other factors of race, gender,

dis/ability, and class (and millions of other factors that can impact people on individual

levels). In Montreal's 375th promo video, representations of place are being defined by a

political institution: the city's public relations team, who have a specific agenda

regarding how Montreal is represented to the the general public. In contrast to this

official, institutional representation, grassroots, or community-oriented projects are

rearticulating the meaning of a place, or even turn a previously (or officially)

unarticulated space into a place. For instance, the urban wild in the Northeast Mile End,

Le Champ des Possibles, has only recently been identified as a 'real' location (as a public

greenspace) by the City of Montreal after years of community-based opposition to

commercial redevelopment and citizen-oriented use and upkeep. I have been working

for the past few years with Concordia's Jill Didur on a locative media application

exploring the history of this non-place, and it is a powerful example of the impact

community groups can have in (re)defining Montreal (*Global Urban Wilds*).

So, how do we learn to listen to the 'sound' of Montreal? I believe every sound

event has the potential to conjure up a specific image of the city. This dissertation puts

forward alternative sonic representations of Montreal, using interactive sound maps to

challenge the way individuals listen to the city. These maps demonstrate how dedicated

attention to urban sounds can change our relationship to a sound environment and

shape our understanding of place. In an effort to discover this unarticulated, intangible

cultural component of urban life, the three maps in this project explore some day-to-day

experiences of Montreal: the peal of a church bell, the tensions and transitions of a busy

intersection, or the near-constant buzz of activity in the shadow of McGill's downtown campus. The maps I have constructed challenge listeners to listen to the roles of architecture and the lived environment, movement and mobility, as well as time and temporality in our construction of the meaning behind place attachment in the eventscape. However, before describing these interfaces, it is first necessary to define how and why we listen to the urban sound environment.

Within this introductory portion, I will first delineate the difference between a soundscape and an eventscape, then I will introduce the notion of dedicated listening, define my understanding of place, and describe how and why we navigate through places based on sound. Next, I will introduce the field of critical cartography, and work through how a critical cartographic approach can be applied to sound-based mapping projects. This section will conclude with a short introduction of the concepts of movement and mobility and a discussion surrounding their relationship to sound and place followed by a description of the three main chapters of this dissertation and a concluding statement.

Key Concepts:

From Soundscape to Eventscape

Throughout this dissertation, I use the term "eventscape" (Blesser and Salter) to describe the variety of sound events occurring in and through a particular space, ideally assisting in its transition to *place*. My usage stems from a combination of Barry Blesser and Linda-Ruth Salter's work on aural architecture and Stephen Feld's concept of

"acoustemology" (12). I was introduced to these concepts while studying acoustic ecology during my MFA. My framing of acoustic ecology is somewhat broad: quite simply, a study of the role of sound within a larger ecological construct. However, the history of this term goes back to the early 1970s with the formation of the World Soundscape Project (WSP) at Simon Fraser University. The WSP was spearheaded by R. Murray Schafer, who popularized the term 'soundscape,' and created a (somewhat troubled) conceptual framework for talking about the sonic environment. Schafer's 1977 book, *The Tuning of the World* (re-published in 1994 as *The Soundscape*) guides listeners toward opening their ears and trying to hear the acoustic environment as a musical composition. Schafer suggests that we, as listeners, also own responsibility for the creation of this composition (205). The difficulty I have with Schafer's framing of the 'soundscape' comes from the value-based judgements he makes regarding good and bad sounds. This judgement is already implied in his use of the term 'composition,' which privileges dominant Western notions of art and aesthetics. This good/bad binary is heavily skewed toward favouring rural or 'natural' sounds and dismissing urban or technological sounds as being unworthy of inclusion in this composition.

Over the past two decades, critiques of the term 'soundscape' have become very easy to find (cf. Sterne (*Soundscape Landscape Escape*), Ingold, Helmreich, Kelman). It seems I am not the only one who finds issue with the ways in which R. Murray Schafer has framed this term. In his original popularization of 'soundscape,' Schafer is very broad, referring to it as "[t]he sonic environment. Technically, any portion of the sonic environment regarded as a field of study" (274). But his definition becomes more

problematic when Schafer establishes binaries between hi-fi and lo-fi soundscapes—setting up a dialog of good versus bad sounds that are almost universally associated with rural and urban soundscapes, respectively. This aversion to urban sound environments, and the objectification of sound environments (treating them as a composition to be analyzed) stands in direct opposition to my intentions with these soundmapping projects, where my goal is to develop a process-oriented approach toward urban listening. By defining the soundscape as an aesthetic object, rather than a dynamic environment, Schaferian soundscape studies become objective, not experiential (Ingold 10).

While Schafer's work has been a major influence on how I (and many, many others) think about sound, the way I engage with acoustic ecology comes more directly from the work of WSP collaborator Hildegard Westerkamp, who is less prone to making value judgements about sounds. In "Linking Soundscape Composition and Acoustic Ecology" she writes: "We are the ones that make listening and working with sound and music our profession. It is therefore a logical extension that we would also be concerned about the ecological health of our acoustic environment and all living beings within" (52). For Westerkamp, acoustic ecology is not about composition (per se), but rather about our relationship with all other living things in the same environment. Westerkamp's framing of acoustic ecology redefines 'composition' not as a fixed aesthetic object, but rather as a fluid, relational network of sounds. We (every living thing) have a part in the construction and reception of the aural environments we inhabit, occupy, and move through.

In *Spaces Speak, Are You Listening*, Blesser and Salter outline four key terms that I will use to describe sound in these projects: "sonic event (15)," "acoustic arena (22)," "acoustic horizon (22)," and "eventscape."[5] A sonic event is a single sound object interacting with space[6]—the caw of a crow, for example. The acoustic arena is the interaction of sound events within a defined spatial area: a murder of crows all talking among the whispers of the wind through the trees. The acoustic horizon is how far any given sound might be heard within a given acoustic arena. This horizon can change on an event-by-event basis due to other louder events masking or overpowering them. For example, it will be harder to hear as many caws or the subtle sound of the wind when a large truck drives by. Simply put, outside its acoustic horizon, a sound cannot be heard. The eventscape is the culmination of all these variables: the interaction of discrete sound events among multiple acoustic arenas (each with varied acoustic horizons), the spaces surrounding them, and the places they inhabit. Blesser and Salter set up the notion of sound as an active event, not a static object, and define the term eventscape in contrast to Schafer's soundscape, writing: "because we perceive dynamic events aurally, Schafer's soundscape—consisting of keynote sounds, sound signals and soundmarks—is actually an *eventscape*. The focus of hearing is on dynamic events" (*Eventscapes* 94). In pointing out the limitations of Schafer's object-oriented "soundscape," Blesser and Salter suggest a shift in terminology that can account for the experiential, durational

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[5] While Blesser's website references this text as the source of this term, 'eventscape' does not actually appear in the book. Even as late as 2009, Blesser was using 'soundscape' and 'eventscape' interchangeably. The first published use of the term appears in the Amsterdam Academy of Architecture journal, May 2010 under the title "Eventscapes: The Aural Experience of Space" (93-100).
[6] Blesser and Salter are writing from a perspective more directed toward the built environment, and the process of artificially re-creating the relationship between sound and architecture. As a result, many of his definitions use the term 'aural architecture (15),' as opposed to 'space.'

qualities of sound environments. Their eventscape takes into account the fluid and

dynamic relationship among all sounds in any environment, rural or urban, while

focussing attention to their value as events, not objects.

Steven Feld's approach to "acoustemology" is a useful extension of Blesser and

Salter's eventscape. Feld conceives of sound as *living* in space and listening as an

experience *requiring* space. According to Feld: "Acoustemology joins acoustics to

epistemology to investigate sounding and listening as knowing-in-action: a

knowing-with and knowing-through the audible" (12). Here, Feld begins to articulate

the ways in which the experience and interpretation of the aural environment resonate

on an emotional level: our ways of knowing *through* sound and the ways in which sound

shapes our lives. "Acoustemology begins with acoustics to ask how the dynamism of

sound's physical energy indexes its social immediacy. It asks how the physicality of

sound is so instantly and forcefully present to experience and experiencers, to

interpreters and interpretations" (ibid). This move toward integrating sound into part of

the lived experience of place is an important complement to Blesser and Salter. Using

their key terms, we can describe the various sound events we encounter within an

eventscape, then apply Feld's acoustemological approach to start piecing together how

those sound events shape who we are and the ways we relate to the spaces we occupy.

We all have agency within our aural environment, and there is a balance between

listening and sound-making (Westerkamp) that is crucial once we start thinking from an

acoustemological standpoint. This mode of thinking (that sound is dynamic and

requires a specific relationship with space) allows the listener to position themselves as

an active part of the sonic eventscape, which can, in turn, alter the way in which they

approach urban sound events and help them move away from accepting monolithic

aural representations of the city (such as the city's promotional film). However, before

listeners can deconstruct the representations they may encounter in their urban

experience, they first need to shift how they listen to the city: moving away from

blocking out the 'noise' of the city with headphones to create an aestheticized

soundtrack (Bull), and learn to approach the nuances of the urban sound environment

in new ways.

   Jean-Francois Augoyard and Henry Trogue's *Sonic Experience: A Guide to*

Everyday Sounds is not only an extensive glossary of sound-related terminology, but

also introduces the importance of the effects (and affects) of sound on listeners. They

highlight the necessity of listening to "ordinary noises or mundane sounds" (3). To me,

this is an integral part of the aural experience—particularly in urban sound

environments. What is equally encouraging about Augoyard and Trogue's positioning is

the way in which they include 'noise' without a value judgement. According to Augoyard

and Trogue, it is important for urban listeners to direct their attention to ordinary or

mundane sounds, even if they choose to categorize such sounds as 'noise.' It is by paying

attention to these less obvious sounds, those of our day-to-day experience, that

dedicated listeners can truly gain an appreciation for the complexity of an aural

experience of the city. With an acoustemological approach to urban listening, and an

awareness of our role as both listeners and soundmakers, it is possible to create an

understanding of their role *within* the sound environment, instead of positioning

themselves outside of it (or, frequently, in opposition to it). For example, if you recently

moved into a condo where they had to blast out the foundation with dynamite, it may

not be your place to complain about the sound of jackhammers drilling out the new

development down the street. Or, if you swim in your apartment building's pool (and

want it to be clean), then you are part of the reason why there is the sound of a

power-washer operating nearby. As a public transit user, I find it impossible to bemoan

the sound of the busses driving by because I personally require the service they provide.

If the busses were removed in order to silence them, how would I get across town?[7]

The eventscape is an arena within which we need to dedicate our attention to the

act of listening, and use sound as our way of knowing. Of course, this situated

knowingness requires an open approach to all the sounds that occur in the environment:

from the smallest, quietest, or shortest, to the larger, more overwhelming sounds that all

contribute to the whole. With this positioning in mind, and the critiques I mentioned

above, I am making an effort not to use the term 'soundscape' to refer to a series of

sound events within a similar acoustic horizon, or a larger aural environment. My

decision to do so comes after a long reflection on my own relationship with sound in the

urban environment, and the ways in which 'soundscape' is most commonly used by

those both inside and outside of sound studies.

It is because of these critiques, and my desire not to get mired down by the

current rhetoric surrounding the use of 'soundscape' (which could easily be the sole

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[7] Of course there are other factors at play with regard to the sounds of busses. They could, in fact, be made to run quieter, but the sound they currently make is tied into our reliance on fossil fuels as well as the political and financial hurdles required to make the shift to a quieter (and more sustainable) form of engine.

subject of an entire dissertation), that I want to move forward with a less loaded term. Thus my shift toward using 'sonic eventscape' or the broader 'sound in the urban environment' to frame the value for dedicated listening with an ear toward how each sound event functions in the built and/or lived environment in which they are encountered. I feel it is important to situate sound as part of the experience of the city, rather than as an aesthetic object to be dissected outside of its habitat. This shifts the focus of this dissertation—which is, admittedly, heavily influenced by the work of Schafer and the World Soundscape Project—away from understanding soundscapes as objects for study, and toward acoustemologically situating the listener in a dynamic, sonic eventscape. Now that I have framed the overall experience of sound in the city, it is important to understand how listeners can engage with it on a practical level.

Dedicated Listening

In order to construct an understanding of a city through sound events, it is necessary to develop an open and engaged listening practice. This dissertation focuses on listening as an active process (Nancy), helping individuals dedicate their attention to the act of listening (Westerkamp). In order to help listeners to reconsider their relationship to urban sounds, I have built three interactive mapping interfaces, each of which engages the listener in a different way, asking them to trouble through the complex interrelationships between sound, space, and place. The first map, *Old Montreal's Acoustic Labyrinth,* uses a hacked tabletop maze game, allowing listeners to hear simultaneous recordings of the Basilica Notre Dame's bells from six different

locations by rolling a steel ball across the game surface and into holes corresponding to each recording location. *Street Ears*, a mobile-phone app, uses relational GPS information to present listeners with an augmented aural reality of either Milton Park or Verdun neighbourhoods. This app tracks the listener's real-time movement from any place in the world and uses it to dynamically crossfade between pre-recorded audio from these two areas of Montreal. The third mapping project, *168 Hours*, explores durational listening, using a clock-inspired interactive surface to remix and playback audio collected from a single location over the course of one full week. Together, these maps encourage dedication to the act of listening and challenge users to develop new techniques for experiencing the sounds of Montreal.

Dedicated listening is a learned practice. It requires the development of very specific audile techniques (Sterne, *Audible Past* 93) to build up the ability to make sense of how sound interacts within a larger environment. An audile technique is a process-oriented approach to the rehearsal and practice of learning how to listen to specific things for specific reasons (ibid). As Sterne suggests, we all use a number of audile techniques daily, often without even thinking about them. Carrying on a conversation in a metro car or a busy pub uses selective listening to focus in on specific voices amind a wash of similar frequencies. This audile technique takes advantage of the psychoacoustic phenomenon called the "cocktail party effect" (Augoyard and Torgue 28). The audile technique required to select a single sound from within the acoustic arena is very different from listening to your personal portable audio device through earbuds, where you are physically blocking out other sounds. This type of listening

requires much less attention to the act of listening. Another example is listening to music on a long car trip. As we become accustomed to the constant pitch of the car's operating sounds, we filter them out of our experience and focus on the car radio or conversations with other passengers. This ability to filter out particular sounds is known as the "asyndeton effect" (Augoyard and Torgue 26). Each of these situations uses a unique set of audile techniques, as well as different levels and modes of listening.

It is important to distinguish listening (an attentive act) from hearing (the casual or passive reception of aural information). In *Acoustic Communication,* Barry Truax writes that "listening implies an active role involving differing levels of attention—'listening for,' not just 'listening to.' The level of attention may be casual or distracted, or in a state of readiness" (18). Truax builds on this idea of active listening, identifying three levels: "listening-in-search" (22), "listening-in-readiness" (ibid), and "background listening" (24). While listening-in-search, one's attention is focused on trying to identify the source of a particular sound event. In contrast, listening-in-readiness is a level where one's attention is equally open to all sounds within the eventscape, usually taking place once the sound events within a particular eventscape have been identified. Background listening is the least 'active' of the three levels, and usually only occurs once one is very comfortable with the eventscape, or not dedicating their attention to the act of listening. In chapter one, I will demonstrate how Truax's levels can be applied to sound-based maps in order to generate an experience of place that is physically impossible. In chapter two, I will use Sterne's concept of audile techniques to develop a framework for dedicated listening to urban sonic eventscapes,

and in chapter three I combine these concepts to describe the construction of narrative

through a durational practice of audition.

Situated as a complement to Truax's levels of active listening, Michel Chion

identifies three modes that allow us to better understand how we make sense of the

aural environment—be it constructed, mediated, or as part of our daily experience.

These modes tie into Feld's concept of acoustemology; in order to understand how we fit

into an active aural environment, we need to understand what the other actors in the

environment are saying, and how they are sharing aural information. The first of Chion's

modes is "casual listening," arguably "the most common, consist[ing] of listening to a

sound in order to gather information about its cause (or source)" (48). Relatively simple

in its definition, it needs a bit of clarification in order to mesh with Truax's framework.

For Chion, 'casual' is not, as Truax implies, a disengaged form of audition, but a mode

that requires dedicated attention to a particular part of the aural environment in order

to identify a sound's source (somewhat similar to Truax's listening-in-search). Chion's

second mode is "semantic listening." "[T]hat which refers to a code or language to

interpret a message" (50). Largely constructed around the function of individual

component parts (linguistic phonemes, or the single letter combinations of Morse code's

dots and dashes), semantic listening uses cognitive functions to piece together small

morsels of auditory information for the sake of communicating a larger concept. With

the right mindset (and properly attuned ears), this type of listening can be applied

outside of language to form a deeper understanding of the interrelationship of all

sounds in the eventscape. It is possible to think of the chatter from seagulls and

red-winged blackbirds in the park behind my apartment as one set of linguistic morsels, and the bluster of wind rushing through the trees and rattling the chain link fence as another. By combining these morsels of auditory information, I can piece together a comprehensive understanding of a particular place and time.

Chion's final mode is "reduced listening," which "focuses on the traits of the sound itself, independent of its cause and its meaning" (50). This mode may initially seem less relevant to my focus on sonic eventscapes, since it removes sounds from their contexts. Chion takes an acousmatic approach (drawing from Pierre Schaeffer's work with musique concrete) that focuses on the tone and timbre of sound-as-object, as opposed to an acoustemological approach that positions the sound event within its source context. However, it is not always possible to exactly define, locate, or assign meaning to every element of a sonic eventscape, nor is it necessary. When listening to the city, there will be sound events that confound the listener—something too far off in the distance to be identifiable, or a unique combination of sounds all happening at once to create a new, almost impossible sound. In these, and in many other moments, it is worth listening just for the sake of the sound.

With these three interfaces, I intend to foreground an audile technique that strives to find connections among space, place, and sound. In order to best situate the ways in which we can actively listen, it is necessary to contextualize *how* we are listening. By incorporating situated knowledge into our listening practices, each component of the sound environment arrives with contextual information. Through repetition, we may be able to identify more sound sources in an eventscape, or link

sounds to a particular time and/or place. This process-oriented position of listening to and building a relationship with a sound environment has a direct impact on the development of community, and a situated knowingness of a particular place. Feld points to the relationality and interconnectedness inherent in building an understanding of a sound environment:

> Acoustemological approaches, while equally concerned with place-based space time dynamics, concentrate on relational listening histories—on methods of listening to histories of listening—always with an ear to agency and positionalities. Unlike acoustic ecology, acoustemology is about the experience and agency of listening histories, understood as relational and contingent, situated and reflexive (15).

Truax echoes Feld's emphasis on agency, noting that "[c]hange can begin with the sound itself, or the listener, or the context" (*Sound, Listening and Place* 194). The three interfaces I have built for this project embrace this acoustemological approach to direct attention toward specific aspects of the urban aural environment of Montreal: exploration, movement and duration. These maps invite listeners to construct an understanding of Montreal through sound (even if they've never physically visited the city), creating their own narratives surrounding these places. In addition to developing audile techniques that users can apply in their daily lives, these maps shift focus away from what the city's PR department has decided to call the official 'sound' of Montreal.

The main chapters in this document will discuss my three mapping interfaces in detail, articulating how each map contributes to an understanding of urban sonic

eventscapes. Before delving into these specific projects, however, it it first necessary to lay a bit more conceptual groundwork for the dissertation as a whole, starting with an important distinction between space and place. I then define 'place attachment' in terms of sonic eventscapes, followed by a discussion of critical cartography as it pertains to sound-based maps. Finally, I outline how differing forms of agency and mobility affect our individual experiences of Montreal and the process of placemaking. This introduction concludes with short descriptions of each subsequent chapter, followed by a section on methodology and ethics.

Listening to Place

Space is a determinant for social and cultural change. In other words, *where* things happen is just as important as when or why. One of the ways in which we understand space is through sound. Sound exists as a byproduct of intentional or excess mechanical energy: the vibrations of the voice box create speech, the swish of a car's tires gripping the asphalt, and even the rhythmic compressions of my fingers on the keys of my computer as I write this sentence create a tiny (and no doubt well-designed) click as each lightly sprung key hits the chassis of the keyboard and then springs back up into place. Yet even the subtle, somewhat personal sound of individual keystrokes can fill a space. While writing alongside others in a busy library, these hundreds or thousands of asynchronous taps and clicks build upon each other to create an ambient tone, and a sense of place. It sounds like a library workspace. Now, in describing this space: a room somewhere in the world filled with books and students typing, it is sound

that adds an additional layer of meaning. However, to transition it from space (a physical location) to a place (a cognitive construct such as the fourth floor of the Webster Library) requires contextual information.[8] I argue that this contextual information can be shared through sound.

Even if you haven't been there, through the addition of sound, a space can be transformed into 'place'—somewhere specific that is linked to my memory (and now your imagination). You may not be thinking of the exact library I'm sitting in, but the idea of 'a' library now transforms from an abstract signifier to a particular instance of that type of space. However, this transfer (or transformation) is far from perfect. Sound is intimately linked to time and temporality. As Blesser and Salter write: "The time dimension of sound produces a complex response to sonic illumination, and we hear aural architecture by the way that the space changes a sound's spectrum, intensity and *temporal* sequence. In comparison with vision, hearing is orders of magnitude more sensitive to temporal changes. In a very real sense, sound *is* time" (17, emphasis in the original). In addition, space and time are also linked. Although sound may well be time, *any* form of experience is based in duration, and within its own temporality. Driving versus walking, for example.[9] In this framework, temporality is a relational comparison among other moments of time, each of which is construed as a segment of the passage of clock-time. All times have their own temporality—their pace, their tempo. These temporalities can also represent larger segments of clock-time as well: decades,

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[8] Cultural theorists such as Doreen Massey, Edward Casey, and Michel De Certeau have pointed to this distinction, and I will discuss their work in more detail later.

[9] There is a substantial body of work on differential mobilities and notions of time and experience (and the power geometries created through these different modes of movement), particularly in Wolfgang Schivelbusch's work on railways, and Laurence Parent's practice of the wheeling interview.

centuries, eons. How we move through space is also tied to time, temporality, and duration. If we consider fully Blesser and Salter's proposition that sound is time, and acknowledge that space and time are linked, then the basis for my dissertation projects becomes apparent. By listening to (and through) recordings or re-presentations of sounds from particular spaces, we are engaging in a durational experience that will help us create a sense of place.

In common parlance, many people use "space" and "place" interchangeably, not giving much thought to the complex relationship between these two words. Throughout this document, I will use space and place in very distinct ways: space as a physical area, and place as a conceptual construct. In order to set up how I am using these terms, it is necessary to first muddy the waters between this distinction, keeping in mind that some of the ways that others describe space may be better applied to my usage of place. In particular, Doreen Massey's writings about space not only touch on the relationships among physical areas and their boundaries, but also on the fluid and productive nature of space (a usage that fits better into my conceptual framing of place as a cognitive function). However, most theorists agree that space (in its broadest definition) is any area within ascribed boundaries. Place, on the other hand, has additional layers of meaning. In my framing of these terms, space may be any area within boundaries, but 'place' is a *felt* space, with both meaning and memories. This is my rationale for describing place as a collection (and comprehension—whether intentional or not) of conceptual aspects surrounding a particular location, not just its physical properties.

Doreen Massey begins *For Space,* by introducing three opening propositions regarding the fluid and productive nature of space:

1. Space as the product of interrelations; as constituted through interactions, from the immensity of the global to the intimately tiny. [...]

2. Space as the sphere of the possibility of the existence of multiplicity in the sense of contemporaneous plurality; as the sphere in which distinct trajectories coexist; as the sphere therefore of coexisting heterogeneity. [...]

3. Space as always under construction. [...] [S]pace [exists] as a simultaneity of stories-so-far (9).

I agree with the ways in which she describes space as the product of lively interrelationships (of any size), as the site for possible trajectories of meaning, and as a container for lived experience (in this lovely term "stories-so-far"). In fact, in order for a cognitive linkage to transition a space to a place (usually through the recollection of previous experiences with or within the location—more on this later when I discuss Michel De Certeau's 'inscriptions'), space must be lively, it must be malleable and open to new constructions upon and within it, and it must be ongoing. While we can have memories of places that no longer (or have never) existed, it is impossible to revisit them and add a new level of story. However, her three opening propositions do not describe *what* makes that location or area lively, or *why* it contains meaning.[10] I believe

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[10] Throughout this document, I will often refer to areas or locations. Normally, their usage will be aligned with my conception of space—bounded, or defined (a particular location can easily be abstracted through GPS coordinates, while still having a site) but without the additional layer of experiential meaning I am assigning to place.

that identifying the what or why is the fundamental shift necessary to distinguish space from place. In my work, the means of getting at that 'what' or 'why' is sound.

Edward S. Casey is more blunt than Massey in his distinction between space and place, although it is worth noting that they both agree space is not an empty void. However, Casey is quite specific in his definition of place (with 'site' standing in for a particular location within ascribed boundaries (x)).[11] He writes: "Place brings with it the very elements sheared off by the planiformity of site: identity, character, nuance, history" (xiii). For Casey, place is something to be explored and documented. "To uncover the hidden history of place is to find a way back into the place-world—a way to savor the renaissance of place even in the most recalcitrant terrain" (xv). These places can be anywhere, but getting to know the histories behind these places is just as important as developing one's own understanding in the now.

As such, each place has historical and contextual links to other places that sets it apart from similar spaces. Massey echoes this formulation: "If no space/place is a coherent seamless authenticity then one issue which is raised is the question of its internal negotiation. And if identities, both specifically spatial and otherwise, are indeed constructed relationally, then that poses the question of the geographies of those relations of construction" (10). While Massey elides space and place in this quote, it is not necessarily to suggest interchangeability. Rather, I understand it as implying that the two concepts are linked, and that this linkage opens up further exploration into how

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[11] According to Casey, if space is a void, there is no possibility for place. Also, site cannot be located in space (although his definition of space is relatively ambiguous), it must be situated in place.

we navigate through the world. It is the ways in which these relationships among identities are organized that makes all the difference.

To go a bit deeper into the construction of these relationships, and to bring back the links between space and time, Massey introduces the concept of power geometries that occur as a result of differential relationships once we start to look at how people move through space at different paces, effectively allowing them to compress space and time: "Different social groups have distinct relationships to this anyway differentiated mobility: some people are more in charge of it than others; some initiate flows and movement, others don't; some are more on the receiving-end of it than others; some are effectively imprisoned by it" (*Global Sense of Place* 149). Our status changes the way we experience space, and construct place. Issues of education, mobility and economics will drastically modify our daily experiences. My knowledge of Roman Catholic traditions and the Quebec history inform how I walk through Place d'Armes Square. The SSHRC funding I received for my PhD research allowed me to move from a cramped apartment in Milton Park overlooking a busy intersection to a larger one overlooking the St Lawrence River. These factors have also changed my relationship to space and time, resulting in a new set of power geometries, access, and ability. I now take public transit to school instead of walking, and am able to hear a number of different parish bells across my new, more suburban neighbourhood. I can even grow vegetables on my balcony, changing the way I move through and interact with space, as well as my relationships with institutions (both in the heightened awareness toward religious edifices and the banal secularism of the grocery store).

Henri Lefebvre famously describes the *production* of space—the idea that space itself is a social construction, combining the experience and actions of individuals, as well as hegemonic institutions, to produce and use space. Lefebvre writes:

> The form of social space is encounter, assembly, simultaneity. But what assembles, or what is assembled? The answer is: everything that there is *in space*, everything that is produced either by nature or by society, either through their co-operation or through their conflicts. Everything: living beings, things, objects, works, signs and symbols (101, emphasis in original).

Lefebvre presents a rather abstract line of inquiry into what constitutes space, but it is an important one to add into the conversation between Massey and Casey. By integrating the notion of space being self-productive, he allows for the slippage (or ambiguous linkage) between space and place we see in Massey's writing *and* the relatively hard line of Casey's definition that place-knowing requires knowledge of place-histories. Lefebvre's model of productive space also ties into Massey's initial propositions, accounting for the multiplicity of interactions, but also in how these interactions shape who we are, and how we interact with space. Our personal trajectories frame how we intend to experience space, and define how we then understand these spaces as places. This formulation accounts for how we choose to interpret various signs (church bells, for example) and then what we choose to do with that interpretation (heard as a purely aesthetic sound event, as a marker of the passage of time, or as a call to mass/service).

While the production of space doesn't necessarily help in creating a rigid definition of the difference between space and place, it does help flesh out some of the similarities between these two terms. In a sense, I think of place as the venue for an eventscape. Like space, is it lively and constantly evolving, the site of myriad interrelationships. However, I believe there is a difference between the two. Space is both a physical and social arena, imbued with history and acting as site for present and future experience. But place is what we make it. Place is *knowing*. It is how we move, who we connect with, and—most importantly for this project—what we hear. Also, spaces for some may be places for others. Your home, for example, has a physical presence in the world (be it a house, an apartment, a tent or whatever it is you choose to call home), an address (or location) for which directions can be found, and its own history (built on such and such date, previously occupied by so and so). Thus, a place—for you. However, for me it might only be a space. I can acknowledge its role in your life as part of a social production, and may even get to know its history, but until I experience it through sound, image, or an in-person visit, it cannot transition into place. Throughout this document, the difference between space and place is akin to the difference between house and home. Both have histories, multiplicities of interpretation, and potential futures, but *places* accumulate layers of meaning and memory through the lived experiences of their inhabitants. Now that I have put forward a distinction between space and place, I would like to discuss how we move among spaces and use those movements to create places.

Research Methods:

Navigating Place

This dissertation refigures conventional cartographic strategies to create mappings that help us listen to the city, and develop a stronger understanding of how a space can also function as place, facilitating place attachment and levels of memory or emotional linkage—even from afar. My mappings encourage listeners to engage with both space and time, exploring how we can develop place attachment to locations we may never visit—effectively moving the focus of the map away from visual boundaries projected onto a page, and toward developing a relational understanding of how and why each mapped location functions as place. In order to do this, all three of my mapping interfaces use sound as a conduit for generating place attachment, and a deeper understanding of the city. Place attachment moves beyond simply stating that place has meaning. Instead, it works through the processes that occur in memory-building and the inscription of meanings that assist in transitioning from space to place. Place attachment as a concept is rather broad: integrating patterns of temporality, sociality, affect, and cognition, while also examining places of varying scale and tangibility, and the many different actors at play within these places (Altman and Low 8).

In their book *Place Attachment*, Irwin Altman and Setha M. Low propose four key aspects of this concept:

a) Its focus on affect, with attention given to cognition and practice.

b)   Its place orientation, recognizing that environments vary in scale, specificity, and other features.

c)   Its temporality, including cyclical, linear, and other features.

d)   Its social-interpersonal importance, including who is attached to places, and the social targets of attachment, both of which can include groups, communities, and cultures (11).

This focus on the cognitive awareness of the affective elements of place is a key element in the shift from space to place (at least in how I define the process of developing an understanding of place). Creating a sense of place requires attention to detail, no matter how small they may be. As we learn the nuances of a particular place, we create memories (affect), build cognitive maps about the layout of buildings and streets (orientation), develop a relationship with the patterns of movement through it (temporality), and begin to understand how sounds within that place shape (and are shaped by) culture and identity (community). For example, Montreal as a place is quite large, composed of many smaller places, ranging from borough, neighbourhood, block, apartment, and even room. Place attachment allows us to compartmentalize this range of places, while still understanding how they contribute to knowledge of the whole. In the above quote, Altman and Low introduce several terms that will resurface again and again throughout my dissertation: cognition, practice, temporality, community, and culture, as well as the interplay among multiple environments of varied size and scale.

In a later chapter of *Place Attachment*, Robert Riley writes more specifically about how attachment is inherently given to all spaces regardless of whether we want to

or not. "The common landscape is a source for shared meaning and emotion, whether liked or disliked, whether tasteful or ugly, because it is a shared experience" (27). He goes on to trouble through what happens when physical presence is no longer necessary (similar to Joshua Meyrowitz' apprehension surrounding telecommunication technologies in *No Sense of Place*), positing that individuals can now engage in 'aspatial' activities. Where Riley differs from Meyrowitz (and where I hope to extend this thinking) is that these aspatial processes and activities (surfing the net, or using a smartphone app), still occur in a physical place. It is our interleaving of the two places (for example, the streets of Joensuu, Finland, and the 'Montreal' map of the *Street Ears* app) that creates a hybrid place: physically present in one, but mentally present in another. Both of these spaces have a kind of 'place-ness' (be they physical or virtual), and by walking through Joensuu while listening to Montreal, the listener creates a hybridized place that functions as the source of associative meaning for shared experiences among other listeners. I believe that these hybrid places can still be the source of place attachment, as they still meet the criteria laid out by Altman and Low. Listeners have an affective response to the augmented aural reality they are experiencing; they generate memories of the sounds they are hearing, create cognitive maps surrounding (virtual and physical) trajectories through the mapping (and their own location), explore its temporality, and even engage with sociality and community: hearing how Montrealers interact with their space, and in the (ideally shared) experience of exploring the mapping.

However, place attachment within these hybridized places requires a cognitive shift toward the affective relationship we have with physical locations. Time and memory become the key factors in developing attachment. In order to accrue lived experience of a place we must spend time engaging with it. I believe that it is not necessary to be physically present in an area to develop a sense of place attachment, but it is necessary to have some kind of durational relationship with the mapped place. This builds cognitive and affective links that we can access later to identify similarities or differences, and shapes how we situate ourselves within the produced space, as an individual and as part of a series of larger communities and publics. As we practice listening to a location, it will shift our relationship with the physical world, allowing us to transition from listening-in-search to listening-in-readiness by learning how sound interacts within the location. It is even possible to use sound events as a navigational strategy for moving through spaces, creating a mental mapping of a series of places.[12]

Each of the interfaces I have built as part of my dissertation use a slightly different approach to time and location to encourage the listener to create place attachments through sound-based mappings. Broadly categorized as exploration, movement, and duration, these three approaches refine the modes of listening required to not only make sense of the mapping, but also create a sense of place without being physically present in that particular location. By dedicating their attention to each mapping, listeners can understand how sound impacts the social and temporal aspects

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[12] For more on this particular approach toward navigating through space using sound see the work by Florian Grond and Piet Davos on sonic boundary objects.

of space, and develop an affective, cognitive relationship with these mapped places. In the next section I will outline a critical cartographic approaches to mapping space.

Critiquing Cartography

Urban environments are incredibly complex. The vast number of bodies moving through urban spaces creates a fascinating opportunity for the analysis of changes in the daily experience of sound in urban life, as well as pointing to some of the social and political ramifications of urbanization.[13] I would like to begin this analysis by introducing De Certeau's concept of the "stratified place." He suggests "that social spaces, which are stratified, cannot be reduced to their unregulatable and constructable surface" (200). There is no one way to experience a city. By adding the stratum of sonic experience to our models of urban space, this dissertation builds a conceptual and methodological framework for continued research into the aurality of urban life. I ask: how can an urban sound environment be documented, and how can these documents encourage dedicated listening practices? Most importantly, how do we understand a city through its sound events?

I argue that we need to reconceive the cultural hierarchies of urban sound. This means moving away from the Schaferian notion of urban sounds as bad and rural sounds as good toward one that recognizes the importance of listening to ALL sounds in the eventscape. In addition, I believe it is necessary to break down the rhetoric surrounding 'noise' and the city. I am not saying that sound pollution doesn't exist, or

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[13] According to Stats Canada, just over 80% of Canada's population lives in urban areas, and 60% live in large metropolitan centres (*The City/Suburb Contrast*).

that cities are not getting louder, but rather, that in order to fully understand how we make sense of the city (turning it from a collection of physical spaces into a cohesive place), we, as urban listeners, need to value all sounds for the role they play in how we make sense of our everyday experience. For example, most Montreal residents will hear the sounds of traffic (including busses, sirens, and delivery trucks) as part of their daily life. All these sounds can be heard in both the *Street Ears* app, and the *168 Hours* project. Instead of categorizing these sounds as 'noise' (best defined as an unwanted element in a signal chain), I believe these sounds tell us a lot about how the city works, and how other people live and move through it.[14] Instead of tuning out these sounds, listeners need to recognize what these sounds mean, and how they fit into the functionality of the city as a whole, be they providing access through public transit, emergency services, or facilitating the movement of goods and services.

Before describing my sonic mappings of urban space, I first need to discuss our most common means of spatial representation: visual maps and their processes of mapping. As many scholars have argued, there are inherent problems with the assumed objectivity of the aerial view generated by conventional maps. Peta Mitchell deconstructs this assumed objectivity in *Cartographic Strategies of Postmodernity*. Mitchell discusses the notion that maps are inherently a distortion (2). In further describing maps, she references Korzybski in his statement that a map cannot be the territory being mapped, nor can it include all of the territory, and, a true or perfect map would have to include a map of the map, and a map of the map of the map, and on, and

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[14] As I discuss in more detail in chapter three, sound can be an important indicator of the political economy of time (Sharma).

on, ad infinitum (3). In classical print mapping structures, territory can be visually surveyed from a distance, with the self projected outward, onto space. Claiming it. Mitchell points to the colonialist problem of conventional mapping practices writing: "In the case of the map the all-encompassing eye of the cartographer encircles, frames, and delimits the productive nature of space. Passive space is not to be experienced, but rather is a territory to be conquered, to be seen and to be made 'known'" (19). In contrast, the aural experience of place requires immersion, a bringing-in of sensory information. It is impossible to project oneself aurally (although you can practice listening for very far away sounds, they still need to come into the ear canal). Despite this, many web-based sound maps maintain these visual constructs (and the power dynamics contained within), employing these framing strategies with a focus on the visual nature of the map rather that the aural.

There are of course, mappings that contest this heritage and positioning, many of which are collected in the image-heavy volume *The Art of Cartographics* (edited/curated by Jasmine Deslaux-Salachais) positioning cartography (and cartographics) not just as 'maps,' but as "a processing of multi-disciplinary data synthesized for a wide audience for the common interest" (5), and ushering in "a new and advanced understanding of mapping which links diverse disciplines through the use of observation, data, technological innovation, collage, and illustration" (4). As part of this shift in how we understand the processes behind map-building (and in making their construction more accessible), Jeremy Crampton and John Krygier put forward a process-oriented, open-ended approach to constructing mappings as part of a move

toward a "critical cartography." Crampton and Krygier use "a more social theoretic critique, which [they] argue is a political one, situat[ing] maps within specific relations of power and not as neutral scientific documents. … If the map is a specific set of power-knowledge claims, then not only the state but others could make competing and equally powerful claims" (12). I have adopted a critical cartographic approach in my work to help navigate through these issues of abstraction, accessibility, intention, and powers of representation found in both traditional and contemporary maps.

A map's inability to objectively represent a space is not a striking revelation. Many postmodern theorists and critical cartographers have questioned the idea that a map represents the 'real,' or even *what* a map represents (Crampton and Krygier). The practice of cartography is subject to many of the same cultural assumptions found in the experience of space and place. Mitchell discusses the self-perpetuating power systems within traditional maps. She writes: "For centuries, [the] map has been given privileged status as having a direct correspondence with the real, in that it objectively and realistically re-presents, on a smaller scale, the territory, the real, the truth" (17). In this line of thinking, a map becomes a singularity—a captured moment-in-time. However, this idea of the mapped singularity brings into tension the separation between subject and object. Rob Kitchin et al. describe this shift from representational cartographic theory to a post-representational, processual understanding of mapping (480). They write: "[A] mapping is often read as a collaborative artefact and emerges through an unfolding set of practices and context" (483). This focus on context and process (for them, a collaborative one) outlined by Kitchin at al points to the idea that a map is

always in the process of becoming. It can be read by a number of different individuals in

a number of different ways. While a map may be a fixed document, the ways in which it

can be read or used are not. In this way, the mapping process becomes

post-representational (building on some of Massey's ideas surrounding power

geometries), and open to individual interpretation. We do not need to rely on the official

stories of place—we have our own power and agency to share our own individual stories

of how we navigate, use, and conceive of the world around us. This could be seen as

leading to some friction with my idea that there is a particular 'sound' of a city, but it is

not an impossible situation. Each individual will build their own understanding of place,

and, as such, will have their own favorite sounds (or sounds they believe to be indicative

of that place).

However, this process of individual interpretation is one that is well suited to the

creation of any form of sound-based mapping. Each listener will have their own position

from which they listen to a soundmap: they may be acoustic ecologists listening for

changes in the aural environment, musicians interested in the tone and timbre of a

particular place, or a member of the general public who is simply interested in hearing a

series of foreign sounds, and as a result the same map will sound very different to each

listener. At their heart, soundmaps are relatively straightforward documents that link a

series of sounds collected from a variety of locations through some form of

representative interface (most often a traditional, two-dimensional graphic map using

the Google Maps API). The goal of these maps is to highlight the role of the sonic

eventscape in place-making, adding sound to the conversation about how we experience and understand the world.

Listening to Maps

In order to address to some of these critiques surrounding the power of representation, the relationship between listener and recordist, conceptions of space and place, and the assumed objectivity of a within cartographic traditions, I have built three interactive, sound-based mapping interfaces. Each map draws the listener's ear to a different aspect of the sonic eventscape: how sound is shaped by architecture, the transitions between distinct acoustic arenas, and the durational aspects of listening to a single location over an extended period of time. Additionally, they explore themes related to time, location, and place attachment: exploration, movement, and duration. Drawing from critical cartography, sound studies, and cultural theory, my dissertation discusses how and why we should develop new audile techniques for listening to the city. In particular, I define a technique that breaks down the cultural hierarchies surrounding how we conceive of a good or bad sound, the role listening has in shaping a sense of place, and how sound events can provide useful information in our daily experience of the city.

One aspect of developing a sound-based mapping methodology is the acknowledgement of sound as intangible culture. While we may not immediately recognize the roles of both sound and maps in disseminating culture and cultural values, they both are surprisingly effective tools in this regard. For example, in *Soundscapes of*

the Urban Past, Karin Bijsterveld discusses what she calls "staged sounds" (14) found in film, radio, television, and texts to explore how and why particular sounds are used by foley artists, directors, and writers to represent certain experiences of living in the city, and how these uses propagate a particular sense of what the city is—a form of mediated cultural heritage. Representations of cities frame our expectations. The sounds we use in media to mark a place become what we anticipate (and eventually believe) the sound of the city to be. We can extend this rationale of media informing expectations to the ways in which maps work.

However, cultural and institutional representations do not always have to define our experience of place. It is important to consider the various stories maps tell, as well as when, where, and for whom they were told. The shift to a focus on the narratives within mappings opens up new possibilities for spatial representation, particularly when examining a group or series of mappings. David Bodenhamer et al. introduce the construction of spatial narratives and their relationship to "deep maps" as a way of opening up the type of spatial and temporal information maps can provide. According to Bodenhamer, a deep map's aim:

> is not objectivity or authority but rather a negotiated conversation between insiders and outsiders, experts and contributors, over what is represented and how. In their essence, deep maps are the means by which we represent the contested meanings of space and place, as well as the dynamics that produce them. [...] As such, they contain the seeds of their own subversion (21).

By destabilizing the authority of map creation, and opening up mappings to dialogue surrounding the meanings of space and place, deep maps function by creating and disseminating a city's intangible culture—from the ground up. Deep maps have the ability to show not only space, but the production of space, and the systems of power behind these productions. By creating mappings that use a grassroots approach (effectively reducing the power of the state and/or other authorities) and giving them the same authority to tell stories about how we, as citizens, use and occupy the city, it is possible to create inclusive forms of mapping that question the implied narratives and initial intentions of 'official' representations of the city.

Sound is a part of everyday life, and a key aspect of the urban experience. However, it can be particularly difficult to share an individual's aural experiences of the city. As I mentioned above, sound is fleeting, and not everyone will develop the same attachment to the ways in which sound behaves within a particular environment, or how it changes as we move from location to location throughout the city. In an attempt to shift the way we understand the functions of sound-based mapping strategies, and to move away from the conventions found in most contemporary soundmappings (a web-based, 2D image of the mapped location), this dissertation uses research creation methods to present three interactive sound-based mapping interfaces: *Old Montreal's Acoustic Labyrinth* (a table-top marble maze game), *Street Ears* (a geolocative smartphone app), and *168 Hours* (a clock-like Musical Instrument Digital Interface (MIDI) device). These projects present mappings that allow users to hear the same moment in time from multiple perspectives, explore the tensions and transitions found

when aurally navigating the city, and listen from a single perspective across expanses of time. With my questions surrounding what the 'sound' of a city is, and why it matters if we listen or not, I argue that the primary goal of these three maps is to encourage listeners to rethink their relationship with the sounds they encounter in the city in such a way that is responsive to the everyday subjectivity of individual experience in the creation of place. For example, listeners who have played with the *Acoustic Labyrinth* project (which map the bells of the Basilica Notre Dame from six different locations simultaneously), have responded to how different the same sound appears as they shift from one recording to the next—highlighting the role that architecture plays in our experience of place. However, as an acoustic ecologist interested in documenting the changing function of sound in the urban environment, the secondary aim of these interfaces is to generate content for an ongoing discussion surrounding Montreal sounds, and how they function as intangible culture. In addition to using these mapping interfaces to develop an audile technique for dedicated urban listening (practicing for future listening experiences), it is also possible to 'listen back' to each mapped area (Place d'Armes, Milton Park, and Verdun) and hear how they have changed over time. This was a key component of many of the initial forays into soundmapping collected by the WSP in the early 1970s, and one championed by Bernie Krause in his long-term recording projects documenting the changes in a variety of sound environments (*Animal Orchestra* 69). While this document details how my mappings function as interfaces for the development of a new audile technique, it is worth acknowledging that they also contribute to an ongoing catalogue of changing urban sounds. In the following

section, I will outline how this catalogue can impact movement and mobility through both space and place.

Moving Through Place

As I discuss how listeners engage with space and use sound to generate a sense of place, it is important to discuss mobility. Living in the city, and being a part of the place-making process requires a certain level of agency and ability which are all tied to mobility and movement. There are a number of ways in which we can conceive of this term: the physical movement of objects or ourselves, our ability to move (not just physically, but financially, socially, and culturally), the ability to transfer data across vast distances through technological mediation, or even by mobilizing theories of mobility into other fields of study. For the sake of simplicity, in this project, 'mobility' is about how and why we move through space and place.[15]

In order to best situate how we can move or be mobile, I want to return briefly to my previous discussion of the distinction between space and place. As I mentioned earlier, Massey introduces three opening propositions regarding the fluid and productive nature of space, most notably as a "simultaneity of stories-so-far" (9). Now, keep in mind that Massey does not set up a hard distinction between space and place, so we can also understand these three propositions as being equally applicable to place. Within my definition of place (as a cognitive shift that is capable of navigating through

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[15] Although, of course, issues of mobile networks and smartphones will come up in chapter two, when I discuss *Street Ears,* a geolocative app.

multiple simultaneous layers of meaning), these propositions become even more applicable. With this fluid, self-constructing (and maintaining) understanding of place, it is possible to talk about how we move through, and among places. Tim Cresswell introduces two parallel concepts for talking about the act and experience of navigating through space: 'mobility' and 'movement.' Interestingly, Cresswell sets up these two terms in relationship to location (similar to my construction of space) and place, where movement is "the dynamic equivalent of location in abstract space—contentless, apparently natural, and devoid of meaning, history, and ideology. […] If movement is the dynamic equivalent of location, then mobility is the dynamic equivalent of place." (3). If we combine Cresswell and Massey, place becomes both composed of, and created by, multiple series of interrelated actions and interactions that all exist simultaneously. They, in their pure act of existence, continue to build place itself.

These places have relationships and interactions reaching back into the past (the history of industry in the area) that can manifest themselves in the present (the rapid gentrification of formerly working class areas such as Montreal's Southwest, or calling what is now an affluent, artsy neighbourhood in Toronto the 'Distillery District' in order to memorialize—and cash in on—the area's industrial roots). These relationships continually combine with new (or slightly modified) experiences of the past and present to move forward into the future. In the Southwest or the Distillery District, the history of a neighbourhood is being mobilized to provide caché for developers in a way that is completely contrary to its roots. These were poor, working-class places that are now being transformed into upscale condos. However, these developers are still banking on

the backs of the labourers—this time with the cultural caché of mobilized history. This leads to a different type of experience for each group within the neighbourhood. Marginalized groups get pushed out of affordable housing, contractors cash in on new spaces for development, and the upper classes can revel in their panoramic view of old industrial spaces while (perhaps) still feeling like their neighbourhood has some 'authentic' grit to it. Here we are looking not only at layers of mobility creating place, but also how diverse individual experiences affect both mobility and place. I will expand my argument surrounding sound, mobility, and agency in chapter two, but first I would like to outline exactly what I mean by experience.

Throughout my dissertation, I will be using experience in two ways: the first is similar to Raymond Williams' 'past' and 'present' experiences (126), which I use when I describe the lived experience of the city, or (some of) the ways in which we understand the role of sound in our daily lives. Williams describes experience past as "lessons," and experience present as a "full and active awareness" (127).[16] My second usage is more in line with John Dewey's concept of *an* experience—which he defines as when "the material experienced runs its course to fulfillment" (36) or, more concisely, a combination of action, reaction, and perception whereby the "action and its consequence [are] joined in perception"(46). I will use Dewey's formulation of *an* experience when I talk about the ways in which listeners interact with the three interfaces I have developed, and the process of dedicated listening required (both in listening to the mappings, and later, in the physical world) to construct an aural

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[16] In preparation for my discussion of time and narrative in chapter three, it is also worth noting that Williams points to the "general movement [of experience present] which underlies the development of culture" (127).

understanding of place. Within *an* experience it is possible to combine the act of listening with the cognitive associations required for place attachment (developing aural memories of these mapped spaces allows the listener to transition them into place)—combining act with consequence. Dewey's formulation of *an* experience fits in well with Williams' notion of experiences having the ability to exist in the past (as memory) or present (as part of Dewey's action/reaction/perception). As Williams remarks, "experience past already includes, at its most serious, […] processes of consideration, reflection and analysis which at the most extreme use of experience present—an unquestionable authenticity and immediacy—excludes" (128). As listeners experience these mapping interfaces, they are diving into the immediacy of the moment—listening in the now—while building associations with the mapped locations through perception and reflection.

Additionally, throughout this document I make reference to "lived" experience. This usage applies Williams' framing of past and present experience to describe how and why we make the (small or large) choices we do on a daily basis. Coffee or tea? Walk or bike? All these choices are informed by past experience, and present conditions.[17] Additionally, lived experience brings together both Williams' and Dewey's notions of experience, particularly in discussions of everyday patterns and movements. One's lived experience (associative, or practical memory) not only combines past and present

[17] There is a fair amount of research being done in the pure sciences to explain exactly how this works. Essentially, the hippocampus and the medial prefrontal cortex have an ongoing conversation that, over time, creates associative memory and cognitive maps. For more detail, see Neal Morton et al's article "Memory Integration Constructs Maps of Space, Time, and Concepts."

experiences into *an* experience, it allows for De Certeau-ian inscriptions. According to De Certeau:

> Practical memory is regulated by the manifold activity of alteration, not merely because it is constituted only by being marked by external occurrences and by accumulating these successive blazons and tattoos inscribed by the other, but also because these invisible inscriptions are 'recalled' to the light of day only through new circumstances. The manner in which they are recalled corresponds to that in which they were inscribed. Perhaps memory is no more than this 'recall' or call on the part of the other, leaving its mark like a kind of overlay on a body that has always already been altered without knowing it (87).

I believe lived experience is the combination of multitudes of inscriptions, and the differences we note in comparing a remembered experience of place with the one we are currently having. Without this ability to compare the minute (or major) differences from a trajectory through one space to the next, we would never be able to generate a sense of place. What makes this passage particularly resonant within my work is the role of the other, or external occurrences (in this case, sound events) on the experience of the individual.

According to De Certeau, we may lack control over what comprises our experience of place, but we do have agency in the inscriptions we carve for others to encounter. We can be selective regarding which of these previous inscriptions we choose to focus on when we activate practical memory. For example, I have spent many years listening to the bells of the Basilica Notre Dame, largely because I worked at a theatre

around the corner. For me, they have a particular set of memories, but they can mean very different things to others. These bells are part of the culture and history of the area, and are a focal point within the Old Port. Place d'Armes has been a public square since the founding of Montreal, and there has been a church in that location since 1672 (*La première église Notre-Dame de Montréal* 13). This is a meeting place for residents and visitors alike to generate shared experiences. Additionally, the bells themselves are part of the history and traditions of the city as it has developed (more on this in chapter one). As a central meeting point, it has also attracted businesses as the city grew. Across from the Basilica and bordering the square are two banks (one old, one new), an Art Deco office tower, a boutique hotel, and Montreal's first high-rise building. Even the name "Place d'Armes" shows how this space has been used over the years (due to its use as a military parade ground in the 18th century). All the events that are occurring throughout this location are shaped by space, and are produced as a result of it. There wouldn't be a church if there wasn't a public square, the bells wouldn't ring if not for certain sacred and secular traditions, and the theatre I worked for wouldn't be located where it is if not for the square functioning as a tourist draw. Applying practical memory to lived experience provides a framework for discussing how we understand the places of our day-to-day existence, how we move through them, and why we chose to move (or stay still) in certain ways and along particular trajectories, both spatial and temporal, whether we are consciously aware of it or not. Now that I have outlined how I am positioning the interrelationships among urban sound, dedicated listening, critical

cartography, movement, and mobility, I will now outline each of the three main chapters in this document.

Chapter Descriptions

Each of the three projects I am discussing in my dissertation present their own temporal trajectories: exploring apoesis (the pausing or folding of time) by mapping a single moment in time from multiple perspectives, engaging with rhythm and counterpoint by applying the pace of physical movement to navigate both real and mapped locations simultaneously, and mapping a single location across an extended duration to focus on processual listening. In each of these chapters, I will first lay out a theoretical groundwork before describing the methods and processes I employed to create each of these mapping interfaces.

In chapter one, I discuss in detail my first mapping interface: *Old Montreal's Acoustic Labyrinth*. Created by modifying the playing surface of a Brio-brand tabletop marble labyrinth game,[18] this map inverts the normal rules of the game, encouraging players to navigate the marble into the holes on the playing surface. Each hole corresponds to a recording of the Basilica Notre Dame's bells chiming at noon on November 17, 2013, recorded simultaneously from six acoustically distinct locations.

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[18] While Brio is not the only manufacturer of this tabletop game, they are certainly 'the' brand name for this particular design, having kept a version of the marble labyrinth in regular production since 1946 (*Labyrinth Game*). In this game, users must roll a small metal marble around a series of barriers and holes using knobs to pan and tilt the playing surface in order to navigate through the maze.

Using a combination of soundwalk-inspired phenomenological listening practices and De Certeau's "tactics," this project allows listeners to roll across all the pedestrian-accessible areas within Place d'Armes square and surrounding side streets, while drawing their attention to the changes in the acoustic horizon as they roll into a hole closer to, or further from the bell tower. This interface uses critical play to highlight what Blesser and Salter refer to as the "aural architecture" of an urban area just under a half kilometer square. This chapter also introduces the concept of apoesis (the folding or pausing of linear time), and outlines a critique of contemporary web-based soundmaps.

Chapter two teases out some of the tensions and transitions of urban sound environments, exploring how to represent the subtle shifts in traffic from one street to the next while avoiding the point-click-listen ontology of contemporary soundmaps to highlight the necessity of physical engagement with the aural environment. In order to create a map that creates a fluid, mobile experience of aural place, I built a GPS-enabled smartphone app called *Street Ears* that tracks the listener's real-world movements through any physical space and plots them onto a re-presentation of two Montreal neighbourhoods: Milton Park, and Verdun. As the listener walks, bikes, runs, or rolls through physical space, the app crossfades through a series of pre-recorded audio files from one of these two neighbourhoods. This chapter explores the links between *Street Ears* and other GPS-enabled soundmapping projects (including *Recho, Echoes,* and *SonicMaps*), as well as contemporary location-based sound and intermedia projects (such as Cardiff & Bures-Miller's *Audio Walks* and *The City of Forking Paths*), with a focus on the distinction between 'movement' and 'mobility' (Cresswell). It also troubles

through the idea of 'being *here*,' examining how a non-locative location-based project uses the abstraction of the pinpoint found in the studies of chorography (place-writing, or the descriptions and mapping of regions) and wayfinding.

Moving away from physical notions of mobility and into issues of duration, the third chapter in this dissertation works through the relationship between time and sound. As mentioned above, sound requires *both* space and time. *168 Hours* is a clock-inspired custom-built MIDI interface. By pressing the 12 buttons marking each hour on the clock, listeners can navigate through audio recorded from my apartment window at the corner of Ave du Parc and Rue Milton across an entire week in October of 2015. Volume knobs for each day of the week and an AM/PM selector make it easy to move through the vast amount of data. I use the Deluzean 'fold' combined with film theory to work through the ways in which listeners are able to create complex narratives without a defined relationship to time, working through notions of 'frustrated' time, a-chronicity and a-temporality. This chapter continues to explore the audile techniques required to listen to the urban sound environment—in it's mapped form and 'live,' but in this case highlighting the processual nature of constructing narratives from non-linear texts—particularly ones that are presented aurally.

Conclusion

The ways in which a city represents itself changes how its inhabitants and visitors experience and move through it. The promotional video released by the city of Montreal presents an idyllic version of the city bursting with happy throngs of crowds enjoying

public spectacles. However, that is not the city that millions of people live in every day. The sound of a city is not limited to concerts, drum circles, or illuminated see-saws. A city has traffic, construction, conversation, and weather. These are the sounds that shape the cultural identity of a lived city. It is all the sounds, including the gritty, rough, and 'noisy' ones we all hear that shape our experience of place.

By engaging with an acoustemological experience of place (which is to say that sound is a way of knowing place, and that sound *is* time), it is possible to understand how sound exists as part of the social construction of place. The ways in which we interact with space (how we are able to travel, the routes we take to get where we're going, and even our social interactions) affect how others hear it, and these choices shape our day-to-day experience of the city. When we turn our attention toward the dedicated act of listening to the city, we are able to discover how and why we make these choices, as well as how others are choosing their own trajectories through these shared spaces.

As we navigate through the city, we begin to build place attachments—developing associations and memories that colour our present and future interactions with specific spaces, turning them into places. When we start to listen, we can understand the multiplicity of stories that are unfolding simultaneously throughout the eventscape. This project introduces three different approaches to mapping the intersections of space, time, and sound to assist listeners in generating their own sense of place within Montreal—even if they never visit the city. By creating interactive soundmaps, I am using critical cartographic strategies to destabilize the power relationships found in

traditional print and sound-based maps. I have created subjective, personal documents that allow listeners to hear how I experience and move through the city, not an official representation of how it *should* be. These maps account for differing modes of mobility, access, and accessibility and present a perspective of the city very different from Montreal's PR department.

In this introduction, I have discussed how we listen to the eventscape and the role that audition has in generating a sense of place. Additionally, I have worked through how mapping process can destabilize the power dynamics found in traditional cartographic strategies, opening up the opportunity to create new forms of interactive sound-based maps that provide the listener with a durational experience of mapped space, encouraging them to develop place attachment, and begin listening to the city not as an aesthetic object, but as a multiplicity of interrelated events that tell a unique story—one of lived experience and a sense of place.

Methods and Ethics

<u>Research-Creation</u>

The following three chapters describe the things I have made, but it is also important to consider *why* I make things. Simply put, I make things that help me ask and answer questions. A simple, self-reflexive moment many years ago helped me discover research-creation as a methodological framework. By combining my creative practice with the theoretical tools to perform critical and analytical thinking surrounding the things I make, I have uncovered complex interrelationships among concepts such as time and temporality, mobility, experience, space, and place. That is not to say that my research is only formulated to support or justify my creative decisions, but rather that these two aspects exist in a symbiotic relationship. This formulation is not new; Owen Chapman and Kim Sawchuk discuss the entanglement between these terms (and some of the tensions that arise from their use) in their 2015 paper "Creation-as- Research: Critical Making in Complex Environments." Throughout this paper, they refine and build on their earlier writing surrounding modes and process of research-creation.[19] They put forward four categories:

1. "Research-for-creation,' the gathering of materials, practices, technologies, collaborators, narratives and theoretical frames that characterize initial stages of creative work and occurs iteratively throughout a project.

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[19] In 2012, Chapman and Sawchuk published "Research-Creation: Intervention, Analysis and 'Family Resemblances,'" a paper that outlined the linkages among several different practices in the relatively new field of research creation. In 2015, they published a follow-up that expanded upon their earlier claims.

2. 'Research-from-creation,' the extrapolation of theoretical, methodological, ethnographic, or other insights from creative processes, which are then looped back into the project that generated them.

3. 'Creative presentation of research,' a reference to alternative forms of research dissemination and knowledge mobility linked to such projects.

4. 'Creation-as-research,' which draws from all aforementioned categories, and engagement with the ontological question of what constitutes research in order to make space for creative material and process-focussed research-outcomes (49).

Of these four, 'creation-as-research' seems the most interesting—the most ambiguous, and therefore ripe for the type of inquiry that (in my opinion) serves as the backbone of research-creation. It draws from the other three categories, but is still distinct; it is charting its own trajectory by reframing what it means to create/make/build within the academic arena.

Along this line of thinking, Craig Batty and Marsha Berry interrogate the *why* of creative practices in PhDs, pointing to some of the issues that arise when integrating creative work into a doctorate, particularly in the inherent drive to put this type of work into neat, conventionally academic 'boxes' (186). However, they have identified practices that are pushing these boundaries, writing: "At the heart of a creative practice methodology is a concern with performance: with the doing itself as well as the outcomes it creates. There has been a push by some to lead research through practice, whereby performative researchers conduct academic inquiry that is both experiential and iterative" (184). This push they identify resonates with Chapman and Sawchuk's

idea of creation-as-research, and leads toward an understanding of research-creation

methodologies as a form of bricolage. Lisa Kay identifies her arts-based methodology as

one of "bricolage," through the integration of multiple practices (in her case, combining

"visual field notes, bead/found object collage, poetry and creative writing" (26)). She

describes bricolage as "an approach to learning and problem solving that relies on

playing and experimenting with new things" (27 referencing Turkle and Papert). Over

the course of my PhD research, I have found myself working as a bricoleur, combining a

number of different methods to create interactive sound maps (field recording,

soldering, carpentry, and computer coding, to name just a few). This process of bringing

together a number of different methods, and the simple act of *doing* the research (the

building and sharing of these maps) has had as much of an impact on my research as the

outcomes themselves. Chapman and Sawchuk embrace the nebulous distinction

between making and research, further blurring the boundaries between research and

creation: "Here, creation is approached as a form of research in its own right: research is

understood as both a noun and a verb, and creation is not perceived strictly as a

stand-in for art making" (50). With my creative practice integrated as an essential part

of the research process (a process-oriented approach is a key element in performing

research-creation), and research informing the creative process, it is possible for me to

generate a vast range of multi-modal outcomes that contribute to more general

academic discourse outside of the Fine Arts. By changing the ways in which I perform

and present research, I can use new methods to tell new stories, or old stories in new

ways (Chapman and Sawchuk 50). By blurring the distinctions between theory and

method, my research-creation practice fall in line with Tim Ingold's framing of his own ethnographic practices, and the idea of knowing from the inside. For Ingold, research cannot be situated as outside of, or "in isolation from what is going on in the world around us" (*Making* 4). By combining my research and creation practices, I am hoping to make work that responds to the ways in which the citizens of Montreal experience the sound of their city. While these maps can function as documents of a set of particular sounds from a particular day and time, I prefer to think of them as conduits for learning how to listen to the urban eventscape. In order for them to fulfill this function, I have drawn together four key methods as part of my research-creation bricolage: soundwalking, field recording, map-making, and interaction design.

Over the course of my PhD research, I have brought these four methods together in order to create devices that encourage playful engagement with urban sounds, while still asking larger questions about how and why we listen. However, even within this processual and ever-evolving methodological framework, there still need to be standards of rigour and a methodological transparency in relationship to my line of inquiry. I would like to identify some of the considerations (both ethical and practical) I have taken into account as part of my process, while also describing in more detail the four key methods I have applied as part of my research-creation process.

Ethics of Soundwalking and Field Recording

Soundwalking has been a cornerstone throughout my creative and intellectual careers. A soundwalk is a very simple activity: spend a period of time with your

attention dedicated to the act of listening.[20] However, the results of an ongoing

soundwalk practice are far more complex. Embracing the ephemeral and chance-based

nature of the sound in an environment generates a fluid understanding of our

relationship to the world around us, one that is open to the multiplicity of stories that

are continually unfolding. In "Sound, Listening and Place: The Aesthetic Dilemma,"

Barry Truax describes a soundwalking experience as "arguably the most direct aural

involvement possible with a soundscape and one where repetition does not dull its

effectiveness, since each walk is unique and unrepeatable. It is also a good practice to

open one's ears and self to whatever is inherent in an environment, with minimal

preconception, ideally treated as a phenomenological experience" (196). With this

phenomenological approach in mind, soundwalks can also create links to

psychogeography, the Situationist 'drift,' and De Certeau's strategies of inscription. The

soundwalk also ties into the dynamic understanding of the definition of place, one that

fits well with my somewhat metaphorical framing of mobility. Each of the three

interfaces I created as part of this dissertation started as soundwalks. I listened and

walked through these neighbourhoods, generating a thorough understanding of the

multitude of ways in which each place (with its own multitude of interrelationships) can

perform as a sounding space. With this level of familiarity I am able to generate

mappings that speak directly to my own experience of these mapped areas, and share

my own listening perspective.

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[20] I will discuss the development of soundwalking as a creative and research practice in my chapter on the *Acoustic Labyrinth* project, going into more detail surrounding Hildegard Westerkamp's definitions and strategies for composing and performing a soundwalk.

While a strong relationship to the nuances of a particular sound environment can be developed through a series of soundwalks along similar trajectories, it is impossible to share these experiences with others (even in a group soundwalk the experience is necessarily individual—although the sound of 25 collective footsteps can easily overpower smaller sounds). In order to collect and share the sounds I have identified as interesting or that function as identifiers for a particular location, I have drawn from the practice of field recording. I have built up my own field recording methods over the past 15 years, but knowing the polar patterns of microphones or the optimal sample rate to balance recording duration and frequency range still leaves many issues surrounding the act of recording sound in public open to discussion. As Truax writes:

> All recordists, as well as photographers, understand that the act of recording is far from objective or neutral, both technically in terms of microphone characteristics and strategically in terms of recording perspective and other choices with regard to location. However, the further manipulation of those recordings raises ethical issues for the artists as to representation, of what, for whom, and in what future context (*Sound, Listening, and Place* 195).

Although he is writing from the standpoint of a soundscape composer (who normally process raw field recordings, and often obscure or obfuscate elements that could be used to identify a particular individual), the ethical issues surrounding representation that Truax mentions are perhaps more salient in the context of my own work because I am not processing or transforming my recordings in any way. These considerations came to influence my recording methods: determining my choice of locations, recording

practices (mic placement, public interaction, and recording duration), and, most importantly, the editing process. Throughout the recording process for each project, I was as open as possible to interactions with the other people moving through these places. This meant not hiding behind a corner, huddled next to my bag of gear, or cutting myself off from engagement by monitoring the recordings through headphones. As a result, I recorded a number of conversations about me, my project, and the recording process, as well as a few kids (and adults) who spontaneously felt the need to perform for the large furry blimp on a mic stand.

The larger ethical considerations I am working through as part of my field recording methods (privacy, mis/representation, and even the simple act of using someone else's voice) don't begin and end with the act of recording. As a tall, white man I am able to move through space in a way that others cannot. Additionally as a student and long-time recordist I have access to equipment that others do not, and even my physical presence has a certain status. Over the years I have spoken with police and other officials (city workers, paramedics) who have approached me while recording. Considering my status and privilege, these interactions are usually benign. The authorities are not harassing me or accusing me of anything, just simply interested in what I am doing. Also, my own assumptions and positionality surrounding how and why a particular place 'works' impacts my choices on which sounds to record (or not). For example, there was a group of jobless people who congregated in a parking lot behind my apartment. While their happy chatter was a part of my daily experience of that place, I could not walk into their group with my recording gear and add that sound to my map

of *Street Ears*. Nor is it right for me to employ a stealthy recording approach, using a parabolic reflector (as favoured by ornithologists and live sports recordists) to 'zoom in' on their conversations while hiding unobserved. As a result, these maps become very personal documents. They re-present the places I can access, and omit those I cannot. This innate subjectivity can be a stumbling block (as per Jacqueline Waldock's critique), but I cannot change who I am. Instead, I have to make a map about the sounds I hear. This falls in line with the way in which I describe mapping practices. All maps are about voice and agency, and I am sharing my own. In addition to issues of access, accessibility, and privilege, I also have the responsibility to re-present the sounds I have collected in a way that is fair to all the individuals who knowingly or unknowingly contributed to my mapping projects.

These issues of voice are most present in the *168 Hours* project, where the microphone was collecting both the sounds of the intersection below, and the interior sounds of the apartment I share with my partner. This led to an editing challenge I had not encountered with the previous mapping projects (where many of the voices recorded were transitory snippets, or the above-mentioned conversations) which led to relatively easy editing choices: remove anything that seems personal (as I don't know the individuals that were recorded, so long as their conversation didn't divulge personal information I felt it was fair game). With *168 Hours*, I tried to find a balance between presenting a slice of my and my partner's daily lives together (sounds of cooking, bits of conversation, the occasional social gathering and TV watching) and providing 'too much information' about our work, social, and personal lives.

Ethics of Mapping

As part of my research-creation process, I found myself sharing ethical issues with other ethnographers and cartographers. What data is important for the maps to include? What may be relevant or interesting, but would simply overload the person reading (or listening to) the mapping? Kitchin et al work discuss this participatory mode of mapping, framing the observer participant as a sort of auto-ethnographer. They write:

> The principal benefit of such an approach is that the researcher is fully aware of the diverse and complex landscape (socially, politically, economically) within which a mapping emerges; they were the ones after all creating the mapping, experiencing various negotiations with other actors, playing with the data, using various pieces of software, making decisions, reacting to certain constraints and situations, and to varying degrees dealing with the on-going life of a mapping once it is released for others to engage (485).

Here, both the mapping methodology and the resulting ethical considerations are self-reflexive. It is necessary to negotiate one's own perspective in relationship to the information presented by the site alongside the public's understanding of it. Additionally, all the choices made with regard to what data to include (or exclude), and how to present this information are all personal choices, and reflect where I, as map-maker am positioned within a social, political and economic landscape. Essentially, each of these maps reflects my own ear toward Montreal. I have listened and recorded the sounds of *my* city and built a map to re-present it. All three sound maps present the

sounds of neighbourhoods I know well: the places surrounding my former workplace, my old apartment, and a new one.

I will be discussing a few examples of both web-based and mobile soundmapping platforms in more detail throughout this document, but it is important to first acknowledge underheard voices in these mappings, and how I have framed my own listening/recording perspectives. In order to do this, I would like to discuss a critique of web-based soundmaps introduced by Jacqueline Waldock. Waldock explores gender bias and issues of access and accessibility across a number of online soundmaps including the *Montreal Sound Map*, and the British Library's *UK Soundmap*. She points out that the majority of soundmap creators and content providers are male. In turn, this creates a bias toward certain sounds or recording locations to be catalogued and re-presented. As listeners become content providers, they will add to the existing catalogues and categories, which could result in entire categories (and the recordists personal relationship to sound) being omitted (6). Waldock is not suggesting that there is a gendered 'ear,' but rather suggests that this bias has to do with which sounds (and places) are being omitted from the mappings. She discusses the impact of this gender bias with regard to a lack of private or personal sounds within these soundmappings: "the public/private debate here is not reducible to the discussion around male and female, […] rather the issue is that the public realm outside of the home is given significance in a way that domestic sounds are not" (4). However, it is not just personal or domestic sound events that are being omitted or erased from these aural archives. Within current field recording practices, it is customary for the recordist to try and

eliminate their own presence from the recording, by standing still during each session, and editing out any handling noise, conversations or body sounds (coughs, sneezes, tummy rumbles or even footsteps). This recording strategy is possibly a carry-over from the traditional notion of cartography as an objective pursuit (and definitely one from the WSP's desire for quantitative data), but it severs the link between the individual and the places they occupy. Field recording becomes a practice for collecting data, not being a part of the environment. Perhaps these recordists are subconsciously fulfilling the power structures contained within traditional maps, and performing the aural equivalent of a bird's eye view—essentially listening to a place as though no one was ever there.

In addition, the language used to describe these sounds are rarely personal. "Some soundmaps use a tag system allowing the user to input keywords, however this system rarely produces an opinion; the keywords might be: 'horns,' 'birds,' rather than 'annoying taxi horns' or 'beautiful bird song'" (Waldock 6). Even when a recordist adds sounds of their own direct actions, they are depersonalized. It is simply 'footsteps in snow'—not *my* snowy footsteps (5). As users self-moderate their recordings to better fit into particular tags or categories (largely done to make managing the map's data set easier), the map itself loses diversity, and fails in its attempt to document or archive the aural environment as a whole. One example of this is the *Montreal Sound Map*, which claims that "[s]ound maps are in many ways the most effective auditory archive of an environment, touching on aspects political, artistic, cultural, historical, and technological. [...] The soundscape is constantly changing, and this project acts as a

sonic time capsule with the goal of preserving sounds before they disappear" (*Montreal*

Sound Map/About). However, in listening through this soundmap, the tagging system

used rarely touches on the personal, and as a result, is really unable to provide any

insight into the culture of the city from the individual, lived perspective. We can hear the

Tam Tams, yes, but we can't hear what it's like to actually live in Montreal. Waldock

takes this point further, writing: "The battle here lies between data and the cohesion of

person and place. The effect of the sound on the individual and the significance of the

sound are lost" (6). For Waldock, sound is a very personal—and

interpersonal—phenomenon, something I wholeheartedly agree with, particularly when

it is brought into conversation with mapping and placemaking practices.

It could be argued that many soundmap websites are really not maps at all, but

map-oriented visual interfaces for cataloguing and exploring an archive of sounds (and a

somewhat biased one, according to Waldock). However, I don't want to belabour that

point, but rather consider how a sound-based map presents its information to users, and

to what end. Not everyone uses a map in the same way, nor are they expecting exactly

the same data on each and every iteration—effectively disjointing our experience of

place *through* the mapping. The Google-based (and regularly updated) map on my

phone tells me a very different story of place than the tourist's map from the hotel lobby,

or the 'official' street map.[21] And so, even through these soundmapping sites may

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[21] One of my favorite disjointed mapping experiences was in Dubai, where I realized that the city itself was too large and expanding too quickly for map publishers to keep up. The map I had bought in advance was only a few years old, but only covered about half of the city, and occasionally contained completely incorrect information—even about something relatively static as the station names and routes of the public transit system.

function as an entry point to an archive, they are still performing the process of mapping, and of establishing links between sound and place.

Interaction Design

Of course, without an interface to present these personal geographies and subjective maps, there would be no way to share my research. The fourth methodological tradition I have incorporated into my research-creation process is interaction design. The three interfaces in this dissertation pull from two schools of interaction design as laid out by Dan Saffer, a "behaviourist view," and a "social interaction design view" (5). For Saffer, a behaviourist view "focuses on functionality and feedback: how products behave and provide feedback based on what the people engaged with them are doing," while the social interaction view "revolv[es] around facilitating communication between humans *through* products" (ibid., my emphasis). Throughout the process of creating these mapping interfaces, these two concerns were at the forefront. How can I make a map that is engaging, entertaining, and most importantly, easy to use and understand? In order to do this, I repurposed everyday devices that already have patterns of use built up around them: a tabletop maze game, a smartphone app, and a clock.

Facilitating a simple point-of-entry was a key consideration in my design approach. This resulted in applying several assumptions surrounding patterns of use, most of which came from the behavioural view of design that were initially encoded into each of these devices. However, I wanted to use those assumptions to generate further

interaction among users, and focus attention away from the devices themselves and onto the sound environment. To do this, I had to invert a few of these assumptions: the ball should fall *into* the hole, not avoid it, your smartphone screen is *not* the primary source of navigational information, and the clock won't tell you the time—it allows you to *control* time. It is my goal for these interventions into the implied design of these interfaces will break listeners out of their routines of urban aural experience: hearing the varied reflections of architectural acoustics, 'soundtracking' their mobile listening experience with a dynamic re-presentation of urban sounds, or understanding the impact of temporality and duration on the sound environment. My goal is to create mapping interfaces that not only train dedicated listeners, but also serve as a point of departure for further conversation surrounding the role of sound in the lived experience of the city—generating social interactions *through* interfaces.

To return to my earlier concerns surrounding issues of access and accessibility, these have been at the forefront of my thinking throughout the design and construction of all three interfaces, often with lofty goals or dreams for 'ideal' use. Unfortunately, I know that all these devices impose limitations on users, require a certain amount of mobility (in the broader sense), and take into account a number of ableist assumptions surrounding patterns of use. It is my hope that these limitations do not detract from the overall ability of each interface to allow for all individuals to contribute to the larger conversation surrounding our shared experience of the aural environment. These four traditions: soundwalking, field recording, mapping, and interaction design are the methodological foundations upon which I have built my own system of

creation-as-research, using elements from, and the process of 'doing' or performing

each to inform one another, as well as my overarching research questions. Soundwalks

have changed the way I listen, challenged my understanding of mobility, and altered

how I move through the city. My work as a field recordist has informed the design for

each interface. Using a single, fixed recording perspective will result in one type of

interface, whereas choosing to record multiple discrete locations, or multiple

perspectives from the same location will lead to different decisions. Do I use a static

interaction point (like a game or clock) or a mobile app? These choices in turn were

influenced by my reading into critical cartography, ethnography, and the very

definitions of space and place. No one approach would be sufficient, nor would it be

possible to create this type of work without each tradition, method, and practice (or

surrounding assumptions) working together.

Mapping *My* Montreal

Together, these three interactive devices create an archive of my personal

experience of the sounds of Montreal over the past 6 years. Each requires a different

type of listening. There is the repeated audition of the same moment in time from

different perspectives in order to stitch together a comprehensive aural image of the

church bells in the *Acoustic Labyrinth* project. Then, the act of rationalizing the

differences between mobile and real world sounds in order to create a sense of how

different areas of the neighbourhood work with or against each other in *Street Ears*.

Finally there is the dedication to weaving together a coherent narrative by listening through multiple iterations of time from the same location in *168 Hours*.

These three mapping interfaces are not objective, static portraits of the sounds of Montreal. They are based on my personal experiences of the city, my preferred routes, my tactics for navigating sound-space(s), and only re-present a few select (and very personal) locations: two apartments I've lived in, and my former workplace. Each of these interfaces strives to create a sense of place for each listener, based on my own lived experience in each location. The listener may not have the immediate visual correlations between the mapped sounds and the physical world, but they gain a heightened understanding of both how these sound events react to space, and the larger relationships among each individual audio file or sound-space within the mapping. However, what makes them interesting as deep(er) mappings, is that they are processual. Not just for me in the making of them (in recording and editing sound, or designing and constructing the interface), but for listeners as well. They take time, effort, and a willingness to explore in order to be understood. This processual nature of comprehension gives agency to the listener and invites them to participate in the process of re-presenting Montreal. By eschewing some conventions of traditional sound maps, my interfaces don't demand a single 'correct' way to explore the data. They are useful tools within the larger sonic archive of Montreal. Here are a series of fluid, dynamic repositories of urban sound—ideal source material for conversations around intangible culture, critical cartography, and acoustic ecology.

Chapter One: Exploration

> "A labyrinth, then, is a quest form, a mode of urgent examination
> or perilous exploration."
>
> — Donald Gutierrez, *The Maze in the Mind and the World.*

It was a cold Sunday morning in November of 2012. Windy. I walked to the center of the Place d'Armes Square in Montreal's Old Port and began unpacking. As usual, I'd brought more recording gear than I needed. One by one, my team of recordists arrived. Some even brought friends—just a few extra folks who were interested in finding out what was going on. As we sat, shivered, and chatted, I began passing out iPads and demonstrating the application we'd be using to document our movements through the area, and the sonic eventscape. At five minutes to noon, we all started recording. I clapped my hands to sync the devices then my friends all disappeared off in five different directions. As I sat in my recording location in front of the Basilica Notre Dame, I began to focus in on the sounds around me: the click of heels on pavement, laughter from groups of tourists exploring the area, and parishioners on their way home from mass. Then, the bells struck. I find the sound of these instruments to be absolutely fantastic. Something so large it can only be played publicly, necessitating an interaction with the space and architecture around it. As the echoes of the bells bounced off neighbouring buildings, shimmering around me in harmonic resonance, I began to imagine myself in the place of each of my recordists. Knowing I would later be able to aurally re-visit their experience of these same sounds, I started thinking about how to create a mapping of this particular moment in both space and time while keeping in

mind the larger issue of re-presenting these sounds to audiences in a way that is both fun and encourages a dedicated listening experience to sound *through* space.

As a departure point for my study of the sound of Montreal, I started with one of the most striking soundmarks I have an association with: the bells of the Basilica Notre Dame (BND). These bells have been a part of my life in Montreal since I first moved here in 2005. Not only are they a musical accompaniment to the impressive architecture within Place d'Armes Square, they serve a timekeeping function as well. More than once during my time as a technician at the Centaur Theatre (around the corner from the BND) I would be walking briskly across Place d'Armes Square—almost at work—only to hear the bells start ringing the hour at nine AM. I would then have to speed up as I told myself "I'm not late… yet. As long as the bells continue ringing, it's still nine." They were also a reminder of the passage of time throughout the workday. The back of the theatre touches the edge of the churchyard, so it is possible to hear the bells ringing through the theatre's walls. They also helped keep the crew on time with their lunch breaks—we stop when you hear the bells ring one PM, and you're back when you hear two. I imagine other people who live and work in the area have a similar relationship to these sounds (although perhaps not as conscious as mine), so I felt they made a good starting point for this ongoing examination of our lived experience of urban sounds. Additionally, the Basilica is a centrepiece of the Old Port—not only due to its size and impressive architecture, but also as part of the history of the development of the city. It is the frontispiece to a public space that has always been a public space, and is part of the ongoing negotiations among architectural eras that make up the character of the Old

Port. As I will discuss later in this chapter, these bells are part of an ongoing dialogue between Church and State, and represent Quebec's colonial history and their perceived dominance over the New World.

In this chapter, I argue that alternate modes of navigation can be expressed through a critical cartography-inspired mapping interface, and that the information gleaned from these modes can be used to generate a sense of place. This chapter combines concepts and practices from acoustic ecology and critical cartography to discuss the processual nature of a sound-based mapping, and brings together phenomenology, memory, and the concept of aporia—where time can pause or double back on itself (Harris)—found in traditional labyrinths to describe how listeners aurally navigate this mapped area. Finally, I will explore how modes of critical play contribute to this form of aural and tactile navigation.

The Power of Maps

Maps have the ability to tell stories, but they also obscure other stories. Not just the stories of the locations they demarcate, but of their creation (surveying, inking), distribution, and circulation. As with my earlier discussion of the Montreal 375th anniversary video, it is important to keep in mind who is making a claim on this demarcated territory, who has created and distributed them, and for what purpose. Maps have assisted in no small part to the notion of land ownership and the creation of nation-states—if you can define what and where something is, you can own it (Fiorani).

They have also helped shape our understanding of how neighbourhoods, cities, earth and the cosmos all work together, and defined our current geopolitical mindset (Crone). Maps can also be used to convey complex thoughts or theoretical concepts (the mental map, or concept mappings), bodily systems and the imagination (Harmon), or to plot transit systems, love stories, and even electricity consumption by generating visualizations of the interrelationships among vast data sets (Desclaux-Salachas).

As a response to this wide range of applications for maps and mappings, and in an attempt to destabilize the relationships between these documents and the authority of their producers, Crampton and Krygier critique the normative authority of maps as a static document, and the power assumed by their producers. Critical cartography practices generate process-oriented documents—mappings—that aim to include as wide a range of voices as possible, and are effectively 'un-disciplining' cartography. According to Crampton and Krygier:

> This one-two punch–a pervasive set of imaginative mapping practices and a critique highlighting the politics of mapping–has undisciplined cartography. … It is operating from the ground up in a diffuse manner without top- down control. Yet it is a movement that is ongoing whether or not the academic discipline of cartography is involved (Wood 2003). It is in this sense that we can say that cartography is being undisciplined; that is, freed from the confines of the academic and opened up to the people (12).

Maps made using critical cartography methods and processes (or, according to Rob

Kitchin et al., 'Mappings')[22] are often created by, with, and for artists, community

groups, and other individuals who may not use, understand, or experience the mapped

area in the same way as the purportedly objective viewpoint of the issuing authority

figure(s) (Crampton and Krygier). Critical cartography is about changing the dynamics

of power, opening up the process of creating imaginative mappings to everyone, not just

the State or Academy.

Traditional maps are presented to the public as fixed representations of space

(whether they're digitally-presented, or physical objects). They purport to tell us the

truth about how objects are arranged in space, and the ways in which we can navigate in

and around these objects. However, just because they are fixed, it doesn't mean that

maps don't *do* anything. "Maps are active; they actively construct knowledge, they

exercise power and they can be a powerful means of promoting social change"

(Crampton and Krygier 15). However, this ability to actively construct knowledge or

promote social change means we need to destabilize the way we think about traditional

maps, and use them to create our own narratives and inscriptions. It is not about

looking at a map and understanding it to tell the whole story of a location, but "instead

advocating an ontogenetic position that understood maps as always in the *process* of

becoming" (Kitchin et al 480. My emphasis). In this way, mappings respond to De

Certeau's concept of stratified place (200). We cannot reduce a place to a single layer of

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[22] While Kitchin et al. exclusively use the term mapping to refer to this type of process-oriented document, I believe the critical cartographic maps that Crampton and Krieger describe are very similar to Kitchin's mappings, and will use both terms interchangeably, referring to 'traditional' maps and mapping practices as such.

meaning, which is exactly what traditional maps are trying to do. Instead, mappings

allow for the multitudes of intertwined 'stories-so-far' to each have their own voice.

As processual documents, mappings have the potential for infinite expansion,[23] as

each individual plots their own landmarks (or places of importance), and traces unique

trajectories through space and time. In order to fulfill this potential, it is necessary to

destabilize the power and authority of traditional maps. Kitchin et al posit that:

> Mappings must never then be assumed to have innate ontological security,
>
> instead they are brought into being and made to do work in the world (e.g.
>
> inscribing territory, shaping discourse, producing knowledge, informing and
>
> framing decision making) through practices such as drawing, interpreting,
>
> translating, communicating, determining, denying and so on (481).

By destabilizing the ontological security and authority of traditional maps, (combined

with the imaginative processes and ground-up production practices found in critical

cartography), these documents (be they maps or mappings) are better able to respond to

the needs, interests, and usage patterns of the individuals who move through and/or

occupy these spaces. As Kitchin et al argue, mappings have the power to enact social

change, give voice and agency, as well as effectively communicating relationships

between physical locations and places.[24] As an extension, I posit that, sound-based

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[23] While this may not always be practical or physically possible, there are a large number of online sound-based mappings that are open ended, allowing users to upload content as long as the site is online. A good example of this is the *Montreal Sound Map*, which had been collecting crowdsourced material for over a decade.

[24] Their case study on Irish 'ghost estates' (unfinished or derelict high occupancy housing units) shed light on the slumping Irish economy, demonstrated the inequality of wealth distribution across the country, and pointed to sites where additional social assistance is necessary. All while giving the reader a picture of the way Ireland *is* at that moment in time.

mappings can do even more to help understand the lived experience within a particular place. Mappings do not have to be limited to charts, graphs or images, but can use the processual methods of field recording to develop a relationship with a location and then share these findings with other interested listeners.

With the rapid democratization of mapping processes, due in no small part to the recent availability of Geographical Information Systems software, most notably the Google Earth and mapping services (Crampton and Krygier, Farman), it has become easier and faster to create digital mapping projects. And, this ease of access has helped democratize the mapmaking process.[25] This ability to quickly make maps, and the rapid integration of multimedia playback systems into web design means that it is possible to make mapping projects that are dedicated to recording, sharing, and playing back sound. While soundmaps are certainly not a new idea (a key component of the WSP's research agenda was the creation of sound-oriented maps), contemporary sound-based mappings have a technological advantage—it is much easier to share data, embed sounds, and create dynamic and interactive projects than in the 1970s. Many of the WSP's maps—included under the blanket of "Sound Notation Systems," as Schafer refers to them (264)—project the same authority onto these sound maps that Crampton & Krygier and Kitchin et al are critiquing. They are replete with complicated legends, topographic-like lines marking the relative sound pressure levels of the ambient aural environment. Some contain logs of the time and location of specific sounds, or an XY axis that logs the occurrence of sound events across both time-of-day and decibels. In

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[25] However, there are still many critiques surrounding exactly who has the access or ability to create maps, and what data is being selected as representational of that place. While the process of mapmaking has recently become more open and/or democratic, it is certainly not completely so.

my reading, these bits of quantitative data have been mobilized from within the

Academy, and are being used in order to assert the authority of their maps. It is also

interesting to consider that the WSP was working within the relatively new discipline of

Communications Studies so their nomenclature ('notation systems') and deference to

scientific method (logging coordinates, times, and sound pressure levels) appear to have

been used in order to make their maps appear more objective, quantitative, and

therefore more 'true.' Something worthy of inclusion within academic discourse.[26]

In contrast, most contemporary sound-based maps are better described as

multimedia playback systems. Usually processual in their development (see the above

footnote on the Montreal Sound Map), many are web-based, using the Google Maps or

OpenStreetMaps application programming interfaces to "raise awareness of sound in

the environment and create a vast archive of instant historical snapshots. […]

[Sound-based] maps have a similar format, interactive maps with pin signs/tags to mark

where sounds have been recorded at a particular geographical location" (Waldock 1).

Unlike the WSP's print-based notation systems, in these mappings, users can actually

listen to the sounds as they peruse the on-screen map. These mappings normally use a

point-click-listen user interface, allowing listeners to jump quickly from sound to sound.

Many (but not all) online soundmaps are crowdsourced, calling on the

(internet-enabled) public to submit sounds they find interesting or indicative of a

particular aspect of the mapped location.

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[26] Of course, I have a great debt of gratitude to these pioneers. Without their hard work at legitimizing the study of sonic environments (and situating that study within Communications Studies), I would not be writing this dissertation.

In this chapter, I will discuss the first mapping interface I constructed: *Old Montreal's Acoustic Labyrinth.* This piece is built into a table top game, transforming a maze into a relief map of the Place d'Armes Square. By appropriating the mechanics of the game's playing surface (trying to roll a ball into, or away from holes), this mapping interface moves away from the fixed, two-dimensional representations of sound in space as found in most contemporary soundmaps. Instead, the *Acoustic Labyrinth* creates a gestural, and/or physically-engaged means of interacting with re-presentations of space and sound, exploring the idea of sound-*through*-space[27] and encourage alternative ways of producing and disseminating knowledge. In particular, this interface helps listeners to develop an audile technique that enables them to decipher the acoustic nuances (shifts in timbre, delay, and echo) generated as sound interacts with architecture.

My research practice is heavily rooted in soundwalking methods and a phenomenological approach to listening to the eventscape. Soundwalks, popularised (and legitimized as a compositional form) by Hildegard Westerkamp, are an offshoot of early listening exercises developed by the WSP. These methods encourage participants to engage in a period of dedicated listening, either alone or in a group. Westerkamp writes: "soundwalking is a practice that wants to bring our position-inside-the-soundscape to full consciousness. [...] Or, to put it another way, it is worthwhile to devote a certain timespan to the act of listening, no matter what may meet the ear" (*Soundwalking as Ecological Practice* 12). By devoting this timespan to the dedicated

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[27] Most fixed, web-based soundmaps rarely offer multiple access points of listening for each location (the exception being *Cities and Memory*, which features 'remixed' versions of each field recording). In contrast, by offering the same sound event from six perspectives, the *Acoustic Labyrinth* encourages listeners to hear how sound is shaped by space: listening *through,* not *in* a place.

act of listening, a soundwalker (or, hopefully, someone listening to one of my mapping interfaces) opens themselves up to whatever may happen within the environment for the duration of the walk (or exploration of the map), with a focus on sound as the objective for direct experience.

This shift toward immersing *oneself* into the environment—place—is a key point of departure within many phenomenological practices. As Dylan Trigg writes:

> One of the features that defines phenomenology's treatment of place is a commitment to the belief that lived spatiality is not a container that can be measured in objective terms, but an expression of our being-in-the-world. [...] [This] means being *placed*. At all times, we find ourselves located in a particular place, specific to the bodily subject experiencing that place. We are forever in the *here*, and it is from that *here* that our experiences take place (4, emphasis in the original).

It is this idea of being open to the experience of *here* that is the most compelling aspect of soundwalking. This is not about specifically listening *for* or *to* anything, but rather about being open to the role of sound in the "world-as-experienced" (Natanson, in Edie xi). By moving away from an object-oriented, Cartesian ear that is dissecting and categorizing the sonic eventscape (listening-in-search), the listener is free to make their own associations among the unique intersection of sound, space, and time for the duration of the soundwalk. This dedicated attention toward listening-in-readiness allows soundwalkers to create a heightened sense of being physically present in a particular place—as opposed to a meandering walk where one's attention can flit from

admiring a beam of light through the trees, to what may be for dinner, then to a

shopping list, and perhaps back to the trees again. Not to say this can't (or hasn't)

happened (to me), but by dedicating attention to the act of listening, a soundwalker can

fully experience all the sonic eventscape has to offer.

My own experience with soundwalking began during my MFA at SFU in 2006,

where I had the good fortune to work with Westerkamp as a member of the Vancouver

Soundalking Collective. In addition to composing and presenting several public walks,

my work with the collective included monthly experimental walks with the collective

working through new ideas on how to compose, lead, and experience soundwalks.[28] This

is something that has continued to shape how I think about sound, place, and mobility,

and has informed the development of the *Acoustic Labyrinth* in many ways. In fact, it

was the process of performing many soundwalks through the Old Port (combined with

the relationship I had with the bells while working at the Centaur) that inspired this

project. After hearing these bells so many times from so many different perspectives, I

became interested in being able to compare the aural nuances of each location without

having to wait an hour for the next peal to chime.

My choice of locations for recording the BND's bells is informed by Blesser and

Salter's writing on the eventscape and, more importantly, what they define as the

acoustic horizon of a particular sound event. These bells presented a perfect case study

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[28] This included such methods as a 'timed' leader, where everyone was given 5-10 minutes to lead the group in a new exploration before someone else from the collective took over, and my personal favorite of a 'flocking' walk, with no leader where we were simply trying to follow the collective impulses of the group. We also experimented with the placement of musicians throughout the route, the integration of sound recording, playback and broadcast technologies, and group improvisations using building materials, voice, and other found sound objects.

for exploration and analysis of an acoustic horizon: the Old Port is not heavily trafficked, so sound events (especially loud, distinct ones like bells) can travel further without much masking from the background sound of wheels on pavement, the bell tower is higher than almost all the neighbouring buildings, and the surrounding architecture represents a wide range of different styles and building materials. The combination of these factors results in the bells having a distinct tone and timbre at each different location across their acoustic horizon. In addition to the modulation of the sound's spectral qualities, the relatively dense architecture generates an extremely complex series of reverberations (if the reflected sound arrives less than 50 milliseconds after the original) and echoes (if the reflected sound arrives more than 50ms later) that change dramatically from location to location, and even by walking from one end of the Square to the next. The acoustic horizon of the bells was also served to structure the boundaries of the mapping interface. In this case, the map doesn't need to extend beyond the borders of the sound event.

Rolling the Acoustic Line

The function of the *Acoustic Labyrinth* is to subvert the dominance of the scopic regime, placing an emphasis on the way listeners move *through* re-presented (and miniaturized) space, and directing their attention to the sonic and temporal dimensions of the sonic eventscape. In order to frame the listening experience of this project, I suggest that listeners not listen "in-search," but rather "in-readiness." In this level of listening, "attention is in readiness to receive significant information, but where the

focus of one's attention is probably elsewhere. This type of listening […] depends on associations being built up over time, so that sounds are familiar and can be readily identified." (Truax, *Acoustic Communication* 22). In this level, listeners are asked to recall their own associations with the urban eventscape, using the mapping within the labyrinth game as a set of guidelines for learning to hear a place in novel or physically impossible ways, then applying the memories of that listening experience to our future interaction with the location. This is about practice and memory, two key ways in which we create associations with place. Trigg expands this idea:

> As our bodies reach out into the world, so a mimetic interplay arises, in which our sense of self becomes fundamentally entwined with the fabric of the world … Being attached to a place means allowing memories to be held by that place. In turn, being *held* by a place means being able to return to that place through its role as a reserve of memories. Not only do places hold memories in a material sense—as the archive of our experiences—but those same places crystallize the experiences that occurred there (9, emphasis in the original).

The process of repeated audition (as described earlier both with regard to the notion of experience (Williams, Dewey), and in Truax's listening-in-readiness) generates the memories required for place attachment to occur, without necessarily having to be physically present (something I feel is implied within the 'inscriptions' of De Certeau's practical memory). This memory-oriented approach to crystallizing the experience of place also extends to the listener's interaction with the map's game-based surface and haptics. Without extensive practice or rehearsal (i.e. the building up of associations over

time) listeners may not be able to choose with precision which sound they encounter. By rolling a small steel ball across the game surface, listeners are continually re-sequencing these sounds in new permutations, developing and refining their aural memories of each location alongside the haptic techniques required to roll the ball in the desired direction. Of course, it is possible to explore the map randomly, or without much desire to roll into a particular hole. In my experience watching listeners use the interface (especially for the first time), this chance-and-error mode of exploration is quite common.

The *Acoustic Labyrinth* interface documents the acoustic horizon of the BND's bells—an area of about a square kilometer in total (although the mapping does not cover this entire area), allowing listeners to hear in a novel way while still being accessible (and entertaining) to explore. One of the key concepts that has driven my research and documentation of the sound environment is mobility, and encouraging listeners to think about the experience of sound *through* space. In this project, I wanted to explore alternative means of movement to create a listening experience that is otherwise physically impossible: to hear the same moment in time from multiple perspectives.

This project was inspired in part by Steve Heimbecker's gallery installation *The Acoustic Line as the Crow Listens* (1993). Heimbecker approaches the ambient eventscape in a very different way than the physically present, phenomenological, and attentive listening modes developed through soundwalking. In *The Acoustic Line as the Crow Listens* he uses a process that encapsulates a similar approach to mapping space and time through sound, which he refers to as the "Acoustic Mapping Process" (*Songs of Place* 25). In this work, Heimbecker collected sounds from eight locations, each one

mile apart. These sounds were then synchronized and played back in a gallery through a corridor of eight pairs of speakers eight feet in the air and eight feet apart. As the listeners move through this corridor they are able to move across this vast expanse of space at—or faster than—the speed of sound, which Heimbecker calculated to be 5.5 seconds between each eight-foot span (*An interview with Steve Heimbecker*). It is this integration of the temporal element of sound installation and mapping that first attracted me to this project. Here was someone actually *performing* space time compression (although not exactly in the way Massey originally described), and using sound to do it!

"Acoustic Mapping Process" recordings are collected using an arbitrary pen-and-paper mapping process. Heimbecker implements

> a grid-like network or mapping to capture a representation of a complex sound
> space that is far too large in area to be able to record from a single point of view.
> [...] In [his related] series *Songs of Place*, [he] first looked at a detailed land map
> [...] second, [he] looked for the centre of the community (always geographical),
> and expanded [his] view to the outer wall of a circle, which must always be
> informed or constrained by the geographical (*Songs of Place* 33).

This arbitrary pen and paper approach to location selection is the primary distinction between Heimbecker's work and my own. Despite similar approaches to integrating time into these mapped re-presentations of space, my work develops out of a direct and fairly intimate knowledge of the sounding space, allowing the character and architecture

of the surrounding area to inform the selection of recording locations as opposed to approaching the eventscape from an abstracted visual representation.

However, Heimbecker's *Acoustic Line…* still engages audiences in an embodied or physically-present manner: they must move through the installation venue, creating a shared and participatory experience similar to the one found in soundwalking. One of the goals of my project was to be able to combine the exploratory movement through a city found in phenomenological approaches to space and experience with the dedicated attention to listening found in soundwalking practices, and Heimbecker's approach to compressing space and time.

A Moment Through Space

The *Acoustic Labyrinth* project maps the sonic eventscape surrounding the BND in Old Montreal, Quebec from six recording locations around the Place d'Armes area simultaneously. Each of these locations was selected to highlight the acoustic arena of the BND's carillon and demonstrate the effect the surrounding architecture has on the acoustic filtration of these bells. By switching from one recordist's perspective to another, it is possible to quickly and easily hear the differences in the timbre and reverberation between each location without the delays and shifting aural perspective generated by physically moving through the Old Port. However, there is much more behind my choice to record the BND bells than my own affinity for how these giant instruments interact with the architecture and environment of Place d'Armes and their

role in my day-to-day life over several years. My choice to use church bells troubles the intersection between sacred and secular, reflecting local history and the strong Roman Catholic heritage of Montreal. Church bells have important effects (and affects) in the creation and maintenance of a community, serving as an aural and cultural anchor for all those within its acoustic arena. The significance and role(s) of bells within a community (in particular, Catholic Francophone ones) is well documented by Alain Corbin in his book, *Village Bells*. Traditionally, a church's bells were only used for religious reasons (a call to mass, celebration of feast days), but over time, secular use grew (sounding civic alarms, timekeeping), and with this rise in secular use, tensions increased between church and state. I find it particularly interesting that one of Montreal's oldest and largest churches is used daily for timekeeping—a secular (and, in my opinion, somewhat touristy) purpose, and not for the sacred use of a call to mass.[29] However, it is this secular sound that still shapes the daily lives of those who work and live in the area, constantly providing an aural reminder of the passage of time, the colonial history of our county, and the historical influence of the Church in Quebec culture and identity.

In 19th Century France, bells were auditory markers for each village. Of course, this is not limited to France. A Cockney in London has been described to me (by a

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[29] The BND is definitely a tourist site within the Old Port, and the bells are no doubt part of that draw. They ring out across much of the Old Port, drawing visitors in, or at least highlighting the prominent position of the church within the neighbourhood. It is at the centre of the historic area, and the large public plaza in front encourages visitors to sit, relax, and take in the sights. Additionally, it was (until very recently) a key hub in the network of 'calesh' or horse-drawn carriage drivers (the peal of the bells is still strongly tied to the smell of horse urine in my mind), so most tourists would start and stop their guided experience of the Old Port there (often with hilarious inaccuracies—for example I once overheard a calesh driver tell his passengers that the Centaur (the former Stock Exchange) was where the CBC had filmed *Anne of Green Gables).*

Cockney neighbour) as someone born within hearing range of Bow Bells (St Mary-le-Bow Church). However, what makes French bells more interesting is the detail in which their use has been documented. After the Revolution, communities were charged with providing their own bells. As such, they became extremely important symbols. Corbin writes:

> In rural societies obsessed by the demarcation of communal identities, ever mindful of the defining features of groups and always ready to issue challenges, the bell is a unique object that serves as a natural symbol of a community's identity. The need for bells here involves a series of interlocking logics of conforming, first of all, to the hierarchy of parishes and later, to that of communes. Communities of any significance could not conceive of being without a ring of bells (73-4).

It is important to note that communities required bells in order to position themselves as being 'significant,' or worth 'being on the map.' While it was common practice to hear the sound (and acoustic range) of bells as a symbol of domination over space in 19th Century France, the prevalence of church bells in French Canada can be seen as a continuation of the parish-based system of land allocation in the New World, and the role of the Roman Catholic church as a deeply ingrained cultural institution. Corbin goes further to posit that bells were not only a central aspect of community identity, but also of the power and authority of the Church. Cobin writes: "Bells did not only serve as auditory markers. They also played a part, as we have seen, in the *marking that served to constitute a territory*, and that was indissociable from the notion of surveillance (210

emphasis in the original). Part of my rationale for using the acoustic horizon of these bells as the boundaries of the mapping interface was (initially, unconsciously) linked to this notion of sound as boundary object. These attitudes of ownership and surveillance tied to church bells have continued into contemporary Quebec, with each neighbourhood featuring its own peal (or, in more densely populated neighbourhoods, multiple sets of bells). Within Place d'Armes Square, the BND's bells can be heard as a continuation of the symbolic power and authority of Roman Catholic traditions within Quebec culture, and our shared colonial past.

Within the historical context supplied by Corbin in *Village Bells*, the pastoral communities of rural France would, naturally, use their bells as an integral part of religious life. However, over time, the separation of secular and sacred blurs. Bells could be rung to sound alarms (in case of fire), or to perform more banal, community-minded functions: announcing curfew or acting as an aural beacon to help guide wayward individuals during inclement weather (100). In the case of the BND, I posit that these bells are being rung for a secular, not sacred purpose. Corbin lists the traditional secular uses as "ringing for school, the arrival of the tax collector, the lining up of conscripts, summoning of electors, council meetings, and for the times of toil, rest and retreat" (214). Not surprisingly, even this relatively straightforward exploration of these two modes of ringing exposes tensions between the secular and the sacred: Church and State. According to Corbin, these tensions arose after "the steady decline in the pragmatic functions of bell ringing gradually drew attention to its symbolic properties and powers of evocation, which had subsisted or perhaps even been enhanced" (215).

The desire for many municipalities to have secular rings (often rung on the church's sacred bells) signals not only a shift toward the secularization (or desacralization) of bells during the late 19th century, but it also represents changing attitudes towards the identity of the State. A cultural shift that has been imported to Quebec.

The ways in which these bells perform is deeply rooted in the hegemonic cultures in which they are situated. When I hear my local church bells ring, they are not simply performing these secular or sacred functions, but also performing within the boundaries and systems prescribed by Quebec's predominantly Roman Catholic history and traditions. These normative assumptions were thrown into the public eye in the Fall of 2013 with the tabling of Quebec Bill 60, also known as the Charter of Values, which "affirm[s] the values of State secularism and religious neutrality and of equality between women and men, and providing a framework for accommodation requests" ("Charter of Values"). This bill was aimed at eliminating ostentatious or overt forms of religious expression in the public realm, specifically proposing banning state employees from wearing headscarves, yarmulkes, or turbans in the workplace.

While ostensibly framed as a means of enforcing state neutrality, Bill 60 is most interesting when we look at what it did not ban. In her blog post on the *Immanent Frame* website responding to the Charter of Values, Lori Beaman comments:

> Entwined in this discussion about the charter is the Roman Catholic Church, which, for the purposes of the 'common values' identified by the Quebec government, is not religion but culture and heritage. In other words, the public and government discourse about religious symbols that are associated with

Catholicism and Christianity is that they are part of 'our heritage and culture,'

and therefore not 'religious' in the same way that a turban, hijab or kippa are

(*The Charter of Quebec Values*).

Beaman's identification of Catholic and Christian symbols existing outside of debates on

religion creates an interesting frame through which to explore how church bells perform

multiple roles, acting as community institutions, cultural edifices, and also as contested

spaces.

The BND performs what can be seen as a primarily secular function, ringing (or

in Corbin's language, "chiming") each hour, on the hour from 9AM to 6PM each day of

the week. By relegating the use of bells to this standardized, secular purpose (and one

contained within 'normal' working hours), the BND is acting primarily in a civic

function—organizing time without the rites associated with the actions of a church. This

secular function can also be heard by examining when it chooses to ring, not just how.

Easter week (Holy Thursday, Good Friday, and Holy Saturday) is, in the Catholic

tradition, a period when all bells are silenced, marking the solemnity surrounding the

death of Jesus. However, during the 2014 Easter week, the BND still chimed its hours.

By performing a function outside of sacred restrictions, the BND is clearly operating

within the secular realm. These chimes are being performed not for the purposes of the

church, but for the office workers and tourists who occupy the Place d'Armes area. The

power geometries at play in this particular location are particularly interesting. Who has

the time and agency to really take in these sounds? As a student, I was able to spend a

substantial amount of time exploring the area in detail, but it was a research project. I

was dedicating my attention to when how, and why they chime. When I was working in the area the bells were integrated into my day-to-day life. Something always there: a sound event for which I listen-in-readiness to as opposed to listening-in-search of. However, as a local employee, they served a very different function: time to work, time for lunch. Or, when I was working evenings, curiously absent from my experience of that particular place. For tourists with time to amble and explore the Old Port they may simply evoke sensations of the European charm and character of French Canada, but certainly don't fulfill the same function they do for those living and working in the area.

However, this secular use still has an impact. The bells of the BND bind a community together, whether they are as conscious of it as the Cockneys are or not. I mentioned earlier it is important not to mistake a sense of community for place, but in the case of the *Acoustic Labyrinth* mapping, it is this sense of community—of being able to hear the bells from across the neighbourhood—that helps the remote listener generate a sense of place. A place with important ties to the history and culture of the city. The BND acts as an edifice associated with the cultural heritage not only of the city of Montreal, but also the province of Quebec. In the 2008 book describing the history of the BND, Jean Trudel claims it "has always been a scene of great events that left an impression on Quebec's consciousness" (1). Trudel goes on to list the weddings, state funerals, and cultural celebrations that have been presented at this historic church. Contained within the idea of being able to affect the province's consciousness is the notion that the church fulfills not only a religious role, but also one representing the

history and culture of Montreal—one that is neither simple nor straightforward, rife with complexities and contradictions.

Techniques and Technology

In an attempt to draw the listener's attention to the unique sonic qualities of these gigantic instruments ringing through this historic public square, while generating contemplation upon this relationship between church and state, I began soundwalking and making test recordings through Place d'Armes Square.[30] Using the sound of the church bells as my point of anchorage, I explored an area of about one square kilometer around the BND listening intently to each peal in a morning or afternoon, with an ear toward interesting collections of reflections and the vanishing point of the bell's acoustic horizon. After a series of explorations where I attempted to fully open myself up to the phenomenological experience of the place (and the ephemeral nature of these particular sound events within it), I selected six locations that I felt reflected (sic) the unique acoustic arena of the carillon.

The first location is within the public square, about 100 meters from the church. I chose a location slightly off of center, in-between two relatively modern skyscrapers, which provided an excellent venue to hear the overtones of the bells as they reverberated among these two tall buildings and the church itself. The second location was to the Northwest of the square behind the National Bank skyscraper at the

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[30] While working nearby allowed me to experience the bells from a variety of perspectives, I felt it was important to revisit the area with a dedicated ear toward finding specific recording locations for this project.

intersection of St Jacques and St Francois-Xavier (all directions are based on Montreal's -45° cant from magnetic North). The third location was to the East of the square, in a parking lot just South of St Jacques. The fourth location was slightly Southeast, on rue Notre Dame. This street is relatively narrow and features very dense tourist traffic, and is in almost direct East-West alignment with the BND's bell towers. The fifth location was further South, just past the apse end of the Basilica on rue Le Royer, a pedestrian street filled with birds and high granite walls on either side, creating a high number of shorter acoustic reflections. The sixth and final location was on the Western side of the BND, on rue St. Francois-Xavier in front of the Centaur Theatre. I chose this location not only due to my own memories of working there, but because the combination of a row of buildings and a parking lot across the street from the theatre provide a mix of both direct and diffuse reflections of the carillon, in contrast to the more densely built-up architecture of locations two through five.

In following with my phenomenological explorations, I applied an open-ended, experience-oriented recording process as opposed to a musicological or ethnographic one, meaning I was less interested in recording these bells perfectly, or deeply engaging with the history of this particular carillon. The goal of this project was not to intensively document every possible ring and reflection of the BND's bells, or collect oral histories about how Montrealers respond to the peals, but instead to create a mapping interface that would allow me to explore a singular intersection of space, sound, and time from multiple perspectives. As a result, these recordings represent what was happening at that particular moment in time *through* place. My goal was to record and edit

transparently, allowing the site to perform with as little additional mediation as possible. There is no filtering or multitrack editing and sequencing of these recordings.

I asked my team to use the same phenomenological approach to their recording processes. Simply, take a microphone, find what they felt to be an interesting sounding-space based on the initial location they had been assigned to, and be open to the sound of the bells. It was up to each individual recordist to explore and discover what they felt to be the 'sweet spot,' or even just the most interesting perspective from that particular location. This led to some microphone (or, rather, iPad) 'wanding' (moving the microphone from side to side in order to capture a specific sound) and a few minor changes in perspective or location during the recordings.[31] My team and I each recorded on iPad minis using the *AudioMobile* app developed by Owen Chapman.[32] The six devices were slated with a hand clap five minutes before the bells rang, allowing me to synchronize the recorded audio files afterwards. Each of these tracks contains a series of micro performances reflecting the unique character of its respective recording location. For example: in the recording from the Square location, a beer can rolled across the entire width of the square, a man yells "Loser" near the Notre Dame location (which can be heard faintly from the Square location), the Le Royer location featured a

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[31] The range of approaches was interesting. Some recordists stood very still, maintaining exactly the same position and perspective (mic placement), others used the monitoring capability of the *AudioMobile* software to explore the sounding area more closely. For example, at LeRoyer, the recordist moves the mic toward the trees containing a flock of birds—aurally 'zooming-in' to the sound event

[32] This app allows users to record audio while simultaneously logging real-time GPS information about the (potentially mobile) location of the recordist. As most of my recordists were stationary during the recording session, this additional functionality was used to identify exactly where they chose to record from.

flock of small birds, and a horse-drawn carriage rolls by in front of recordist at the Centaur Theatre location.

Once all six recordings were collected, the issue of how to listen to these simultaneous sounds arose. In order to provide a portable, yet permanent solution to this problem, I began thinking about what kind of physical interface, or platform I could build that would allow me to build a tactile, movement-oriented sound map. During a fortuitous trip to a second hand shop, I bought a copy of the Brio brand *Labyrinth* tabletop marble maze game. I found this simple, hands-on interface to be an intriguing platform for a mapping (See Appendix A-2). It presented a small, confined surface for exploration with an interface that most people are immediately familiar with, and comfortable using. After downloading the GPS data from each of the recording locations, I scaled down a street map of the area, and constructed my own mapping to fit within the playing surface of the game using raised balsa wood boundaries corresponding to places where people couldn't walk (buildings, retaining walls, etc.), allowing the ball to roll through the public square and along the adjacent roads and walkways. I then drilled holes corresponding to each recording location and installed switches below, so that when the ball falls through the hole, it triggers the audio recorded from that location. What makes this form of mapping particularly interesting, is that is does not require sight to explore the mapped surface. It is possible for a listener to not drop and roll the ball, but instead use their fingers to explore the raised ridges of street boundaries, and insert their fingers into each hole in order to trigger the desired sound.

The audio playback system in this project is relatively simple. I used an Arduino microcontroller to power an Adafruit Waveshield made up of a self-contained SD card reader, digital to analog converter, and audio amplifier. When the Arduino receives a value from one of the switches it begins to play the audio file corresponding to that location. Using code that I wrote in the Arduino programming environment (see Appendix A-1), the triggered audio plays through to the end of the track unless it is interrupted by a new value from another switch. For ease of installation and to prevent audio bleed in a public presentation venue, I decided to use headphones as the means for audio playback.

Rolling the Labyrinth

This labyrinth game platform provided the perfect surface upon which to inscribe a mapping that would allow for an aural exploration across Place d'Armes Square, unbound by the rules of traffic, sidewalks, or even other people, effectively challenging the ways in which we are 'supposed' to navigate this public space. Additionally, the notion of re-presenting this single moment in time from multiple spatial perspectives meshes well with many ideas surrounding time and temporality within labyrinths. The written history of labyrinths dates back over 600 years, but their practical use extends back almost ten times that, with labyrinths appearing in ancient Greek mythology, Egyptian ruins, and Bronze Age petroglyphs (Williams).[33] However, Brio were not the

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[33] It is worth noting that the way in which a Brio 'Labyrinth' surface has been hacked, this project actually fits better into Williams' definition of a "meander" rather that a traditional labyrinth, which should only have one, unicursal pathway, as opposed to the more open, "tortuous path" (23) of a meander that is found in my project.

first to project the individual into a scaled down version of a labyrinth using a marble as an avatar of sorts. In fact, marble-based labyrinth games have been dated back to 1889 (Matthews 204). What makes labyrinths important for this particular audio mapping interface is the way in which time in perceived within the physically-present experience of walking (or in this case, rolling) through the labyrinth. In *Tracing the Cretan Labyrinth,* Paul Harris discusses the experience of walking the labyrinth, writing:

> the labyrinthine line evokes a suspension of progress (one begins and ends at a point); one traces a route that maximally lengthens the itinerary within a finite space; the route traverses one line in two directions. Considered as a diagram of time, the labyrinthine line shows linear time being twisted into a repetitious series of doublings back on itself—the labyrinthine line evokes a hiatus in linear time, an aporia or pause in which the directional distinction between past and future is lost (135).

This ability to trouble the distinction between past and future, and this twisting, repetitive hiatus of linear time found in traditional labyrinths is echoed in the *Acoustic Labyrinth* project. By creating a space where linear time is paused, the listener is able to distance themselves from normal constructions of time, blurring together past and future by re-experiencing the same moment in time over and over from different perspectives. They are effectively navigating from place to place (recording location to recording location) without any time passing in-between, which fundamentally changes their relationship between space and time. However, instead of compressing it (as I will discuss in chapter three), the *Acoustic Labyrinth* expands it. A listener can roll across

the surface of the mapping for as long as they like, but they will always hear the same moment in time.

Interestingly, navigating these lengthened itineraries within the finite space of Place d'Armes Square can function as both strategies *and* tactics. In *The Practice of Everyday Life*, De Certeau describes strategies and tactics as two of the ways in which we can understand how and why we move through space. He defines 'strategies' as "the calculation (or manipulation) of power relationships that become possible as soon as a subject with will and power [...] can be isolated. It postulates a *place* that can be delimited as its own and serve as the base from which relations with an *exteriority* composed of targets or threats [...] can be managed" (35-6 emphasis in the original). Within the *Acoustic Labyrinth* there are a number of power relationships at work—the role of the Roman Catholic Church in Montreal, the historical importance of Place D'Armes Square, and even the agency of the listener to manipulate their aural perspective. By contrast, the tactic is less about place, and more about the navigation of (or one's trajectory through) *space*. "The space of a tactic is the space of the other" (37). However, the tactical trajectories required to navigate the *Acoustic Labyrinth* are not bound by the law of a foreign power, but rather by the playing surface, hand-eye coordination, and the laws of physics.

By removing the distinction between roadways and pedestrian areas, even the more traditional strategies of civic infrastructure have lost their power. As the listener rolls the marble through this place where the linearity of time is paused, they must confront the issue of experiencing the streets of the square in a new way: re-listening to

the same moment, while freely rolling across the walkable area without heed for other pedestrians, cars, or horse-drawn carriages. However, there is still the fact that despite their attempted navigational tactics, the marble may not fall in the intended hole, changing to an unexpected aural location, or accidentally cutting off a track that was being listened to with attention.

In this way, rolling the marble across the surface of the interface can better be applied to a strategy. There is an exterior target that can be managed (the desired hole in the game platform), and power structures at play (including gravity and the rules—or guidelines—implied both by me as the designer and the normative assumptions of how the game *should* be played). I've seen people first start using the interface and very carefully avoid all the holes (including one listener who somehow got the marble past a hole and into what I thought was a totally inaccessible corner of the board). What makes this rolling strategy even more interesting is the interplay between aural boundaries and physical ones. These are instruments that have traditionally demarcated the boundaries of the parish through their acoustic horizon, serving as the centre of the community. In this project they are repeatedly demarcating the same, secular moment in time, over and over and over again (or at least as long as there is someone using the interface), as well as being confined within the surface of the tabletop interface. In this way, they demonstrate Harris' concept of recursive temporality or even the pausing of 'normal' time within a labyrinthine structure, never mind the thought that by the time the bells finish ringing, it is no longer noon.

<u>Playing With Time</u>

     While I primarily refer to this project as a mapping interface, I believe it

functions equally well as a game. Another entry point into this project is through the

concept of critical play. Mary Flanagan writes: "Critical play means to create or occupy

play environments and activities that represent one of more questions about aspects of

human life. [...] Critical play is characterized by a careful examination of social, cultural,

political. Or even personal themes that function as alternates to popular play spaces"

(6). By placing this sound mapping within a gaming surface, listeners are encouraged to

approach the re-presented sound environment in a lighthearted, exploratory way.

However, while this play-oriented approach appears on the surface, there are a number

of other issues being presented within this project. As previously mentioned, there is the

dialog surrounding the performance of the bells themselves, the history of the square

(and the architectural balance between historical buildings and more modern

skyscrapers), and there also exists the nebulous nature of time within the labyrinth.

What I find most interesting about this project and its use of critical play is the ability to

challenge how individuals use rehearsal and repetition to listen to their surrounding

environment to develop place attachment.

     This may not work with every listener, but my goal in creating these sound

mapping interfaces is to challenge how and why we listen to the sound in the

environment. By allowing listeners to roll across the square, I am encouraging them to

re-listen to the same moment multiple times from multiple perspectives. With this shift

toward dedicated listening, they can piece together how architecture, weather, and

distance modify our acoustic experience, helping them to build place attachment, even if they are not in that specific location. This modified form of play is also about tactility and chance. By making the listener physically manipulate the mapping interface, watching their marble roll across the table and finally fall in a hole, they become more engaged in the listening experience—each new sound becomes a goal, a target, not an obligation. The listeners gain agency in controlling their own trajectory across—and *through*—the map. Listening to this mapping is about process (journey) over product (destination), reinforced through the continual repetition of the same five minutes.

This process-oriented approach to experiencing the *Acoustic Labyrinth* project resonates well with its origins in soundwalking practices which encourage dedicated, durational listening. Here, however, the focus is not about transitioning through one aural environment to another (as is is with Heimbecker's *Acoustic Line...*), but rather to shift focus toward the nuances of each location's reaction to the carillon and the differences between them. By making interaction with the interface playful, the processual nature of listening to the re-presented time within the mapping interface becomes fun, thus allowing listeners to generate their own understanding of the acoustic arena being re-presented without having to overthink (or over-listen) to the changes in the sound recordings they are hearing—at first. The haptic and somewhat chance-based means of exploring the mapping tie together the phenomenological and aporic—asking listeners to encounter the mapped area in a way that shifts focus from the literal lines of the map (or even the sidewalks and pathways of the real-world square). Instead, it troubles our notions of the linearity of time while encouraging free exploration of the

surface of the interface with the implied goal of inverting the conventional strategy of the game interface of rolling the ball into the holes, as opposed to avoiding them.

Conclusions

My goal with this project is to encourage aural engagement with urban spaces and generate an active, embodied, and mobile[34] mode of mapping sound that shifts focus away from a point-click-listen user interface, focusing on alternative modes of navigation. With the *Acoustic Labyrinth,* I have created a mapping interface that encourages critical, dedicated listening and allows for listeners to hear a single sound event in a way that is physically impossible—with a focus on experiencing sound *through* space. This map asks listeners to repeatedly rehearse how they experience the acoustic horizon of a particular place, creating an audile technique geared toward apprehending the nuances of tone, timbre, echo, and delay across an acoustic horizon. This interface incorporates these goals through the haptics of a tabletop game platform, and the aleatoric nature of pitting physics against hand-eye coordination. Through this interface, the listener is able to delve into an aporic, soundwalk-esque experience that highlights exploration of and navigation through a singular moment in time across multiple locations. Additionally, this development of a new audile technique is situated within the historical and cultural context of the tensions between Church and State in Montreal.

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[34] Although the interface itself is static, the rolling of the ball across the surface of the map implies or simulates physical travel across the real-world location.

This ability to quickly transition from one location to the next, replaying the same moment in time over and over again from different locations creates additional meaning for the dedicated (or at least interested) listener. This audile technique allows the listener to move beyond Truax's "listening in-search" and into "listening in-readiness." By being able to re-listen to the same moment from different perspectives, the dedicated listener no longer has to rely on their memory of how the initial location sounded the last time they heard it (be it an hour, a day, or a week ago). They are now able to compare and contrast these locations immediately and develop a more cohesive understanding of how sound responds to the surrounding architecture.

By embracing a phenomenological approach to my own recording, and editing processes, it is possible for listeners to explore this moment in time as it was in that moment—not in a 'perfected' form compiled through an extensive multitrack recording and editing process (which leans heavily on the recordist/editor's subjective relationship to the location). After exploring the *Acoustic Labyrinth* these well-rehearsed, dedicated listeners are able to conceptualize the entire sonic eventscape of the Place d'Armes Square phenomenologically, allowing them to hear the shifts in tone and timbre as they move from location to location across the Old Port, and can give them a sense of the role of this sound in the daily lives of residents and visitors.

In turn, this sense of how sound changes through space can create a bank of aural memories and associations with place, the same way looking through a photo album before a family reunion can help reinforce memories and associations among people you may not have seen recently (or ever before). At the same time, it helps listeners to

understand the role that sound has in not only defining the moment at hand, but also the history and culture of place. This process of listening and relistening highlights the process-oriented nature of a mapping, not only through the work that went into the creation of the interface, but through the process of developing audile techniques for dedicated listening, and applying them to the re-presented area. However, it is important not to make this attention to developing a dedicated, critical listening practice seem like work. The game-like platform of *The Acoustic Labyrinth* encourages play and lighthearted exploration of the map's surface.

The recursive temporality, the folding back of time onto itself over and over again found in the audio tracks not only allows listeners to develop audile techniques for listening to the city, but also invites them to apply the sense of aporia associated with labyrinth walking practices to remain in a moment of suspension, continually moving backwards and forwards through time as they listen. This is about rehearsal and repetition. As with any mapping, this process-oriented approach to learning how to listen to the interface promotes an ongoing engagement with the re-presented area, both in the experience of the mapping, and in later encounters with the physical area, generating even more stories-so-far. Through *process* we experience the temporality of engagement, but through the labyrinth, we experience a pause in time's linear arrow, instead bending it back upon itself. By presenting the project through a game-based platform, many listeners are able to shrug off assumptions surrounding how they would 'normally' engage with a soundmap, applying practices of critical play to encourage engagement for longer durations. The *Acoustic Labyrinth* not only applies acoustic

ecology concepts to rethink our relationship with sound in the urban environment by developing an audile technique for dedicated listening to city sounds, but also calls into question the ways in which we navigate the city, the role of church bells in contemporary Montreal, and the ongoing development of the Place d'Armes Square.

Chapter Two: Movement

"Nothing looks the way it sounds. And nothing sounds the way it looks."
- Christina Kubisch, *Electrical Walks*

I enjoy the sounds of the city. Yes, at times they can be loud or distracting, but that is part of living in, and experiencing a city. Large buildings dominate our view, but we don't by default refer to them as 'eyesores' the same way we call traffic 'noise.' In fact, this hodgepodge of buildings becomes the 'skyline'—something to be praised and compared in relation to those of other cities. So, why do we not talk about the sonic qualities of the city in the same way? Perhaps because it is difficult to capture a sonic image, or 'character' of the city due to the relatively ephemeral and transitory qualities of sound. There are several authors who have described the changing sound of cities in the modern era, or are working to create a framework through which to dissect the component parts within the eventscape (I am thinking here of Emily Thompson's *The Soundscape of Modernity* and *The Roaring 'Twenties*, as well as Torsten Wissmann's *Geographies of Urban Sound*), but little is being done now to develop a deeper understanding of the relationships among sounds within the urban environment, and how they contribute to the culture and character of the city.

When I start talking about how sounds work together within a sonic eventscape, I immediately think of Bernie Krause's 'niche hypothesis' where, in the natural world, each species of bird and insect communicates within limited, but unique frequency ranges, preventing their songs from competing with those of their neighbours (99). However, this theory doesn't translate very well into an urban context (although some

similarities can be drawn), with many different sound events (e.g. traffic, exhaust fans) having very similar frequency ranges. Additionally, the built environment of the city lends itself to the creation of multiple smaller sound fields all contained within a larger eventscape. I can turn the corner and lose the sound of traffic, or walk past a window with music playing through it. Even snippets of conversation float past the ear as I walk along the sidewalk. Sound in the urban environment is a source of tension and transition. I believe it is an important extension of contemporary soundmapping practices to build maps that allow for a comparative analysis of several different locations while still maintaining a fluid relationality across the mapped data, preserving as the points of tension and transition among each of the recorded (or mapped) locations.

As I have discussed in the introduction and in chapter one, soundwalks are a useful method for exploring the aurality of the city, but a listening-oriented approach to moving through the city does not have to be limited to a dedicated soundwalk. For me, walking is not just a form of locomotion, but a period of time that encourages reflection, free thinking, and exploration. It is an experience where I open myself up to the sounds of the city. I love encountering a barely audible sound that seems to be the most beautiful music from a distance, then walk toward it only to discover it was the combination of an exhaust fan and a garbage truck backing up (or some other equally 'noisy' sources). My goal with the second mapping project was to capture some of these so-called 'noisy' city sounds, and create a way for listeners to explore the slow transitions from the indistinct to the identifiable, the sublime to the quotidian. To do

this, I created a smartphone-based mobile interface that documents the tensions and transitions within the sound environments surrounding two neighbourhoods in Montreal, and re-presents them through a movement-oriented geolocative playback interface.

Street Ears (SE) is a mobile sound mapping application built for android devices that uses relative GPS locativity to track the user's real-world movement through an alternate, augmented aural environment. This platform allows users to listen to prerecorded mappings of the Montreal neighbourhoods Milton Park and Verdun from anywhere in the world. The GPS information from the listener's real-world movement is tracked by the app and used to crossfade between continuously looping pre-recorded audio from a series of recording locations within the mapping. Listeners are encouraged to explore this augmented aural environment with soundwalk-like attention to the dedicated act of listening, engaging with the tensions, disruptions, or serendipitous convergences that occur when listening to one space while moving through another.

The mobile interface of *SE* draws on established soundwalking and geolocative audio practices, allowing listeners to actively participate in their exploration of this archive of my daily experience in these two neighbourhoods, drawing attention to the role of sound in the practice of wayfinding by working through the roles of three types of sonic events: keynote sounds, sound signals, and soundmarks (Truax). Additionally, I further the work done by Andra McCartney in her mobilization of ecotone hierarchies (Gosz) into sound studies, introducing my concept of the 'sonotone.' Ecotones are sites of transition among distinct ecoregions (where forest meets field, or foothills dissolve

into prairie). My introduction of the sonotone brings this same fluidity of definition into sound studies—moving away from Blesser's largely quantitative approach to acoustic horizons, and bringing sites of tension and transition into the conversation surrounding the sonic eventscape. By highlighting the tensions that can arise from a mapping that requires listeners to slowly transition among the pre-recorded sounds (if a listener encounters a sound they don't like, the only way they can change to a different one is by physically moving away from the mapped location), this project responds to issues surrounding the intangibility of navigating urban audio documents in the real world, reconfigures our experience of sound in the urban environment, and extends the audile technique (a learned way of listening) associated with place attachment to disrupt conventions of use surrounding earbuds in the city and locative media narratives. In this chapter, I argue that by using real-time GPS information to navigate a superimposed map of another place, listeners can refine their urban listening practices and gain new insight into the relationships and hierarchies among multiple sound fields within a larger sonic eventscape.

The *SE* app presents the listener with a sense of location outside geolocative norms. *SE* allows the listener to freely explore the sounds of a mapped area by walking through any space, creating dynamic repositories of sonic environments that encourage new modes of listening. I have borrowed the psychogeographic/ situationist term "la dérive" (literally, the drift) which Guy Debord describes as an activity where "one or more persons during a certain period drop their usual motives for movement and action, their relations, their work and leisure activities, and let themselves be drawn by the

attractions of the terrain and the encounters they find there" (in Mitchell 119). To take a

sonic dérive implies a drifting through social constructions of the city, fragmenting and

disrupting them by placing one's attention not on *where* one is travelling, but on how

sound is changing based on the individual's movement and location.

I find the concept of the drift particularly useful in framing my approach to this

particular interface. Within the drift, the map ceases to function as an objective source

of information; instead it works more as a series of guidelines for urban exploration,

pointing to the politics of movement and access introduced by the Situationists—how

and why we can (or cannot) move through urban spaces. The idea of map-as-guideline is

also true when adopting a phenomenological listening approach. As I've noted before, I

believe this type of approach allows the sonic eventscape to perform itself, framed only

as a singular intersection of time, space, and sound. The recordings within *SE* not only

document a sonic environment, but create a listening experience that highlights the

transitions between individual field recordings generating a completely new aural

experience each time the map is used. By highlighting the indeterminacy of

encountering each individual recording, the *SE* app performs an aural experience

similar to the real-world environment, demonstrating the constant flux within sounding

environments and the ephemeral qualities of sound-in-space. This re-presentation of

the fluctuating relationship among recorded sounds allows the listener to create their

own narrative within the map, developing an individual understanding of the mapped

area. However, in order to do this, the listener needs to practice: both listening to the

interface (to separate pre-recorded sounds from ambient ones and to learn how to hear

the transitions among them), and walking through it (to learn where certain sounds are virtually located and how to move between them). Of course, if would be impossible to discuss how listeners can move through this augmented aurality without first discussing mobility.

What is Mobility?

In the introduction section, I briefly introduced Cresswell's separation between movement and mobility with regard to spatial navigation. It seems to me that there is a whole lot more going on with Cresswell's 'mobility' than there is his 'movement.' Movement is the pure act of getting from point A to point B, without paying any attention to the line connecting the two. It is as though Dorothy simply put her head down and followed the yellow brick road. For Cresswell, as for Dorothy, the navigation between A (Munchkin Country) and B (Oz) is where the real story happens. These stories of the in-between are what constitute mobility—but they don't magically come to life in a tornado-inspired dream. According to Cresswell, "mobility is practiced, it is experienced, it is embodied. Mobility is a way of being in the world" (3). To shift our movement into mobility, we need to be engaged with all the interrelationships and interactions that space provides, and allow it to become place: befriend a lion or tin man, fight some flying monkeys, and maybe kill a witch or two. Without mobility, there is no story-so-far. No place.

Since we are talking about the stories we can tell while moving among space and place, we also need to talk about time. Narratives require temporality, and take time to

tell. Space and time are inseparable, but the ways we experience, and talk about time necessitate talking about this relationship in a more malleable way. Cresswell writes: "Mobility, as a social product, does not exist in an abstract world of absolute time and space, but is a meaningful world of social space and social time. Mobility is also part of the process of the social production of time and space" (5). Our durational narratives of place are constructed not only by how we can navigate through space, but also how quickly we are able to overcome barriers in our intended trajectory, be they physical, financial, social, or cultural. Our ability to overcome barriers leads to the potential for a compression of the fixed relationship between space and time. If I can afford to hire a cab from Munchkin Country to Oz, I can reach the wizard faster than Dorothy, and save myself from the risks of interacting with all the unknowns along the ways (no getting drugged in a field of flowers for me). This agency and ability to move compresses the construct of absolute space-time, and creates a power differential among groups. It is easier for me to move faster and further than you; therefore I have power over you.

By bringing Massey and Cresswell together, it is apparent that time is a social production, *and* there are a range of temporalities and mobilities that are all being produced on a variety of scales and scopes simultaneously. This sets up my position of 'mobility' as our navigation *through* the accrued layers of meaning that constitute space—at different paces and for different durations. The resulting trajectories have to take into account all the different layers and modes of transportation, information, history, and experience, even if we are doing so subconsciously. This is part of what constitutes the cognitive shift from space to place. Of course, the development of place

attachment is not nearly this simple: there are layers of inscription (De Certeau's "practical memory") and the slow accumulation of lived experience over time that shape which spaces become places and why. However, with the *SE* interface, I believe it is important to highlight the roles of mobility and movement in our processes of place-making.

Where does mobility meet place? In the introduction, I outlined Massey's three propositions on the nature of space, but if we follow through with my distinction, place has an additional affective layer—one that allows for us to create a sense of attachment with our understanding of a location. It is easier, perhaps to think of this distinction between space and place (with regard to mobility) as our awareness of one particular thread within Massey's multiplicity of interactions and interrelationships. Space can hold (and produce) all these rhizomatic potentialities (and pasts), but our sense of place can only really contain one thread: our own. This is not to say that a single thread cannot be woven into another (or a line folded into a crease), but we are the ones who navigate and weave together these threads, effectively constructing what we believe that place to be. Still, place is not a completely individual construction. It is produced and propagated by outside forces and systems of power (Lefebvre). However, it is up to the individual to make their own sense of these forces and systems as they move through the urban environment.

Through mobile place-making in the city, we are able to navigate *through* many of these layers of meaning: tracing new trajectories, and inscribing new layers of meaning for ourselves and others. This process of inscribing and reinscribing space

changes our relationship with place over time—all based on how able we are to navigate our intended trajectory. It is important now to consider how intricately tied these concepts are to our movements in both space and time, as well as the power geometries that afford our relative access to this mobility.

In addition to these theories regarding physical navigation and movement through space, I am applying a more metaphorical notion of 'mobility' in this project. This formulation takes into account our own cognitive ability to navigate through all the layers of meaning that create our personal understanding of place. Throughout this chapter, I demonstrate how mobile experience(s) of place(s) can be documented, mapped, and shared, and how these mappings can be brought into the daily experience of the city for others, expanding our dynamic knowledge of multiple 'stories-so-far.'

In order to create and share a story about place, it is necessary to understand how we experience the world around us. Raymond Williams describes the notion of experience as a conscious process existing in two distinct yet intersecting temporalities: past and present. As he explains:

> Experience, in this major tendency, is then the fullest, most open, most active kind of consciousness, and it includes feeling as well as thought. [...] It is evident that the grounds for reliance on experience past ('lessons') and experience present (full and active 'awareness') are radically different, yet there is nevertheless a link between them, in some of the kinds of action and consciousness which they both oppose (127).

Williams is positing that experience has two levels, or planes: the PAST (our histories and memories—'learning from experience'), and the PRESENT (what we are currently undertaking, perhaps something new or unknown, for example: 'experiencing BLANK for the first time' or even re-experiencing it in a new context). The second plane refers to something in the process of becoming (not unlike the multitude of stories-so-far). So what does it mean to experience sound in the urban eventscape? It is a mix of these two planes of experience: past and present. We remember sounds, and we are in the process of understanding new ones—or new iterations of ones we have experienced before—as we perform the Truaxian shift from listening-in-search to listening-in-readiness or engage with Chion's semantic listening mode. As city dwellers, we have all experienced urban sounds before, so each time we experience them again we are building our own relationship and understanding of the city and its intangible culture of sound. For Williams, there is not only these linked, temporalities of experience, but another spectrum where experience can either be seen from a solipsistic perspective, where it is "offered as the necessary (immediate and authentic) ground for all (subsequent) reasoning and analysis," or, as "the product of social conditions or of systems of belief or of fundamental systems of perception, and thus not as material for truths but as evidence of conditions or systems which by definition it cannot itself explain" (128). This is where talking about experience becomes particularly tricky. Is our experience of the here-and-now informed by recalling prior knowledge of similar situations which we can reflect upon before acting, or is this experienced shaped by other conditions of which we may not be fully aware?

Williams' conceptualization of experience likely feels familiar—we are aware of where we are and our past experiences, and use the two of them together to best figure out what to do next. However, it is never quite as simple as that. As an extension of Williams' consciousness-oriented approach, Dewey defines *an* experience. Noting that we have "*an* experience when the material experienced runs its course to fulfillment" (36), he is also interested in what happens when something cannot necessarily be understood as running that course. Emphasizing the notion of consummation as opposed to cessation, Dewey strongly believes that *an* experience is self-sufficient, exists as a whole, and has its own individualizing qualities (37). However, one experience can seamlessly blend into the next. "In an experience, flow is from something to something. As one part leads into another and as one part carries on what went before, each gains distinctiveness in itself. [...] [T]here are no holes, mechanical junctions and dead centres [...] There are pauses, places of rest, but they punctuate and define the quality of movement" (38). Thus, every experience has a duration—something that brings about consummation, but there can be multiple experiences of different durations all being perceived simultaneously. Of course, there are many, many experiences happening all around us, but they are impossible to be aware of unless they somehow become integrated into one's own experience, and, as such create a brand new experience.

This idea of there being a multiplicity of potential experiences ties in well with Massey's 'stories-so-far,' and creates an interesting branching-out point to begin talking about mobile media technology and the curation of site-specific experiences. Before going into detail with regard to the *SE* interface, I would first like to discuss a few other

mobile, location-based audio platforms. What makes these platforms noteworthy are the ways in which they combine place, movement, and mobility—both in one's ability to move, and their access to technology—within a dedicated listening experience.

Mobile Listening and Site Specificity

The idea of presenting listeners with an augmented aural reality is certainly not new. Over the years, many artists and institutions have created ways of listening to sounds-through-space using a variety of different interfaces. I still vividly remember my visit to the Musical Instrument Museum in Brussels many years ago. Each visitor was given a pair of infrared-enabled headphones which would 'talk' to the different display cases, broadcasting audio samples of the instrument(s) contained within. Of course, verbal audio guides are a staple of many larger art galleries, narrating the history of the collection and pointing to particular techniques employed by the artist. There is an interesting extension of this type of audio guide interface employed by artist Janet Cardiff in her *Audio Walks* series (1991 - 2014).[35] These are site-specific works hosted by an art gallery or institution that ask the listener to explore the area surrounding the gallery with multiple layers of binaural audio on top of a guiding narrative.[36]

On her website, Cardiff describes these projects as:

> similar to that of an audio guide.[...] On the CD you hear my voice giving
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> directions, [...] layered on a background of sounds: the sound of my footsteps,

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[35] Cardiff often collaborates with her partner George Bures Miller, and many of the walks during this period contained video or images, described separately as "video walks."

[36] Unlike the malleable '3D' audio of ambisonic recordings, binaural audio employs a pair of microphones positioned in or near the ears of the recordist, using the natural reflections off of the pinnae (folds of the outer ear) to record spatialized sound.

traffic, birds, and miscellaneous sound effects that have been pre-recorded on the

same site as they are being heard. This is the important part of the recording. The

virtual recorded soundscape has to mimic the real physical one in order to create

a new world as a seamless combination of the two (*Audio Walks*).

Here, the concept of site-specificity is essential to the artistic approach. But what is

more interesting to consider is the idea of multiple temporalities, and the creation of a

new, mobile experience of the world that meshes the two. Cardiff's layering of her voice

over top of "miscellaneous sound effects" draws the listener into the experience, asking

them if what they are hearing is live or prerecorded. If they experience the *Audio Walk*

more than once, they may begin to learn how to discern between these two planes of

experience—that of the recording (and therefore part of the past, but being experienced

in the present), and that which is occurring in the real-world environment (creating an

overlay of multiple iterations of the present). This type of listening experience requires

developing a new form of audile technique that allows listeners to create links between

temporalities and create place association within a hybridized real/virtual place.

However, this new audile technique is not so easy to develop. In 2014, Cardiff and Miller

created a piece for the Sydney Biennale called *The City of Forking Paths*. This piece

incorporates location-specific images, video, and audio that layer temporalities of

experience within a historic quarter of Sydney. In fact, Cardiff and Miller speak directly

to the difficulty in sensing where (or when) exactly their audience *is*:

In this physically cinematic experience, fiction melds with our immediate

location. It is exciting, intriguing and, at times, confusing for participants to

blend the two realities: the virtuality of the video component and the concreteness of the real world. We begin to imagine characters in our physical world aligning with the figures on the screen, and vice versa (*Forking Paths*).

The confusion referred to by Cardiff and Miller is similar to that found within my *SE* app. Listeners are forced to reconcile the differences between what they are hearing and what they are looking at. To overcome this confusion or lost-ness, Cardiff and Miller make extensive use of the screen of an iPod Touch to create a quasi-cinematic augmented reality experience. In contrast, *SE* privileges sound, using a very simple visual representation of space (the mobile Google map API), inviting listeners to give more attention to the dedicated act of listening. The *SE* app was designed to run in what I refer to as 'pocket' mode. What separates *SE* from other locative media experiences, is that *SE* focuses on navigating using only sound—and provides the ability to do so from anywhere in the world. When *City of Forking Paths* launched, I downloaded the app—all 8gb of it—because I was excited to see and hear a new work by two of my favorite artists. Of course, I immediately hit a critical stumbling block: I was not in Sydney, Australia. There was no way I could access *any* of the content created and compiled by Cardiff and Miller without being physically located at the start point of the piece (the Sydney Customs House).

There are also a number of other mobile apps that encourage experiencing multiple aural temporalities such as *Recho, Echoes,* and *SonicMaps*. However, all of these applications are stuck within geo-locative norms—to hear a 'recho,' you need to be in the place where it was initially recorded. What makes these apps interesting is their

ability to collect and re-present crowd-sourced aural information about a particular location. *Recho,* for example allows users to record and post publicly any sound that is picked up by the onboard microphone of their mobile device. In this way, the app is contributing to the conversation surrounding intangible culture and mobile narratives, collecting these moments-in-time linked to particular locations—or 'hotspots'—for other users to discover and navigate through. Others, such as *Echoes,* encourage users to generate and share curated aural experiences that function more like Cardiff's *Audio Walks*, guiding listeners through a series of geotagged boundaries following a set (and often linear) narrative. In contrast to the linearly defined narratives imposed by curators presenting their work on the *Echoes* app*,* or the more random agglomeration of crowd-sourced aural data provided by *Recho, SonicMaps* bills itself as "a festival for the senses," allowing users to set overlapping and variable GPS boundaries and hotspots linked to each sound source.[37] These mobile experiences create a narrative thread in the exploration of space and the experience of place, while simultaneously inspiring alternative or unusual navigational tactics.

Many of these platforms are focussed on generating a specific narrative experience tied to the curator's relationship with place, but it is also possible to write new stories by weaving together seemingly unrelated threads. For example, you can use *Recho* as a sort of scavenger hunt generator, where you wander across the city waiting for the next geotagged sound to appear on your screen, trying to find as many different sounds as possible. Searching for an invisible (and ephemeral) subject requires

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[37] It is even possible to embed a hotspot within a boundary object, effectively combining the locative functionality of both *Recho,* and *Echoes.*

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inscribing a new navigational trajectory (traced through previous users' uploads and usage patterns) and generating additional associations to place within the city. Finding a particularly funny or beautiful sound on *Recho* will change your relationship with that location, giving it a layer of technologically-mediated meaning, and creating place attachment. It may even become a destination, a sound to be revisited or shared with others. However, each of these applications have the same stumbling block I found with Cardiff and Miller's *City of Forking Paths*. You have to physically be in the geotagged location to experience the work. While they perform wonderfully with regard to documenting and sharing individual experiences with sound in the environment (and the intangible cultural history associated therein), there is little transmissibility across locations—it is impossible to experience these sounds without being *there.*

Of course, the concept of 'being there' via locative media is an abstract one. Sawchuk and Thulin describe "the problem of the pinpoint" (161) with regard to locative media and the larger concept of chorography (a combination of 'chora' -place and 'grapho' -to describe).[38] Chorography helps us understand how our ways of knowing a place are being defined by mobile technologies. We always assume that the floating blue dot or pinpoint in Google maps will tell us exactly where we are (or where we want to go), but this dot or pin is really an illusion, an abstraction—a series of digits that are processed by our mobile devices and projected onto a birds-eye view of conventional street maps. So, how do we make sense of where we 'really' are when using a locative app?

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[38] This is a philosophical concept that mediated between the absolute entities of time and space and a fundamental cognitive function in experiencing the world (Sawchuk and Thulin, 163).

Jen Southern outlines six aspects of locative awareness that, when combined, produce a new relationship to location and, in my extension, can each be a source for developing place attachment. These aspects are:

> *situated and embodied* awareness, the way that the world is experienced through the senses and in situated action; *mobile* awareness, experienced through movement; a *relational* awareness of place brought about by social and participatory interactions that are performed and through which location is enacted; an awareness of *networks* that are connected to presence in space and that extend that presence; an *experimental* awareness, the process through which actions test, explore, observe and critique in location; and an awareness of the *multiplicity* of perspectives that we inhabit (181, emphasis in the original).

The way Southern describes locative awareness allows for a multiplicity of interconnected threads (or stories-so-far, to bring Massey back into the conversation) to all be experienced simultaneously. As the listener becomes aware of their surroundings, they are not simply situating themselves in space, they are working through all the ways in which their experience can extend within and across multiple locations, particularly when becoming aware of the surrounding networks. Additionally, it is important to consider the role of relational and experimental awareness when listening to the *SE* app. Part of the practice required to fully explore this mapping requires a shift in how we understand locative awareness. Listeners are challenged to rethink their relationship with space as they attempt to move through a map that doesn't correspond to the space they are physically moving through. As such, a relational awareness of location is

necessary in order to engage in participatory interactions that not only enact location in

the real world, but in the virtual one as well. Additionally, listeners need to actively test,

explore, and critique their experience of location and work through the multiplicity of

perspectives generated through the mapping.

While not all six of these aspects may be attended to in every moment of every

mediated experience, they create a useful framework for analysing how we interact with

the superimposition of a virtual world atop the physical one. With locative media

experiences, despite (potentially) believing that a digital representation is showing our

location, we are never truly immersed in a virtual environment. We still move through

and relate to physical space. We may use the interface to explore place in a new way, but

we are aware of the networked infrastructure necessary to generate the experience. And,

perhaps most importantly (especially when applying these aspects to the *SE* interface),

we are consciously inhabiting and navigating a multiplicity of locations, both physical

and virtual.

This concept of locational awareness is not limited to describing our

understanding of place within locative media platforms, but can also be used to frame

how we use them as both maps and mappings. Southern also points to the ability for

locative media to fill in some of the gaps created by traditional forms of maps. Unlike a

fixed representation of space (referring to the physical properties and arrangement of a

specific location) found in a traditional map, locative art "offers new ways in which the

movement of mapping and the task of map-making are brought closer together, in

which maps can change according to local user movement and input, whether to distant

users via networks or to a database" (189).[39] By creating space for the in-between, for movement and process, locative media platforms are always in the process of becoming. While the digital architecture may be fixed (as with Cardiff and Miller's work), the experience of the work is flexible and fluid, creating a unique narrative thread linking both physical and virtual environments. A mobile, locative experience is constantly unfolding, charting traces or inscriptions (or interventions) across multiple interrelated places. There are infinite possibilities for generating new layers of meaning in the intersections of virtual and real world environments, and this is where the stories of mobility are created. Imagine if Dorothy had taken photos and audio recordings throughout her trip to see the Wizard. She could have left geocached warnings about the possibility of flying monkeys, pointed to where she first met the Tin Man and Cowardly Lion, or even created a GIF of the Wicked Witch melting, before finally hitting the "home" button and returning to Kansas. We could then follow in her ruby-red footsteps, reliving her experience of Oz and inscribing our own trajectories as we navigate through both past and present—retracing Dorothy's story as we write our own.

However, geotagging locations with information does not necessarily make them better, they just accrue more data that can be accessed through mobile interfaces. As we add information to spaces through mobile media, we can increase our understanding or knowledge of a location, creating alternate ways of 'knowing' space, and depositing digital layers of meaning within our experience of the city—this has been well-discussed in the extended body of research on locative social media apps like *Foursquare,* or

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[39] Throughout her writing, Southern frames her writing as an extension of an art practice into the social sciences, and as such refers to her locative media platforms as artworks.

through locative media mappings (de Souza e Silva and Sheller or Ozkul and Gauntlett, respectively). However, I believe there must be a way of learning to know a place without having to be physically present. As I suggested in chapter one, it is possible to rehearse (or practice) the experience of listening to a particular place, allowing the listener to develop associations with how sound moves across a particular location (or series of locations), and we can hold imagined versions of places based on visual stimuli (maps, photographs, sketches, etc.) in our heads. However, none of the above-mentioned geolocative platforms provide an aural means of constructing a sense of place from a remote location.

Sound in Space and Place

Street Ears (and the other audio-based locative media platforms discussed above) allow listeners to practice listening to sounds that are 'there' but not physically present. I use the term 'practice' intentionally. Recall Jonathan Sterne's concept of "audile technique." "Technique," according to Sterne "connotes practice, virtuosity, and the possibility of failure and accident, as in a musician's technique with a musical instrument. It is a learned skill, a set of repeatable activities within a limited number of framed contexts" (92). Sterne's use of practice as an essential component of technique is important. 'Practice' leaves the learning process open, asking the listener to engage with dedicated listening over and over again. This processual nature of practice implies no specific end goal—unlike 'rehearsal,' which is a process that culminates with a performance (in the case of the *Acoustic Labyrinth*, this could be visiting the actual

Basilica and listening to the peal of bells after initially playing with the interface).

Practice is unending: it is something we do in order to become good enough to rehearse, and finally perform. In thinking about practice from the perspective of audile technique within the *SE* app, there is no end goal for the exploration of the re-presented sounding environment. Instead, the app is intended to allow listeners to practice the audile technique required to understand the relationships among sounds in the urban environment in a way that moves beyond the one-time confluence of space, time and sound within a soundwalk, thereby encouraging listeners to experience sounds *through* space.

While *SE's* aim is to develop a mobile, dedicated listening practice, it still requires specific audile techniques to embrace the sounds of the city as well as the sounds of nature. The primary issue encountered when first listening to the app is the challenge of separating what one is hearing in *SE* from that which is currently happening in the physical environment. Michael Bull has been writing about mobile listeners for many years, and over the past decade or so has focussed on iPod users. Bull frames the modes of listening attached to mobile audio devices in a number of ways, ranging from creating filmic experiences of the everyday (where the playlist on your portable audio device generates an often serendipitous soundtrack to events unfolding in front of you) to managing interpersonal behaviour (wearing earbuds as a signal to show a lack of interest in interacting with others on public transit). One issue I have with Bull's argument is that he presupposes the solipsistic intention of the listener to block out 'unwanted' sounds and aestheticize their aural experience (180).

The apps I have mentioned above seem to counter Bull's argument, particularly

Recho. Now listeners are actively exploring urban sound environments containing

potentially random sound events generated by someone else, unaware of what they

might encounter. This may result in the filmic experiences described by Bull (86), but

without the listener's control over content. In contrast, Cardiff's *Audio Walks* (and apps

like *Echoes* and *SonicMaps* that, to me, seem heavily inspired by Cardiff's desire to tell a

story through place) ask the listener to blur the boundaries between the pre-recorded

and the real, again, with the intention of creating an aestheticized, or narratively driven

experience of moving through place. What is important is that listeners are practicing

how to hear multiple temporalities of a given place simultaneously. In the next chapter,

I will introduce another interface that circumvents the need for locative specificity,

instead focusing on layers of aural temporality that generate an experience of place.

The process of creating the *Street Ears* application began with the goal of

creating a mapping interface that allowed listeners to experience transitions and

tensions between recorded locations while exploring a non-distinct geographical

location by foot (or bike, car, etc.)—where the listener's movement and real-time GPS

information drive their exploration of the mapped area, but without a pinpoint or

floating blue dot claiming 'you are here.' The first map within the *SE* platform,

"Montreal," uses a grid-based system to document an area within Milton Park—located

in Montreal's lower Plateau—an area approximately 500m x 500m bound by Rue Prince

Arthur to the North, Ave. St. Urbain to the East, Rue Sherbrooke to the South, and Ave.

du Parc to the West. This small area allowed me to focus on working through the

relationships among three functions of sound within an eventscape as identified by Truax: "keynotes," "sound signals," and "soundmarks." According to Truax, "the reason for any sound being termed a 'keynote' is not because of any characteristic it has in itself, but rather because of the way it is habitually perceived" (*Acoustic Communication* 25). A sound signal, however, is "a sound that stands out in an environment, and is clearly distinguishable from the ambient noise" (ibid). Due to the subjective nature of how we 'habitually perceive' sound, Truax is quick to add that a sound signal can still act as a keynote sound—it just depends on our relationship to place.

He goes on to write: "Keynote sounds paradoxically seem to be unimportant in perceptual terms, but precisely because of their prevalence they reflect a fundamental characteristic of the environment" (ibid). Certain sound signals can contain unique or historical importance (the bells of the Basilica Notre Dame, for example). Truax refers these culturally important sound events as "soundmarks." However, status as a soundmark is conferred by the community. "Sometimes these sounds are also 'keynote' sounds and the subject of background listening [...], but their special ability to become associated with long-term memories means they create an extremely important continuity with the past" (67). The distinctions between these roles are a little blurry, but they still serve as a useful framework to help me identify individual sounds of interest (such as church bells, sirens, or snippets of conversation), and shifting my attention toward the ambient 'noise' of the urban keysound (traffic, footsteps, and ventilation systems) to uncover the aural characteristics of Milton Park.

With the *SE* app, I want to provide remotely located listeners with an aural experience similar to that of walking through the neighbourhood, discovering louder, quieter, more diverse, or distinct-sounding areas in the same way that local citizens will discover them. The *SE* app hopefully encourages users to consider how they moderate their own aural experiences, creating navigational narratives between quiet alleyways and louder or more heavily trafficked streets through their unique process of aural wayfinding.[40] In order to create *SE*, I needed to select recording locations that demonstrated how these three types of sound events are interrelated. For me, the sound of traffic is a keynote—an integral part of the everyday cycle of movement in the area. The ringing of the local church bells may appear as a sound signal to someone listening to *SE* for the first time, but because of their prominent role in the neighbourhood (and, as discussed in chapter one, their position within the cultural identity of both Montrealers and Quebecers), I feel they are better acknowledged as a soundmark of Milton Park. My goal was to break the sonic eventscape down into component parts, work through my relationship with the various sounds within, then build an interface that fits them back together. How big was the acoustic horizon of a particular sound? Could I find other sounds that might be masked or hidden by these 'larger' sounds? How will other listeners stitch these components together, and what stories will they tell? In order to describe how listeners use *SE* to navigate a virtual mapping in a real-world environment and create their own story of place, I'd like to introduce the concept of "wayfinding."

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[40] For example, my father, who walks or bikes to work almost every day, will take an alternate route 2-3 times a week that goes out of his way by a few blocks, but allows him to hear an exhaust fan in an alleyway that he particularly enjoys.

While "wayfaring" or a "wayfarer" (referring to travel by road or an individual on foot, respectively) are terms in common usage since the 16th century, "Way-finding" is relatively recent (first used in print by Kevin Lynch in 1960). In their book, *Wayfinding,* Paul Arthur and Romedi Passini work through the design elements required to create more efficient forms of spatial navigation and cognitive mappings. Although they are most concerned with the role of architecture and graphic design, there are some key concepts that can be used in talking about how we use sound to experience and navigate through space. They posit that the process of "wayfinding" requires a dynamic relationship to space (as opposed to the static relationship found in spatial orientation). Additionally, they posit that wayfinding comprises three specific but interrelated processes:

- *Decision making* and the development of a plan of action
- *Decision execution*, which transforms the plan into appropriate executable behaviour at the right place in space
- *Information processing* understood in its generic sense as comprising environmental perception and cognition, which, in turn, are responsible for the information basis of the two decision-related processes (25).

These three processes are not limited to walking or even physical movement—they could just as accurately describe how I found my way through reading their book. First, I looked at the table of contents, trying to figure out what I wanted to read first (the same way I think about where I want to go before heading out of the apartment), then I flipped ahead to the chapters I was interested in—executing my decisions (the same way

I would head to the right as I leave if I'm going to the metro station, or straight across the street if I'm going to the grocery store). Finally, it is necessary to make sense of what I'm reading, applying information processing. Now here is where wayfinding becomes really interesting. As I am in the middle of this third step in the process (either reading the book or taking a walk), my brain starts to make associations among what is happening and the decisions I have made (and begun to execute) and that in turn informs future decisions and executions. As I'm reading through chapter two, I may realize there is something important I missed in chapter one, or, as I read the introduction to their book, the chapter descriptions may cause me to realize that only the back half of chapter three is relevant to the idea I am exploring. This feedback loop between cognitive processes and decision making/execution occurs in the navigation of all spaces, real or virtual.

Now, wayfinding is not constrained to how an academic may choose to read a book (or explore a locative media app), but is also part of our daily navigational strategies in the physical world. When I leave my house to head downtown, I usually turn right and start to walk toward the metro. However, if it is a particularly sunny day, I may decide to walk behind my apartment building and cut through the park, or, if it's rainy, I may head straight and walk toward the grocery store in order to make use of the storefront awnings along Wellington to keep some of the rain off. Arthur and Passini describe wayfinding as "spatial problem solving" (27), and it is this idea, combined with their term "information processing" that best describe the forms of aural wayfinding used when listening to the *SE* app. Listeners need to use their ears to determine exactly

which recorded location they are walking towards or away from, performing spatial problem solving and information processing without a visual corollary. We can take this notion of constructing simultaneous, parallel relationships with both physical and virtual places a little further by combining wayfinding with Southern's locative awareness. That said, this is not a perfect framework for describing how listeners use the *SE* app. Even if we take into account relational locativity, it is still difficult to determine exactly how or why someone navigates based on acoustic stimulus due to the subjective nature of what sounds a listener may be drawn toward, and the necessity of building a relationship to the mapped sounds.

Due to this application of both locative awareness and aural wayfinding, a listener's experience of the *SE* mapping will change over time. They may begin with a focus on information processing, listening-in-search to discover the range of content in the mapping, moving with larger, sweeping gestures as their mode of spatial problem solving (with a goal of covering as much of the mapped area as possible). This approach inspires a tricky relational awareness, as listeners are forced to constantly check in with both the real and virtual environments in a situated manner. As mentioned before, this creates a multiplicity of experiences—using one place to navigate another. This is a unique cognitive process, one that I believe can heighten our understanding of place, and change our relationship toward urban sound. As a listener develops an audile technique that reinforces listening to the subtle shifts from one mapped location to the next while walking, it is relatively easy to apply this technique to a non-mediated walk, shifting focus away from the 'noise' of the city to how acoustic horizons overlap and

sound events shift from signal to keysound to soundmark. In this regard, Arthur and Passini are somewhat reductive. For them, wayfinding requires destination. I would argue instead that the 'way' is not a specific location, but rather the construction of an ontology of urban sound. How all the layers of aural information present in the world come together to create place, and using the mapping interface to drift between real-world locations and augmented aural reality in order to understand how sounds work together across the eventscape.

The process of finding one's way (especially across unfamiliar terrain, real or virtual, visual or aural) can be difficult, as is the process of building an understanding of place. It is possible to get lost, or even be stuck in a particular location (by accident or design). For example, the real-world environment may present a physical barrier or particular strategy for navigation (a building, busy road, or other obstacle) that does not correspond to those found within the virtual "Montreal" or "Verdun." Alternatively, the listener may choose not to move, exploring a more durational experience of the interrelationship between the two sonic environments. These approaches reinforce the subversive nature of the Situationist drift, challenging notions of what it means to occupy and move through space (physically or aurally). I have found that many listeners' first experiences of moving through the *SE* mapping to be somewhat disorienting. There is a specific audile technique required to be able to make sense of how the sounds coming from the headphones are related to one another, and how they are different from those encountered in the real world. This results in a sort of aural lostness and

requires the listener to try and reorient themselves between two parallel places—just like the hybridized "new world" described by Cardiff.

In my own experiences testing the app, and after conversations with other early testers, it is easiest to begin listening to *SE* in a large open space, and start moving in concentric circles. The shape of this movement is not coincidental: Vivian Sobchack describes the physical experience of being lost as circular, pointing to the common adage of "going round in circles" and numerous other accounts of the cyclical nature of being lost.[41] The visual element of the app is not particularly helpful in resolving this sensation of lost-ness. Unlike other mapping apps, there is no pinpoint, no floating blue dot to orient the listener as to where they 'are.' Rather, the app was designed with the intent of using this disorientation, this lost-ness, to focus attention toward sound in the urban environment—ideally, listeners would simply put their phone into a pocket. This was done in an attempt to limit the chorographic impulse and "representational fiction of the pinpoint" (Sawchuk and Thulin 161), and to push back against the visual distortion of space within a map, and to the map as an extension of the body (Sobchack 34). With *SE* it is necessary to extend one's ears in order to make sense of space, and create place with an alternate version of reality (or aurality).

By embracing our lostness within the *SE* aural mapping, and discarding the need to find a specific pinpoint, or hereness, the aural wayfinding process shifts from the necessity of a destination to the freedom for exploration to create one's own mobile experience of place. The practice of listening to *SE* asks the user to discover the sounds

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[41] Sobchack makes extensive use of Freud to define the shape of lost-ness (23).

contained within, and navigate the transition points among them. This creates some tensions in the split between re-presented and real-world sound signals (for example, crosswalk tones—one of the few audio examples discussed by Arthur and Passini—or the sound of oncoming traffic). Listening to the *SE* app can generate some very off-putting experiences, particularly when exploring the map in another urban environment. The sounds of traffic are, at times, quite prominent, and it can be very strange to be walking along a quiet street while hearing busses chugging up Parc Avenue, or having a disembodied conversation float past your ears. However, I feel that these tensions are an important aspects of the *SE* experience. The ability to document and then dynamically relisten to these transitions among recorded locations allows for the sustained practice of how these overlapping acoustic horizons of keynote sounds create what I am calling "sonotones," (after Andra McCartney's initial extension of "ecotones" into sound studies). My use of sonotones reframes the function of the ecological term ecotones (Gosz) into sound studies. Holland (in Gosz) defines ecotone as "a zone of transition between adjacent ecological systems, having a set of characteristics uniquely defined by space and time scales and by the strength of the interactions between adjacent ecological systems" (369). Their focus is on the transition points between adjacent systems. With my term sonotones, I am trying to draw attention to the transitions found when experiencing sounds *through* space—the aural experiences discovered in-between recognizable keynote sounds, soundmarks, or distinct sounding environments.

A sonotone differs from Blesser and Salter's term "acoustic horizon" by adding the idea of perceived value for the way in which a sound event enters or fades from the

acoustic environment. This functions in the same way that ecotones have value as a means for understanding the transition points between larger ecological structures. Gosz writes about ecotone hierarchies, identifying several common shapes and makeups for these transitional places, and how they can be used to assess the health or viability of the system as a whole. This implied additional meaning behind the ranking and identification of common features within the transition from one ecosystem to the next can easily be applied to an understanding of sounding environment, as opposed to Blesser's relatively empty (or, better put, quantitative—having mostly to do with the maths of decibels and architectural acoustics) definition of how far a sound can be perceived from its origin point. In contrast, my concept of the sonotone is much fuller, using both qualitative *and* quantitative ways of knowing—understanding *how* to listen to the ways in which urban sounds work with one another to create a sense of place.[42]

This sensation of place (and subsequent place attachment generated by the affective relationship created by cognitive mapping) does not require the listener to know intimately (or even first-hand) the area being aurally explored, but instead creates a fluid and processual construction of a 'knowingness' of the mapped area. This knowingness requires practice: an audile technique that can make sense of the sounds coming from the headphones versus those coming from the physical environment, the

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[42] I like to think of the acoustic horizon as operating like a fence separating pasture from woodland. It is an arbitrary distinction. Actually, there are many stages of transition in between field and forest: a section of grass may spill out onto the tilled soil, shrubs and taller plants shade out the grass moving toward the woods, and finally make way for trees and undergrowth. Each of these transitions between ecotones demonstrates a series of negotiations among the plants, and with their physical environment. In contrast, the fence is just a line. Sonotones functions in a similar way. Acoustic horizons overlap and mingle with one another, buildings may create small oases for quieter sounds to live—sheltered from the hubbub of the main thoroughfares, or a siren may cut over and above all the other sounds in the eventscape—claiming a top spot in the aural hierarchy.

visual acuity to navigate the real world without sound signals, as well as the knowledge

of scale and time to piece together the various discrete field recordings.[43] Thus, the

additional value (or cognitive imaging of the virtual sounding environment) created

within this mapping is an attempt to present a mixture of sound signals and keynote

sounds as sonotones, encouraging the listener to get away from the point-click-listen

ontology of existing web-based sound maps, and toward an active exploration of

re-presented aural place(s). What this active mode of mobile aural exploration

provides—that few other sound maps do—is an opportunity to hear more clearly the

tensions and transitions between and among these pre-recorded sound fields. In the

next section I will describe the techniques and processes I used to create the *SE* app.

<u>Recording Process</u>

In a traditional urban soundwalk, there are many who prefer to 'unplug' from the

mechanical 'noise' of the city (primarily the sounds of traffic), choosing to highlight

paths through urban greenspace in the composition of their route.[44] While I am not

against walking through a park, the bias toward natural sounds and quiet roads

provokes an interesting tension within our experience of city sounds. Why do

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[43] Time and the temporality of the listening experience within *SE* is constructed in a cyclical manner. All the recordings loop continuously, and are of different lengths. This creates the sensation of unique transitions across mapped locations, and can make it difficult to identify soundmarks, or aural anchors in a cursory exploration of the map. As opposed to the repetition of a single sound from multiple perspectives (as in the *Acoustic Labyrinth*), this abundance of independently looping material reinforces links to Sobchak's discussion of circularity and 'lost-ness' within the mapping.

[44] This was a very common practice I encountered during my time with the Vancouver Soundwalk Collective, and even since. The majority of the soundwalks I have taken seem to always spend more than half their time meandering through urban greenspace or very quiet residential areas. In fact, many of the walks I composed—which tended toward longer stretches of busy roadways—earned me rather dirty looks from some participants.

soundwalkers tend to avoid heavily trafficked areas? Are they not equally part of the urban sounding environment? If a listener using the *SE* app wanders into the proximity of Rue St Urbain or Ave. du Parc, they cannot just click somewhere else to change the sound. As with the real world, they have to physically walk about a block or so until they enter the location of a quieter recording. This tension—and the transitions that occur when physically moving in order to resolve this tension—respond to (and can encourage reflection upon) the ways in which we use sound to inform our wayfinding and inscription practices. Without the experience of walking through an unknown (and invisible) aural place (perhaps while exploring a preferred route through a place familiar to the listener), they may never understand the impact of how and why they have chosen that 'preferred' route home.

In order to collect sounds that represent the tensions and transitions among Truax's three types of sound events (keynote sounds, sound signals and soundmarks), I first made a list, identifying the sounds I felt were indicative or characteristic of the area to be explored. I then drew out a scaled map of the area and (after several soundwalk experiments) placed circles upon the map that roughly corresponded to the average acoustic horizons of the more ubiquitous keynote sounds: traffic on the main thoroughfares, the relative quiet of the residential streets, and summer construction (See Appendix B-2). By overlapping these circles on top of the scale mapping, I identified a series of field recording locations that represented what I felt to be the 'everyday' sounds of the area. Within this imposed, grid-like array defining the keynote sounds, I performed several additional mobile recording exercises to accustom myself to

the smaller, quieter, or less frequent sounds in the area (a mix of signals and keysounds). Many of these were collected 'on the fly' during recording sessions, and the list of sounds I ended up collecting bears little resemblance to those I had initially identified. I performed these initial experiments and follow-up recording sessions between April and June of 2015.

All sounds were collected from a fixed perspective using a consistent (Montreal) North-is-North alignment of the microphone.[45] I used a SoundField SPS-2000 ambisonic[46] microphone recording onto a Tascam DR-680 portable recorder. My reasons for using an ambisonic microphone were twofold: first, I could alter the position of the stereo signal to the listener in post-production (eg. spinning the perspective of the pre-recorded sound in case there was a particularly interesting or unique sound that was not well framed within the North-is-North recording alignment that I wanted to draw the listener's attention to), and second, in order to make these recordings future-compatible with potential updates of the app. For example: using the compass and gyroscope features of a smartphone to allow listeners to dynamically pan and tilt their own—virtual—binaural experience of the mapping while navigating physical space.

For my initial mixes of the raw field recordings, I stayed away from shifting the perspective of the ambisonic recordings, maintaining their original recording alignment. However, I did perform a small amount of post-production imaging on the original

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[45] As mentioned in the introduction, the commonly accepted understanding of what "North" is in Montreal—according to the grid-like layout of streets within the city—is actually closer to North-West. In Verdun, the grid system is further skewed whereby what I would consider North (or 'up') is actually almost due West.

[46] This is a microphone that uses four capsules arranged in a tetrahedron to allow the recordist to capture a so-called '3D' sound environment.

recordings to transfer them from 4-channel ambisonic files to 2-channel stereo (with a broad stereo image of 120 degrees), and performed small amounts of transparent audio editing (trimming the start and end points, and occasionally removing sections and crossfading between edited sections of the same recording). This type of editing follows closely in line with audio documents and early soundscape compositions that arose from the WSP—with closest links to some of Hildegard Westerkamp's radio work in the late 1970s and her later series of *Sound Documents* (1981-1992) including "Streetmusic" (1982), and "Under the Flightpath" (1981). In order to provide as close an aural experience as possible to actually occupying the sounding space oneself, I followed in Westerkamp's footsteps and made a conscious choice not to manipulate the collected sounds in any way beyond transparent crossfading from one excerpt of the original file to the next. However, my work differs from that of Westerkamp as she uses live commentary combined with post production narration to create fixed-media works in contrast to the more open-ended, non-linear mappings that I am creating in my research.

     Street Ears was programmed on the Android platform by Montreal-based programmer and sound artist Matthew Griffin (see Appendix B-1 for the code). The current build is compatible with all devices running Android 4.4 or later. The app functions primarily using the capabilities provided by Google Location Services, an essential component of all location-based applications which allows developers to access the Global Positioning System (GPS) coordinates (latitude and longitude) of a given user. I was interested in exploring the locative potential of mobile devices (in this case,

smartphones), as they break down some of the barriers found with other interactive

technology (cost or availability of the input interface, accessibility, and assumptions

regarding 'how' to use the device). Instead of buying a proprietary input device (and

having our project bound to that specific piece of hardware), smartphones seemed like

the perfect medium through which to explore a mobile relationship to sound. The choice

to use smartphones was reinforced by the relative ease of designing the user experience.

Smartphones already contain the ability to track the user's movement in real time, and

people are used to using them for this purpose. Provided the listener is able to physically

navigate space, no additional information is required to move through *Street Ears*.[47]

What makes *SE* particularly interesting from an experiential perspective is the

ability for the user to scale their relative (virtual) GPS movement. Users default to a 1:1

virtual to real-world relationship, but can increase their relative, virtual 'footsteps' to 3:1

(small), 5:1 (medium), or 10:1 (large). Through this function in the app, the entire

Milton Park mapping can be shrunk down to the size of a small sports field, while still

allowing the listener to explore the transitions among sonotones.

Testing Process

The initial testing of the *SE* app proved to be quite difficult. There were problems

surrounding re-presenting the acoustic horizons of the recorded sounds (as expressed

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[47] I am aware of the potential issues surrounding this app's accessibility for individuals with differential mobility, and have made efforts to make this mapping open, available and (ideally) useful for all.

through log functions to alter the amplitude) relative to the linear math representing relative GPS location between the mapped locations and the real-time data. Additionally, there was the difficulty of determining if the desired mapped sounds were properly crossfading based on the movement of the listener. My personal experience gave me an advantage in this regard, as I had spent many hours walking, listening, and recording in the mapped area, and was able to recognize the blend of keynote sounds and sound signals working together—a prime example of the audile technique this mapping requires. In order to clarify these technical issues, we reverted to simple test samples that were easily identifiable: a mix of short pop music and spoken word excerpts. Once the issues of programming maths were resolved, we were able to test more rigorously the ability of listeners to develop the audile technique necessary to decode the mapped sounds.

In order to create more variety for listeners (and because we had a functioning prototype), I decided to go ahead with the collection of sounds for a second mapping that could be integrated into the *SE* app. For this mapping I used Parc J.-Albert-Gariépy in Verdun as my focus. The mapped area is comprised of three roughly parallel East-West lines that run between Rue De l'Eglise (to the East) and Rue Beatty (to the West) along the shore of the St Lawrence River (to the South), Boulevard LaSalle, and Rue Wellington (to the North—an overall area of approximately 600m x 1600m). This rather free-form delineation of the map area (in contrast to the grid-like structure found in the Milton Park map) allowed me to collect sounds from a wide range of locations: wetlands, major thoroughfares, as well as residential, and commercial areas.

Additionally, the recording process used in this mapping was considerably different from that of Milton Park, as I was much more interested in the subjective experience of place. I had just moved to Verdun, and wanted to use the seasonal transition into Spring as the drive to explore my new neighbourhood aurally. To do this, I performed a series of exploratory soundwalks between March and April of 2016 where I would stop to record whenever I felt I was in, or moving through, a transition point between keynote sounds or representative sound fields: a sonotone. This led to a more diverse repository of sounds to work with than the deconstructed, pen and paper approach to Milton Park. While it can be said that there is less traffic in a riverside Verdun park than on the Plateau, traffic and construction sounds still permeate these recordings (although there is a much larger variety of sound signals: footsteps, dripping water, barking dogs, wind, and the whistling doors of a metro station).

Having tested the functionality of the ambisonic recordings with the initial mapping (and then realizing the technical complexity of integrating real-time decoding of the 4-channel recordings into the app' programming language), I decided not to use the ambisonic microphone in the "Verdun" map, but instead recorded with an Audio-Technica 825, a 120° X/Y stereo microphone and the same Tascam DR-680 portable recorder used in the Milton Park recordings. The smaller size of the stereo microphone allowed me more flexibility in directing it toward particular sound signals, and was certainly easier to carry for longer walks. I followed a similar editing technique used in the Milton Park mapping, but again with a slightly more subjective approach geared toward isolating a wider range of unique sound fields, as opposed to specifically

trying to blend together a series of keynote sounds. That being said, there are still a number of what could be considered 'ambient' or keynote sound recordings within this mapping, just more emphasis was placed on including more distinct sound signals.

In the "Verdun" map, it was my own exploratory wayfinding through a new neighbourhood that drove the recording process, similar to Dorothy first stepping out onto the yellow brick road (although without a song-and-dance welcome from the Munchkins). I was trying to document my own experience of turning space into place as opposed to the pen and paper-oriented recording process in the Plateau, where I first identified the sounds I thought seemed common—or indicative of the location—then set out to collect them. This contrast between *exploring* or *defining* the sense of aural place allows listeners two very different entry points into these two distinct areas of Montreal and speaks to the ability of the *SE* mapping interface to create a range of listening experiences, while still using the same platform.

Version 2.0 of the app was completed in May of 2016 in preparation for workshop presentations in Joensuu, Finland and as part of a paper presentation in Hong Kong. The testing for V2.0 was considerably more intensive—now that the app worked, what did it mean? Could all these theories I had on sonotones and place attachment actually work? Was it possible to perform an aural drift through physical space while listening to an augmented aural reality? In advance of these presentations, I devised three testing strategies: in situ, cross-situ, and open field. The in situ tests were performed in the locations they were initially recorded with the listener (usually myself and Matt—although we did have a few other early testers) starting the app from the

centre point of the mapping (either my present or former apartment) and beginning to walk. These tests led to some very interesting results, particularly in the Milton Park mapping. As most of the recordings presented keynote sounds, it was possible to (more or less) 'match up' what you were seeing with what you were hearing. The same was generally true of exploring the Verdun mapping in situ, but with the recording process focussed more on collecting sonotones (or sites of transition), it became a bit more like a treasure hunt, or an exploration of the unknown. Sounds would pop out at you that did not have a strong visual corollary, such as the sounds of a street-cleaner driving by, or the construction of a now-completed building.

The cross-situ tests also provided some interesting data (while certainly less useful for testing the spatial relationship between real-time movement and the app's relational movement). Exploring Milton Park in Verdun and vice versa was (I found) very entertaining. Here we were, using headphones to engage in a solipsistic aestheticization of our aural experience (Bull), but we were inserting the sounds of another urban environment. It became a way to mash-up the juxtaposition of the visual environment and the sounding one. Standing, looking out at the St. Lawrence River while hearing the crowd on the patio of a bustling brewpub and the surge of traffic along Sherbrooke is a pretty interesting experience, one that also calls into question our relationship to the history of places, and the role sound has in defining or qualifying that relationship.

The open field tests provided the best experience of the tensions, transitions, and hierarchies among the sonotones of each mapping. In order to better hear the

relationships among the various sound recordings, I tested each mapping on the lower fields of the McGill campus. These locations were relatively quiet (it was late April/early May, so there were very few students on campus), and allowed my to explore the mapping without the physical constraints of urban architecture. This freedom from the boundaries of streets, sidewalks, and buildings created a fascinating aural experience. I was now able to perform purely aural wayfinding, giving my ears primacy in guiding me toward interesting or unexpected sounds and away from those I was less attracted to.

Of course, all these tests simply validated my own assumptions surrounding mobile media devices and interactive mappings. It is important to consider the assumptions of other listeners surrounding content and the workability of the interface. In May of 2016, I presented the *SE* app at a series of workshops at the *Music, Ageing and Technology* conference in Joensuu, Finland. Workshop participants came from a wide range of ages and backgrounds: from middle school students, to music educators, and the general Finnish public. Participants first took a short soundwalk, followed by a discussion period identifying the keynote sounds, sound signals, and soundmarks of the local area. After introducing the development and functionality of the *SE* app, they were asked to go out and explore the sounds of Montreal—in Joensuu. The grounds surrounding the conference were composed of a few university buildings surrounded by open, semi-wooded areas, a stark contrast from the much busier, heavily trafficked eventscape of Milton Park. In the post-testing debriefing, participants generally enjoyed the experience, yet (as I had assumed) were hard-pressed to determine if it worked 'properly.'

I believe this is largely due to the necessity of engaging with multiple experiences of the app to develop the necessary audile technique (as Matt and I had done in preparation for the workshops). This could have been due to a rupture in trying to rationalize their situated and physically-present locational awareness with the multiplicity of perspectives. Perhaps they were not engaging enough with an experimental awareness while trying to perform wayfinding through a completely foreign acoustic place. What stood out the most was their desire for a more dynamic visual interface. They *wanted* the 'pinpoint,' something to represent where they were in virtual space, even though they were already somewhere else. They wanted these conventions of networked mobility, pushing back against my desire for the app to run in 'pocket mode,' in order to have an anchor in this strange new place. It seemed to me that they were unwilling to engage with being lost in a foreign sonic environment and perform purely aural wayfinding.

The most successful component of these Finnish workshops were the participants' discussion surrounding their experience of exploring sonotones. Many participants mentioned a shift in their experience of the app once they ceased to worry about navigating and moved to a more exploratory, play-oriented listening approach, moving back and forth between a pair (or small grouping) of locations, trying to understand the transition points between them and (this is my own extrapolation—as I didn't want to lead the discussion too much) determine the hierarchical relationship among these re-presented places. In this regard they were using my deconstruction of

sound signals, keysounds and soundmarks to develop their own deeper understanding of Montreal's 'sound.'

This ability to move back and forth between pre-recorded sound fields allows listeners to generate narrative within their mobile experience. By layering a dynamic secondary soundtrack on top of their real-world movement, they are stitching together a story of how they imagine Montreal. This form of cognitive imaging (albeit somewhat different than that described by Arthur and Passini, who favour visual information such as maps and signposts) generates an augmented reality experience that departs from the location-specific approaches discussed previously. In *SE*, the real-world location is variable, and the app asks the listener to construct their own story of Montreal in a non-linear fashion. As the listener moves through the re-presented sounds, their decisions on how, why, and where to walk (or roll, bike, or drive) generate an aural pathway through the city, *using* the city. This is in stark contrast to many mobile audio users who normally strive to mask the aurality of their urban environment while navigating the everyday.

Conclusions

By overlaying two sets of spatial data (the fixed relationships among the recording locations, and the mobile, real-time GPS location data of the listener) the *SE* app functions as an interface for the fluid exploration of any sound archive, not just a representative mapping of a single area. *SE* is about mobilizing the senses in a unfamiliar or novel way in order to draw attention to the listener's 'normal' relationship

to everyday experiences. Moving forward with the *SE* interface, even more intensely scaled versions could be built, allowing dedicated listeners to practice wayfinding among the soundmarks of a daily commute (or foreign location) in their homes (or, probably more practically, a gymnasium).

Additionally, non-linear narrative structures could easily be presented through the *SE* interface, allowing listeners to experience a psychogeographic augmented aurality—a more accessible *City of Forking Paths*—where the goal is to explore *any* area, trying to decipher the relationship between characters and narrative threads while walking around the city—any city—creating multiple forms of place attachment, particularly if some of Cardiff's more intimate binaural effects were integrated.[48] As mentioned above, the creation of aural narratives with regard to both real and virtual spaces is something that *SE* already does in its current form, but integrating speech and text may create a more accessible audio guide for those who are not as interested in getting a little lost in their exploration of city sounds. There is even a potential for the use of this interface as a gaming platform. The relational layers of location data could find their way into aural scavenger hunts (similar to the way in which I described a *Recho*-driven exploratory soundwalk earlier), or even modified so that listeners could grab or tag sounds, creating the platform for a headphone-based game of aural capture the flag.

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[48] This is actually quite easy to do in the Milton Park mapping, as the ambisonic converter I used also provides the ability to emulate binaural recordings by mixing down the quadraphonic tracks down through a head-modelling filter. In the initial mixing and editing portion of this project I tried it, and found I preferred the stereo mixdown, both in creating a more 'open' sound field, and because I was not directing the listener along any particular route, so there was less of a need to provide the listener with a highly spatialized recording.

By presenting an open-ended, exploratory format for understanding a dynamic aural environment, the *SE* app allows listeners to generate place attachments with sound-based spaces, reconfiguring how and why they listen to the urban sounding environment and developing the audile technique to practice aural wayfinding. This exploratory format also asks listeners to create their own narratives of the urban aural experience as they explore the interface—from anywhere in the world. Despite this freedom, listeners still need to practice audile and navigational techniques to discern not only the interrelationship among the pre-recorded sounds, but their relationship with the environments they encounter on a daily basis, highlighting the role of sound in the spatial decision making process, and creating new navigational inscriptions onto place.

As I mentioned earlier, there are a number of ways in which we use mobile audio to shape our experience of place, most commonly by 'soundtracking,' or playing music directly to our ears through headphones or earbuds. However, mobile applications encourage a more engaged, exploratory relationship with sound and place. Other applications (such as *Recho*) eschew the narrative constructs found in Cardiff and Miller's work, allowing the public to upload and access geolocated audio excerpts—either recorded on site, or 'brought' to a particular location. In contrast to these established mobile modes of listening (and accessing geotagged digital audio), *Street Ears* uses a secondary, relational mapping layer that uses the listener's real-world GPS information to navigate a pre-recorded mapping of Montreal without the need for physically being 'there.' A drift through non-locative locativity.

In using the *SE* platform, listeners are able to transition among sonotones, shifting their locational awareness from a situated and embodied mode to one that focuses on experimenting with the multiplicity of layers of meaning across both virtual and actual environments. Through this shift in audile techniques, in my interpretation, both app testers and workshop participants are able to identify points of transition among sonotones, refining their understanding of keynote sounds and sound signals in order to develop a narrative of how these sounds shape the lived experience of these mapped areas, and contribute to the 'sound' of the city. Additionally, their sense of lost-ness within a virtual place allows them to highlight a relational and experimental association with location—creating a sense of place through another, while being able to decipher the shifting functions from sound event or keysound to soundmark, and work through the hierarchies among the sound fields that make up the eventscape. Of course, listening in this way takes time. The next interface I will discuss is centred around durational modes of listening and how we can construct narratives across a temporally vast data array.

Chapter Three: Duration

"Time flies when you're having fun."
-Anon.

Our sensation of time is ephemeral. The adage above points to the flexible nature

of how we make sense of various temporalities and durations. Of course, there are

markers that help us divide the day—sunrise, sunset, the changing of the seasons, and

patterns of human movement—but for the most part our experience of time is

understood through the artificial construction of the clock. Clock-time is vastly different

from perceptual time. Each moment can be assigned to a particular subdivision of what

we believe to be the passage of time (a year, month, week, day, hour, minute, second, or

millisecond). Of course, this construction is not perfect. We add a day every fourth year

to keep the arbitrary subdivision of 365 days to a year in line with the rotation and orbit

of the earth, and (as someone who grew up without Daylight Savings Time, for no

apparent reason) shift our clocks forward and backward an hour in the Spring and Fall.

While we are able to manufacture an understanding of the passage of time within these

subdivisions, they are all still relative. My watch may not read the same time as this

computer's clock, your smartphone, or the illuminated screen on the Metro platform

conveniently counting down until the arrival of the next train.[49] How, then, can we begin

to understand the roles of both time and duration in our experience of the sound in the

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[49] The countdown clock for the arrival of the next Metro train in Montreal is an excellent example of how
our constructed, clock-time understanding of duration can fail. I have spent many moments (are they
actually 60 second minutes?) watching the clock flip back and forth between 5 and 6 minutes for the
projected arrival (as though the train just couldn't decide how long it wanted to take to get there), or hover
at the 3- or, worse yet, the 11-minute mark for what seems like an eternity.

environment—blending together our perceptual understanding of temporality with the constructs of clock-time?

I discussed in the previous chapter how new interfaces for sound-based mapping can allow listeners to engage in a form of psychogeographic approach to navigating sound *through* space by troubling the distinction between the places they are seeing and the ones they are listening to. This chapter will discuss the possibility of listening *through* time. The *168 Hours* mapping interface uses a single recording perspective to re-present the recorded sound from one week (or, as per the title of the project, 168 consecutive hours). This interface calls into question how and when we construct a durational relationship with sound and place. If we concieve of space as being 'point-less' (as in the Deleuze-ian sense), we can use *duration* to construct narrative meaning and place attachment. Sound can be the source of Deleuze-ian folds, of creases, or, to link back to the previous chapters, of De Certeau-ian trajectories. Over time, as a series of sounds are heard moving through space, they create the inscriptions (or folds) necessary to generate a sense of place.

Marcus Doel discusses these folds (or, in my extension, creases) in his chapter "Un-glunking geography: spatial science after Dr Seuss and Gilles Deleuze," starting with the rather broad assertion that: "poststructuralist geography emerges from the deconstruction of pointillistic articulations of space, time, and place; with the joyful realization that oneness simply lacks consistency" (122). Doel goes on to say that when using this point-less, post-structuralist approach to space, "a place is not a constant undergoing change, but a differential equation: flow upon flow; variation upon

variation; differential upon differential" (125). So, how does one inscribe meaning within this seemingly rhizomatic equation combining flow, variables and differentials? Doel's solution to this equation is simple: the "open fold" (126). If space is conceived of as a series of folds, rather than points, all locations become combinations of all their composite elements as well as their continuously morphing relationships to other folds. Like origami—which is simultaneously a piece of paper, a series of folds, and a swan—a location within space is viewed as an 'and,' not an 'if.' What makes the fold even more versatile is that, like Douglas Kahn's discussion of the "line,"[50] it is both the thing, *and* the division between that thing and other things, effectively containing itself and its own boundaries. What is more, every time a fold is unfolded or re-folded in a new way, additional meanings and cross-linkages to other folds are created: creases. As Doel notes: "the fold is, precisely, what can be folded in many ways. This is why the figure is never *one"* (126 emphasis in the original), and "[w]hat appear as points or constants are really folds upon folds" (128). Of course, this process of folding over and over again takes time—duration. Whether consciously or not, the folds the crease contains (and is made up of) can be understood to represent lived experience. And, as per Massey and Williams, lived experience can be accrued in order to transition a location from space to place. Through the process of lived duration, our relationship to place accrues additional folds, themselves generating more new creases. The lived nature of duration

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[50] Kahn discusses the line in *Noise Water Meat,* moving away from a narrowly modernist perspective where the line can only exist as a trace, or remnant. Instead, he theorizes that lines "are productive and reproductive; they can be intensifications and not just rarifications, and, most important, they can be both at once. … [T]he line exists as a reservoir and not a residue, and as a reservoir *and* a residue" (72 emphasis in the original).

is what separates it from clock-time and from temporality—at least in situations where temporality functions in reference to clock-time.

However, duration still takes time. The meaningful inscriptions within each crease are only a single fold each—something as simple as the crunch of a leaf underfoot or the hot air of the Metro—but there are thousands of these minute inscriptions that accrue over time to create a greater understanding of the lived experience of place. Of course, maps are a very interesting source for folds—the well-travelled copy of the Saskatchewan Grid Road map that lived in my car for many years is testament to that. However, folds are not limited to paper maps: online sound maps and locative media projects are amazing sources for folds in places we've only visited aurally (or aural augmentations of real-world locations). But where are the creases? A point-click-listen sound map only provides a single, thin fold within the experience of each recorded location. There are rarely links between recorded locations—no tensions or transitions. Each recording represents a different location. With this information, we are basically just scrunching up the piece of paper into a ball, not making a swan at all. In order to be able to fold into intricate origami shapes, we need time and practice. In order to hear the paper/folds/swan of a particular place, we need to spend time listening to it. We need to experience lived *duration*. This mapping project asks: is it possible to create an interface that allows the listener to experience the durational process of learning how a particular location sounds *through* time?

Listening to field or archival recordings can be referred to as a form of time travel—or at least a way of reconnecting with the past (Edison originally touted the wax

cylinder as an ideal means of preserving the voices of the dead). But listening back in time this way has difficulties. We are used to modifying our experience of the surrounding aural environment with pre-recorded or mechanically reproduced sound: be it white noise generators, TV, radio, CDs, vinyl, etc., etc.. That said, I rarely think of existing in, or even visiting a different temporality when listening to an album. Instead, I am using the album to modify the now. Of course, many albums have specific folds and creases that link them back to specific places and times—which may be a factor in whether or not I choose it for my modification of the now—but I am not intentionally using them to transport myself back to that particular location or temporality.[51] It is possible to develop an audile technique that frames listening more directly as an attempt to hear the past, or to embody another temporality: there are grammophone (or other recording technology) buffs who only listen in specific ways to specific recordings, perhaps with the intention to shift themselves into another temporality, however temporarily it may be. So, how do we shift ourselves back in time through sound? Edison's idea of preserving voices of the dead makes for a useful starting point. There exists an affective quality to our voices: I can identify a friend on the phone almost instantly (even without caller ID), and recordings of myself, friends, or family certainly have an emotional quality.[52] But am I hearing a separate temporality, or just experiencing a form of emotional recall? By switching the subject from the voice to field

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[51] For example, I have a strong sense memory of smelling homemade smoked duck whenever I hear the live version of "The Night They Drove Old Dixie Down" from *The Last Waltz*, after hearing it for the first time while making a New Year's Eve dinner as a teenager.

[52] There is also strong affective relationships between radio presenters and their audiences. Laurie Brown (formerly of CBC's *The Signal*) is an excellent example of that. She has a huge fan following online—with the quality of her voice being a common topic for conversation—and after leaving the show has successfully shifted to independently releasing podcasts.

recordings of an urban environment, *168 Hours* attempts to shift the affect necessary to imagine a distinct temporality away from the interpersonal and into the sound environment as a whole. There are, of course, existing situations when this type of aural approach is used—particularly in regard to listening to antique or archival recordings in an au(o)ral history, ethnographic, or sociological framework, but few sound-based mappings are attempting to encourage a duration-based approach to listening. There is, of course the exception of *Locus Sonus*, a site featuring live audio feeds from around the world that implicitly encourages durational listening. Since all the streams are active in real-time, it is necessary to listen for longer periods of time—just for the chance to be 'there' when the whales start singing off the shores of Hawaii.

As we listen to the environment around us, we can hear a vast range of information. Whether consciously or not, this information impacts our understanding of place, creating new folds of aural memory: a shimmering echo, a dull thud, the bus slowing to a stop. How does our experience of sound from the past inform the now?[53] Can we use a durational listening/mapping interface to bring nuanced sound events (a building's architecture reflecting certain frequencies, how a street is transformed by a change in weather, the movement of pedestrians at particular times of day) to the foreground—or at least make them perceptible to the appropriate audile technique. Additionally, is it possible for this durational mode of listening *back* to something generate new ways of understanding our relationship to space through both sound and time thus allowing us to hear differently in the now?

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[53] John Kannenberg has recorded and written extensively about the aural experience of quiet places (museums, art galleries) with the intention of listening to the resonance and reflections of the art and objects within these 'empty' rooms.

<u>Traveling through Time</u>

Time is, of course, relative. But, with the intricacies of whether or not someone is travelling at or near the speed of light aside, I would like to delve into the idea of time travel and the machines or devices necessary to do so. In *The Time Machine*, H.G. Wells writes about the substance of the world (or, in his example, a cube) as necessarily having four dimensions: length, breadth, thickness, and—guess what—duration (from Gleick 6). So, once we accept that duration—time—exists as a dimension of our daily experience, we can start to move around within it. While I am not proposing that we fight Morlocks, change the outcome of WWII, or wake up in King Arthur's court, there are a few ways in which the ontology of time travel and time machines can be applied to the *168 Hours* project. Generally speaking, time machines seem to prefer working in one direction with the option of returning 'home' again later. For example: the predilection of Mr. Peabody and Sherman's WABAC machine for visiting the past, or Wells'—which only moves forward until it's time to wrap up the story. Others, like the one *Futurama's* Professor Farnsworth builds in "The Late Philip J. Fry," can only go forward in time, forcing the Professor, Fry, and Bender to loop around through a few iterations of the universe as we know it, eventually returning back to when they started, but ending up ten feet higher than in their original timeline—which accidentally results in them squishing their previous selves and effectively closing any temporal paradoxes.

There are notable time machines which are able to move back and forth with relative mechanical ease (although they tend to create a number of unexpected results with regard to personality, family dynamics, and and social status). I am thinking here

of Doc Brown's DeLaurian in *Back to the Future*. However, for the sake of my argument, I would like to focus on a one-way mode of time travel (no need to go back to the future a second time) by creating a mapping interface that allows the user to look, or, rather, listen to an expansive archive of the past, and then be able to pop back 'home' again (even though technically by that point, their home will effectively be in the future).

In order to discover how we listen *through* time—and how we can create a mode of listening that engenders listening to multiple sound sources as parallel temporalities—I have developed a sound-mapping interface that allows listeners to explore a series of durational field recordings from a single location. Housed in a box 46cm wide, 60cm tall, and 28cm deep, this trapezoidal piece features 12 buttons arranged around a working clock mechanism, with 7 volume knobs below. Built as a large clock-face (with a working movement at the centre), each dot representing the hour is an interactive button that allows listeners to select to a pre-recorded sound file—mapped time. By pressing a button, the listener is aurally transported back to October of 2014. However, the sticky question of whether or not the listener will agree to shift their mode of listening pops up. As with other forms of archival listening, the volume of data available pushes the listener to use a durational approach to work their way through the collection. It takes time to travel through time—or at least to experience an alternate temporality. But this work is not just in taking the time to listen, it is also in how the listener constructs a meaning or narrative thread from their experience of time outside of the linear progression forward, one minute following the next. What is more, all these sounds exist as a set—a series. Unlike the perusal of a collection of wax

cylinders or 78s, this interface can immerse the listener for 14 consecutive hours of the same content.[54] They can, however be experienced out of order. There is no rule saying once you've travelled back in time you have to move forward through it one hour or day at a time.

There is considerable debate surrounding exactly how time moves, or, perhaps more precisely, how we experience the movement of time. There are a number of ways in which theorists strive to describe time: there is the A-Theory, where time exists as a horizontal line, with no *now*, only moments existing in the past, and those existing in the future. In contrast there is the B-Theory, where time is structured vertically as a series of moments that all coalesce in the now, including all pasts and potential futures (for more on how we understand time, see Mölder et al, Santoianni, and Wuppuluri & Ghirardi). Others, such as Samuel Baron and Kristie Miller (in Mölder et al), propose a concept of "folk time," where both A- and B-Theories can coexist (or not). Regardless of whether time has a 'now' or not, or if it is experienced horizontally (following the linear arrow), or vertically (implying there are a multitude of cofactual of 'nows'), time still passes, and there is always temporality—duration. Henri Bergson has written extensively about time, and, in particular the idea of duration. David Lapoujade and Andrew Goffey unpack the many levels of Bergson's writing on time, beginning with his notion that time and duration are experienced the same way a listener hears a melody: existing as a fragment of the past, and in an emotional capacity.

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[54] This is not to say that there are less than 14 consecutive hours of material on a given subject or keyword in other audio archives or record collections, but rather to say that the focus of *168 Hours* is a single location and the ways it changes over the week and 14 hours of content.

Bergson specifies that one erases the difference between the sounds and

abolishes the distinctive characteristics of the sound itself, so as to retain only

'the continuation of what precedes into what follows and the uninterrupted

transition, multiplicity without divisibility and succession without separation, in

order to finally rediscover basic time.' [...] That is when duration, the purely

spiritual element of time, its very substance, is set free (4).

For Bergson, duration exists as an emotional, spiritual experience. I believe this concept

can move out of the spiritual, yet remain grounded in the experiential. In this

formulation, duration is an essential part of lived experience. As I have discussed earlier

with regard to Massey's multiplicity of stories-so-far, Bergson's continuation of

multiplicities and successions without separations lend themselves toward a cofactual

understanding of time, where all pasts and futures are continually unfolding in the now.

In order to instill a sensation of multiple/parallel temporalities all emerging into

the present, the clock-works of *168 Hours* display the current time in the centre of the

interface even while listeners aurally move into the past (while creating their own

futures). This means that while listeners are selecting *when* to listen back to, they are

also continually reminded of when their *now* is, and how long ago it was that they

started travelling through time. Then, when they are done listening, they immediately

pop back (or ahead?) to the current moment—kind of like an automatic reset to a new

'now'. *168 Hours* becomes about choosing how and when to interact with time, not just

experiencing it as it passes by on it's arrow's trajectory into the future. As a time

machine, it is not perfect. The surrounding environs do not shift. There are no new

smells, sights, or 'feels' to experience. Perhaps for it to function best, it should be installed in the apartment where the recordings were made—driving home the experience of inhabiting two distinct temporalities simultaneously. Even without site-specific installation, it still allows the listener to navigate through an alternate temporality, one that is weighted with duration, and the process of listening to another place, another time.

The Process of Mapping Time

As they explore *168 Hours,* listeners are able to select 5-minute excerpts from each of 168 hours recorded continuously from the open window of my 7th storey apartment overlooking (or overhearing) the intersection of Rue Milton and Ave. du Parc in the heart of Montreal's Milton Park neighbourhood. The audio was recorded from a single, static location using the Zoom H4's built-in stereo microphones perched on the inside of a bedroom window ledge (See Appendix C-2) from October 15-22, 2014. The audio files were recorded in 4-hour chunks (to fit onto a 4gb SD card) and initial editing to divide these files into one hour slots was done using Audacity. However, initial attempts to integrate all 168 hours of audio within the interface proved very tricky. The sequencing/playback software (Ableton Live) is not designed to hold that number of large files in the computer's RAM, which initially led to a considerable delay in the interactive user experience as Ableton Live (hereafter, Live) tried to cue up 14 hour-long files simultaneously, and created issues with my computer's hardware (in fact, I burnt out my RAM completely). As a result of these technological stumbling blocks, I decided

to edit each of these hour-long slices down to shorter excerpts. The 5-minute mark for an individual file matched the choices I have made about audio file duration with the other interfaces in this dissertation as a whole, and serves to drop the overall audio content down to only 14 hours.

From an interaction design perspective, the interface is relatively uncluttered: a ring of 12 white buttons mark each of the hours on the clock face, which dominates the upper centre of the device's face. Below and to the left are a line of seven linear potentiometers with names of the days of the week in both French and English printed below. To the right of the potentiometers are three buttons: two in blue (one with AM/00:00h-11:59h printed above and the other with PM/12:00h-23:59h printed below), and the third in red with Stop printed above and Arrêt below. Operation is intended to be very simple—if the top centre button is pressed, the Live software will begin to play the 14 tracks corresponding to both noon and midnight from all seven days of the week. The listener can then use the potentiometers and AM/PM buttons to choose which of the seven days they would like to hear, and whether they would like to hear that day (or days) at noon, midnight, or both. My goal in designing this interface was to allow for rapid movement among the set of 12 options implied (or assumed) by our understanding of analog clock-faces, while allowing the listener to compare, contrast, and mix together sounds from the seven days of the week. The solid 'click' of the arcade-style buttons punctuates the relatively ambient material being explored, encouraging multiple selections, even if they are somewhat random. This ability to

quickly move among the recorded sounds has a few drawbacks, most notably in the

feedback between the Live software and the interface.

For this iteration of the interface, I was unable to include a visual feedback

system that would allow listeners to see which hour (and which half of the day) has been

selected—for example, illuminated buttons that would indicate which hour was playing,

or a small LED to show if the listener is hearing AM, PM, or both.[55] However, I do not

feel this is a marked drawback to the interface, especially if the listener is able to see the

computer screen running the Live session while exploring the mapping. Additionally, I

feel the sense of lost-ness is a useful part of exploring the interface (as I have previously

mentioned with both the *Acoustic Labyrinth* and *Street Ears* projects). Re-selecting (or

restarting) a particular track will only assist the listener in their ongoing process of

constructing (or drawing out) meaning from the mapping. As with any adventure,

having a map doesn't mean one can't veer off the path from time to time. Rather, the

map is there to help reorient oneself once a landmark (or soundmark) has been

identified.

In this mapping interface, the clock itself functions as the landmark. It is a

constant. The buttons do not move (although the hands of the clock movement do), and

pushing the same button twice only serves to restart the audio tracks. I feel the ability to

get a little lost (or at least to become a little confused as to *when* exactly one is listening

to) encourages the durational mode of listening I am interested in generating with this

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[55] This functionality could be included by installing a second MIDI socket on the Arduino that would
receive data from Live—although I am unsure if Live actually sends MIDI control values when a track
finishes playing, or if it outputs the toggle data for soloing tracks. This uncertainty is part of my rationale
for custom-coding the playback engine in future iterations of this project (more on this below).

mapping. While time passes normally in the centre of the interface, the listener is able to move outside of time, drifting around the clock and across the week. As the listener continues their engagement with the interface, their ability to control what they are listening to increases. As soon as their initial fear of becoming lost is overcome, it is possible to perform nuanced adjustments to create a dynamic acoustic arena, and really move across the duration of the mapping without (necessarily) listening to it 'in order.'

Throughout this entire project, the theme of duration has been at the forefront. Not only in changing the pace of my days (and nights) to ensure I was changing the SD cards every four hours while recording the audio, but also in working through the CPU's lag time as Audacity created an overview for each 4gb file, editing and sequencing these large chunks of data into coherent hour-long slices, then re-editing each of those 168 files down into 5 minute excerpts. I initially attempted to be rather objective with these excerpts, doing the first round of editing visually (looking for an interesting slice of the waveform),[56] and more often than not simply selecting the first five minutes from each hour. This choice to use the first five minutes also lined up conceptually with my perceived expectations of the listener: when you push the button for 2PM, you'll want to hear 14:00, not 14:24 or 14:45. However, this process was not foolproof (few are), and there were a number of excerpts that needed to be revisited, either because the mapping was missing what I believe to be an important sound (the start of a hailstorm, the local church bells, or revelling college students) that doesn't necessarily occur 'on the hour,'

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[56] I acknowledge the subjective nature of this term, and even encourage it. What I mean by 'interesting' is that it showed significant dynamic contrast, or was representative of a sound event I had previously noted, and felt deserved inclusion in the mapping (see below for a more detailed description of these sounds).

or, on the other hand, removing sounds: some moments were just too windy to be heard clearly, and others a bit too personal for public presentation. However, duration was still a key theme even after the audio was excerpted—they still had to be listened to (which I did in three marathon listening sessions), arranged within Live (another solid hour of drag-and-drop), and have MIDI channels assigned to each individual track. Collecting, editing, and organizing the data for this interface required a lot of 'point, click, and wait' to get all the various bits of sound all lined up properly.

The inspiration for the interface came from the relatively simple question: how can I make sense of the sounds from across an entire week? Managing data from an afternoon of recording can sometimes seem like an overwhelming task, so what happens if that is multiplied many, many times over? Aside from taking up a fair chunk of space on an external hard drive (or three), what can this information be used for? As with the other two projects in this dissertation, *168 Hours* uses very simple studio processes with the goal of re-presenting the acoustic arena as it was recorded. I performed no modification to each 5-minute file (such as splicing or layering multiple excerpts from the same hour-long segment on top of each other) beyond a slight equalization to accomodate for the acoustic characteristics of the relatively inexpensive microphone capsules in the Zoom recorder. As I continued with the process of developing this interface, I became interested in how the interface functioned as a search engine or catalogue for the set of 168 hours—like an archive or a library, not as an artistic expression or with the intention of transporting the listener to any imagined or

artificially constructed place, but in the way a card catalogue can be viewed as a map of the library's holdings.[57]

The interface itself is built using an Arduino Mega rapid prototyping board running a custom sketch that reads the analog (potentiometers) and digital (momentary buttons) inputs from the clock interface and translates them into MIDI (Musical Instrument Digital Interface) signals which are then communicated to Live via a Roland UM-ONE MIDI-USB device. The coding required to generate a MIDI signal proved to be somewhat more difficult than it seemed to be at the outset, with the Arduino initially having some difficulty in properly sensing the buttons and putting out a string of random values for the potentiometers. After assembling and disassembling all the hardware several times, I was able to construct a stable version. However, the potentiometer code was still giving me trouble, refusing to output the correct range of values (0-127) necessary to function as a MIDI signal. Building on the success of our *Street Ears* collaboration, I enlisted the help of Matt Griffin in finalizing the code. In the end, it was the difference of storing the potentiometer values as integers, not bytes that were giving me grief. The full code for the project is included in Appendix C-1.

The decision to use Live was, initially, a practical one. After a few attempts at building a custom playback patch in the open-source audio processing platform PureData, I found that it lacked the ability to wrangle enough processing power to manage the volume (data-wise, not amplitude-wise) of audio I wanted to include. At this

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[57] Of course, the intent of this mapping interface is, in a sense, to transport the listener to the window of my apartment. I mean to say it does not transport the listener to an alternate, imagined place through conventions of soundscape composition (as popularized by Barry Truax, Hildegard Westerkamp, and many others) wherein contextual links to the source of the recorded sounds are maintained, but the composer is free to interpolate dreamy sequences lush with resonators or granulation (for example).

point in the process, I was still contemplating including a scrubbing function where listeners could fast-forward or rewind through the entire hour-long track and hear the resulting sped-up audio in real time. Once I realized this was not an option (PureData's object-oriented programming environment didn't have an object that would allow me to perform this function on 168 tracks simultaneously), the rationale for using PureData became moot. Why spend the time and energy custom building a playback engine when I already own software that can do it automatically? Of course, as I write this, I am once again contemplating the benefits of writing custom code: there are a few idiosyncrasies within Live that do not mesh well with my intended user experience (there is a frustrating glitch that pops up when toggling between AM and PM, for example), that I could easily avoid if I had developed my own playback system. However, the use of Live—initially designed as a real-time performance and playback software solution for DJs—as the playback engine for a sound-based mapping brings up interesting ideas surrounding remixing and DJ culture.

Within *168 Hours*, listeners are essentially using Live to remix a series of field recordings. Due to the ability to select from any of 24 hours and modify the amplitudes for all seven days, *168 Hours* invites listeners to perform *with* the interface, hearing this series of daily ambiences as a source for creative expression, as well as the object of interrogation within the study of acoustic ecology. Moving beyond approaching these environmental sounds as potentially musical, listeners are also able to perform with, and through *time*. In this project, the fixed, cyclical constraints of the clock are shattered. Time becomes remixed. Listeners are able to move through the collected

sounds without any regard for the processual nature of time—jumping instantly from day to night, or bouncing around: choosing which button to push without rhyme or reason. However, if the listener moves beyond this toe-dipping, randomized, sampling method which frames these recordings from a musique concrete perspective (where they simply function as sound *objects* to be dissected and potentially repurposed without any link to their contextual sources), toward an understanding of the mapped eventscape as a whole, this interface encourages deeper listening practices toward understanding each sound event as functioning within a larger ecological construct. As such, each sound has meaning, and these meanings can be combined to create narrative—be it constructed in a linear or nonlinear fashion. By being able to move freely around the clock (and throughout the week), the day-to-day cycles of space come to the attention of the listener, and emerge as the texts from which to generate narratives.

Piecing the Story Together

The sample-based structure of the interface (through native constructs of the DJ sampling software), and the reliance on looping (structuring the audio content as a series of shorter excerpts) generates a folded temporality that is similar, but different from the aporic relationship to time found in *The Acoustic Labyrinth*. This folding (or, hopefully, creasing) of time upon itself (although still moving forward or backward through time) while remaining in the same physical location creates a challenging relationship to narrative that can tell us something deeper about this place. The narrative structures generated by the listener are not necessarily just about

understanding sound and space (eg. place attachment), but about stitching together a larger story. Because the listeners are free to construct the order in which they encounter the content, these stories can become extremely complicated. In order to discuss how we can make sense of the narrative threads present within *168 Hours*, I'd like to first talk about some of the ways in which we are able to make sense of complex narratives in film. In writing about these narratives and "puzzle-" or "mind-game" films, Thomas Elsaesser addresses some of these issues:

> Surely, in these [puzzle] films (as indeed, some earlier ones as well), the most intriguing and innovative feature is this insistence on temporality as a separate dimension of consciousness and identity, the play on nonlinear sequence or inverted causality, on chance and contingency, on synchronicity and simultaneity and their effects on characters, agency, and human relations: we are in worlds that often look just like ours, but where multiple timelines coexist, where the narrative engenders its own loops or Möbius strips, where there may well be a beginning, a middle, and an end, but they certainly are not presented in that order, and thus the spectator's own meaning-making activity involves constant retroactive revision, new reality-checks, displacements, and reorganization not only of temporal sequence, but of mental space, and the presumption of a possible switch in cause and effect (21).

Elsaesser points to loop-based (or Möbius strip-based) relationships among sequences of content as an earmark of complex narratives and mind game films. This story-world is similar to our own, but just doesn't follow the same rules of when something begins,

where the middle is, or even what the ending may become. I believe these features (and complex narratives, for that matter) are not solely tied to visual representations, such as film and television. These traits are all found within *168 Hours*. What changes with this interface is the amount of agency given to the listener. Without presenting a curated (or, to draw this link a little closer to film, directed) arc or trajectory through the mapped material, the listener is forced to piece together their own adventure, and decide when their narrative will begin and end. Even within the open-ended frame of interaction with *168 Hours* (unlike film, the listener can come and go as they please, engaging with the interface for a minute, an hour, or a week—building more and more comprehensive knowledge of the mapped area piece by piece) listeners are encouraged to draw links from one excerpt to the next, constructing their own narrative Möbius strips (as per Doel, Deleuze, and Elsaesser) with indeterminate beginnings and fuzzy middles, then, to simply end it whenever they decide the story is done.

This is not to say that *168 Hours* is better or worse than a film because of its open ended-ness, but rather that attentive listeners will be able to piece together a much deeper understanding of the sound-space by approaching it with the goal of unpacking the relationships among each excerpt the same way they can think through the complete disregard to providing the audience with a rational relationship to temporality found in *Adaptation.,* or by repeating their experience with the data set over and over again as with *Groundhog Day*. The ontological frames of narrative construction found in these films provide examples of how listeners can create meaning from within the *168 Hours* interface. They can practice listening to the mapped space as though they were

experiencing a retrograde exposition while refining their ability to reach a certain

conceptual goal, drift aimlessly across the embedded temporalities, or better understand

the complexity of the whole through multiple rehearsals.

Time, like sound, requires memory. Both are constructs of, and function in the

past.[58] Duration, like listening, is the shift in attention toward the passage of time (or the

changes in a sound environment over time), and the meanings behind how we compile

an experience of not just time, but place as well, and entering into a process of

"sustaining a-chronological perusal" (Elsaesser 38) while listening through the

mapping. Of course, as we listen, we are constantly making sense of things that have

already happened, and comparing them to what is happening now. As a result, listening

is always about complex storytelling.

I would like to push this notion of puzzling through a complex narrative—or at

least a narrative presented in a chronologically complicated way—a little further by

examining the lack of an established temporality in *Adaptation*. (Jonze 2002). This film

is centred around Charlie Kaufman's (Nicholas Cage) inability to stitch together a

coherent screenplay from the novel *The Orchid Thief*, attempting to avoid all the

sensationalist trappings of conventional Hollywood films (car chases, drugs, guns) and

just tell the story. To do this, the film awkwardly jumps backward and forward in time

by relative increments of clock-time. The film starts on the set of *Being John Malkovich*

in 1998—in what we assume to be the present day (or at least the start of Kaufman's role

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[58] As I mentioned in the Introduction, Blesser and Salter remark that "In a very real sense, sound is time" (17), but moving beyond sound-specific research, it is also worth considering the work of Anne E Wilson and Michael Ross on the role of autobiographical memory in the construction of identity and the sense of self, as well as Neal W Morton et al's article detailing the cognitive mapping of relationships among memories when contextualizing new events or experiences.

in the story)—when Kaufman meets with a film executive to discuss adapting the novel into a screenplay. From there, we jump back to four Billion and forty years ago, return to the present, head back three years earlier, two years before that, to the present, then one hundred years earlier, then back to the future (or is it the present by now?). The first few temporal transitions are labeled with title screens, but as the film moves on these temporal markers or signposts are abandoned as we bounce backwards and forward through multiple temporalities, forced to make our own decisions as to *when* exactly these scenes take place.

Chris Dzialo introduces the concept of "frustrated" time in his discussion of Kaufman's screenplays, pointing to *Adaptation.* as being

> both simultaneously simple and complex as it revels in 'the impossibility of establishing a precise chronology' or 'achronicity,' as Mieke Bal terms this phenomenon (1997 p. 213). This is not an immediate impediment for the narrative meaning, however, as this temporal complexity is only fully realized after experiencing the work as a whole, and upon detailed reflection (109).

Thankfully, Dzialo's frustration has a resolution point—once the film ends, the achronological elements can be pieced together and restructured into a single, coherent timeline. Listeners using the *168 Hours* interface can choose to experience this same frustration, depending on how they approach several of my (and their) assumptions surrounding the 'normal' organization of time that are embedded in the creation of the mapping. For example, even though its volume knob is at the leftmost end (for Western audiences, this signifies a start-point), Sunday is not the beginning of the recordings. I

actually started recording midday on Wednesday, with the weekend as the midpoint, and ending the following Wednesday morning. So, from the start, *168 Hours* presents an achronicity: the week does not flow forward in the way we believe it should. The distinction between AM and PM can also be blurred, due in part to my attempts at making the clock face 'work' as an interactive surface conceptually and practically as well as the software glitch that can combine both sets of recordings depending on the order in which the two toggle buttons are pressed.

Each individual's experience of the interface will also engender other small frustrations of time, depending on how they choose to explore it. With the ability to adjust the amplitude of any given day, listeners can move freely across the recorded week, bringing multiple days into direct conversation with each other or jump from one moment (or temporality) to the next with only minimal signposts. In *Adaptation.,* the audience need only pay attention to the signposts at the beginning. As they continue to construct the narrative of their own experience, they are able to quickly jump backwards and forwards through time—effectively 'un-frustrating' time as they discover their own ability to manage multiple temporalities and make sense of the whole. Of course, within the open-ended experience of *168 Hours,* this process is troubled by the lack of a finite duration of engagement (as an interactive interface, it is up to the individual listener to decide when to start and when to stop), but we can understand the cognitive processes happening during that period of interaction as comprising the whole (or a whole) understanding of the narrative thread within the mapping. Whether that thread makes

sense during the interaction (or, as per Dzialo, only occurs upon later reflection) is up to the individual listener.

      Adaptation. provides linked achronological narrative ontologies for how listeners can either move backward in story-time (while still moving forward in clock-time within each scene), or (in what initially seems to be a haphazard manner) jump back and forth across multiple temporalities, while still considering the story to be moving forward along a continuous thread. By abandoning our preconceptions about the "arrow" of time (Dzialo 108), we are able to piece together a very complex narrative after reflecting on the structure and organization of the whole. Or, what if the experience of this interface is not about *abandoning* our sense of time and temporality, but about remembering and rehearsing? Instead of aurally perusing the mapping in Elsaesser's a-chronological mode (only to piece everything together at the end), should listening to *168 Hours* become about rehearsing our experience of sound-in-time as we play with the interface?

      While both Dzialo and Elsaesser use the term a-chronological (or a-chronicity), I am also using a-temporal in this chapter. I realize this can get confusing, as chapter one introduces aporia—yet another term for time that starts with an 'a'. However, I believe these are interrelated, yet distinct terms that each have their place in how we understand sound moving through both space and time. Aporia refers to a pause in the normal, linear flow forward of time, achronicity (or a-chronological time) is about rearranging and restructuring this linear flow, whereas a-temporality is a disruption in our overall sensation of time—as would be found in listening forward, backward, or

across several moments simultaneously while still moving forward in real time. Without a set conclusion point, *168 Hours* is necessarily about process and practice in exploring an a-temporal relationship with sound. Without an end (or a set beginning), this interface moves beyond achronicity, and towards a-temporality wherein the normal rules of time no longer apply. After all, it is possible to hear the same hour from each day of the week simultaneously. And, as an interactive interface, it is up to the listener to decide how and when they want to explore the mapping, further complicating the narrative generated by each individual listener.

It is also possible to approach the interface while thinking about practice and repetition to uncover the subtle sounds: the short, elusive gestures that may be lost in our normal, fleeting experience of sound through space. In order to work through how this style of listening affects the listener's construction of narrative understanding, I'd like to bring one more film into the conversation. *Groundhog Day* (1993) is a Harold Ramis film starring Bill Murray as the wisecracking weatherman Phil Connors who gets stuck in his own personal time loop—forced to relive the same day over and over again. Throughout the film, Connors attempts to change his world in an attempt to stop or alter this process of waking up and reliving the same day: refusing to work, seeing a psychiatrist, robbing an armoured car, stealing and then crashing a truck into a ravine, electrocuting himself, believing he is a God, taking piano lessons, falling in love with his producer (played by Andie MacDowell), and eventually having her fall in love with

him—at which point his recursive time-travelling curse is lifted, and they wake up together in what is now (finally) tomorrow.[59]

Does *Groundhog Day* provide the ideal narrative conceit for listening to *168 Hours*? What if, instead of making sense of a bunch of seemingly non-linear, random moments (as in *Adaptation.*), we learn to rehearse, relisten, and *eventually* construct a complex narrative that ties together all the details from an entire week?[60] Can listeners piece together all these short slices from the aural lives of myself, my partner, and all the other folks moving through Milton Park to finally understand the whole sound-space? Can we, like Connors, break out of the loop? If so, to what end? Due to the lack of a set narrative structure, it is impossible to achieve the same cathartic breakthrough as Connors does (realizing he needs to become a better person, and once he does, winning the heart of his producer as a reward). In contrast, the individual's narrative of *168 Hours* is framed within the space of their interaction (and attention span). However, I believe that even without a cathartic tomorrow, *Groundhog Day* sets up an important structure for listening to *168 Hours*. By giving the listener the agency to construct their own narrative, the balance of power shifts—asking them to *create* the narrative, not solve it—listeners can use this mapping to track more closely the movements of the wind, leaves, pigeons, traffic, and pedestrians, generating place attachment as they learn

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[59] It is interesting to consider that once all 36 on-screen 'loopings' of Feb 2nd have been tallied, the average screen time for each iteration of the day is just over 2 minutes—very similar to the average interaction time with the *168 Hours* interface.

[60] The potential of/for infinite recursive repetitions is what separates *Groundhog Day* from other films with a similar recursive narrative structure. I am thinking here of *Run Lola Run* (Tywker 1998) which uses a set of only three recursive inscriptions where the protagonist, Lola *seems* to learn from her experiences in previous iterations, but it is presented ambiguously—a stark contrast from the self- and temporally-aware Connors working and living through a repetition of the same day (potentially) thousands of times.

to listen to these patterns of movement over time within the mapped location. In turn, this durational audile technique can shed light on the listener's own comings and goings within their local eventscapes and living spaces.

In addition to creating a sense of narrative complexity, the looping structures within *168 Hours* can be thought of as the ideal medium through which to generate a complex series of inscriptions or folds. It is bound within the circle of a clock face—the listener's trajectories can be spirals, arcs or tangents, but they can't break the boundary of the circle. It is also limited to re-presenting a single, specific week (you can never hear the *following* Monday). There is also the same technologically-mediated, recursive inscription found in my *Acoustic Labyrinth* project: if you push the same button twice, it will start the excerpt from the beginning. As with the repeated motif of the alarm clock playing Sonny and Cher in *Groundhog Day,* each iteration of dedicated listening to a section of *168 Hours* adds meaning. Each new meaning builds on the previous one, preparing the listener for the shift from listening-in-search to listening-in-readiness. As with my other mapping interfaces, the goal is that through their practice—each fold building to a crease—the listener can develop associations with the real-world location. However, there is a catch. Unlike the mobile and dynamic ways in which my other two projects interrogate our transitions through space or the nuances of acoustic architecture, such as *Street Ears'* randomized interplay among the mapped sounds (allowing the interface to behave similarly to the real-world environment), or *Acoustic Labyrinth's* directed intention of to the single, repeated sound of church bells (a sound that is still repeating—and accessible—to this day), *168 Hours* is stuck. Just like Phil

Connors. It is a series of moments frozen in time. No matter where you might get to, you will always end up back at the start. The recursive, re-inscriptive, and loop-based nature of the interface allows listeners to explore the aural side of time, to re-listen, to compare and contrast from within the seemingly vast data set. It can do all this, but it cannot let you know what the intersection will sound like if you go there tomorrow. Of course, the goal of this project is not to send listeners down into a bottomless pit of listening to urban sounds from the past, but rather to encourage the creation of place attachment.

By rehearsing each of these hours or days, listeners can inscribe meaning onto the daily patterns and cycles heard at the corner of Parc and Milton. So, while it is impossible for the listener to wake up and experience a cathartic 'tomorrow,' I believe this work can become complete when the listener takes the information they've gleaned from repeated listening to the mapping interface and applies that knowledge into the real world. To stand at the corner of Milton and Parc, and allow these rehearsals to inform the now. Then and only then will the loop truly break and the recursivity end, pushing forward into the future.

Durational Data

In contrast to the other two projects within this dissertation, the sheer amount of data makes it impossible to perform a close analysis of every sound event contained within the map. However, they can be organized into four larger categories: Traffic, Pedestrians, Apartment Sounds, and Weather. Not surprisingly, the two most dominant sounds throughout the mapping are weather and traffic. While these two categories of

sound are often considered to be unwanted noise from a conventional field recording perspective, listening to these two types of sound through the *168 Hours* interface changes this value-based judgement. Due to the ability to hear larger cycles and possible patterns through a durational listening practice, these sounds gain value. The tone and timbre of the cars moving up and down Parc Avenue varies within cycles of daily rush-hours when it is more rapidly punctuated by the deeper, almost guttural roar of the STM busses, before dying down and making way for foot traffic as McGill students flock to and from class.

The sounds of weather also tell a fascinating story when listened to over the course of a week. In addition to the daily cycles of wind gusts moving around the seventh-story window as the air above the nearby mountain heats and cools, these sounds shape the listener's understanding of both time and space. For example, this audio was recorded in Mid-October—a somewhat 'changeable' season in Montreal—and the movements of the Autumn leaves can evoke particularly strong associations to the listener's previous experiences. Moving beyond wind and leaves, there was also a long rainshower that week which allowed the cars to perform a wonderful swishing sweep as they drove past (a nice counterpoint to their usual gritty texture), and a sudden hail storm on Tuesday afternoon which turned the windows, neighbouring buildings, and streets into a massive percussion studio.

In listening to all four of these sound categories, it is clear that there are a number of different acoustic horizons at play within *168 Hours*. The traffic and weather sounds feature actors beyond the individual (or even human) scale, with very loud

sounds that can drown out some of the more subtle, textural sounds happening at the human or animal level. Once attention is given to these smaller, quieter sounds, the pedestrian and apartment sound categories provide an interesting insight into both the daily lives of neighbourhood residents and my own personal habits and movements (as well as those of my partner and our friends).

As I will discuss later in this chapter, the pedestrian sounds uncover a number of interesting themes and routines: the rush of students heading toward (or back from) McGill punctuate the day based on their class schedules, the group of jobless individuals hanging out in the abandoned parking lot directly below the window move with the sun, and those walking to and from office jobs add to the bustle just before nine in the morning and after five in the evening. In addition to the interplay between these seemingly disparate groups of people, there are a number of other groups moving through the intersection: the students reappear in a very different role on Friday and Saturday night as they head away from McGill and toward the nightclubs on St Laurent, marking the end of a work week and, several hours later, closing time at the bar. Not surprisingly, their return home at the end of the night is quite a bit easier to pick out. There are also those whose footsteps are lost or unheard— individuals moving at their own pace, inscribing their own line. Theirs may be a single fold, not a well-worn crease. Of course, there are non-human actors as well—while they may not necessarily be pedestrians, the movements and patterns of the local pigeon population can be uncovered while listening through *168 Hours*.

My own patterns are heard in the apartment sounds category: laughter and conversation from a gathering of friends leaks through from the living room, there are sleep murmurs from myself and my partner, and snippets of conversations pepper the week's recordings. There are long stretches of inactivity as well: while we are sleeping, away at class, or working. Occasionally you can hear the TV from the other room, but as we were both aware of the microphone's presence, and the recording project, we tended to close the door to the bedroom more often than we would normally. I don't feel that this level of performance alters the listener's experience. After all, the goal of this interface is not to catalogue the sounds of our daily lives, but rather the movements and patterns from the street below. Overall, I applied a more subjective approach to content selection than with the previous mappings, omitting what I thought were private sounds or moments both within the apartment and outside (despite my initial, more objective impulse to simply use the first five minutes of each hour). Granted, the overheard conversations from strangers walking below the window don't lend themselves to the same direct association with, say, a personal phone call, or discussing our plans for the day, but I tried to be even handed, and lean toward indistinct conversations—highlighting the atmosphere, not the content—for both indoor and outdoor sounds.

These categories: Weather, Traffic, Pedestrians, and Apartment Sounds all work together to create a series of acoustic arenas, continuously evolving over time. As dedicated listeners spend time with the interface, it is possible to discern patterns of movement: the increased amplitude and altered pitch of rush hour traffic, the daily

migration of the jobless people in the parking lot below, or the two—very

different—trajectories of McGill students as they either head to class, or the bar. These

aurally accessible patterns of movement uncover an additional layer of meaning when

they are considered within the political economies of time. Sarah Sharma examines this

concept in her book *In the Meantime: Temporality and Cultural Politics*. She identifies

a number of temporal itineraries that constitute social spaces while working through

the entangled nature of time and the economies that support these entanglements.

However, *168 Hours* is not as much about the economic structures of time, but about

the shared experience of space in time, and the multitude of places that develop in the

same location over an extended duration. In her conclusion, Sharma introduces the

concept of "temporal publics," writing:

> While publics are almost solely understood as spatial constructs, they are also
>
> temporal. That publics have power-chronographies necessitates a balanced
>
> conception of public space-time. To recognize the power chronography of it all is
>
> to acknowledge that time is a structuring relation of power, exercised over the self
>
> and others. […] More often than not, the sharing of space and a moment in time
>
> with another is part of a synchronic relation of power (146).

While Sharma takes a fairly straightforward ethnographic approach to discuss the

different paces and schedules found in the many layers of contemporary society, the *168*

Hours interface makes the concept of temporal publics audible: we can hear who can

afford to carouse on the weekend, who is sitting in the parking lot below, how many

people are driving at 6AM on their way to an early shift, or when there are more delivery

drivers making their rounds—and, what is more, we can hear how these publics have the power to take control of this particular place at particular times, and where there may be tensions or transitions from one public's appropriation of the space-time to the next, and where multiple publics appear to occupy the same place simultaneously.

We don't hear the bar-going revellers alongside the unemployed people in the parking lot, but having their days free means we can hear the folks camped out in the parking lot interspersed with the deep rumble and backing-up beeps of the delivery trucks, enjoying the sunshine and conversation until the end-of-day rush picks up and they move on to their next location. For the bar-going crowd, their occupation of this place is transitory, moving in packs along the sidewalks, intercut with long, steady swishes of taxis or personal vehicles moving quickly and efficiently up the road, unencumbered by daytime traffic.

Even a Broken Clock is Right Twice a Day

Basing the interface around a clock seemed to be the most obvious decision for a piece exploring temporality and duration. As I mentioned in the introduction, there are a number of assumptions surrounding the passage of time that are ingrained within a clock-face. Early timekeeping devices have always used some form of durational notation (candles, hourglasses, water clocks) to segment and understand the passage of time, but the mechanical clock was the first to clearly demarcate the integrated and continuous segments within the duration being measured. Unlike a candle (which shows how much time is left) or an hourglass (which needs to be flipped before the next

duration can be measured), the contemporary clock face is a continuous, sweeping circle that re-inscribes meaning over top of the previous minute (and the previous time the hands were arranged in this way). I used the assumptions we have surrounding how a clock works in the hope that it leads to a limited learning curve when first using the interface. While analog clocks are slowly fading away, enough people are familiar with them that there is no need to teach the user that the central, rightmost button corresponds to 3PM (or 3AM, for that matter). As discussed above, the freedom to move freely across time and the clock-face without the necessity of the real-world, minute-to-minute passage of time can allow the listener to easily create unique, complex narratives surrounding the mapped location. This ability to 'hack' or remix the functionality of a clock—effectively playing with time—asks the listener to call into question their normal relationship with time and temporality. This troubling of time is further reinforced by the placement of a working clock mechanism at the heart of the interface.

The juxtaposition of re-presented, mapped time with the ongoing passage of real-world, clock-time helps to resolve some of the issues surrounding the duration of a singular listening session, or narrative creation (even if it is a-temporal, a-chronological, folded, or just plain puzzling), by allowing the listener to note the duration of their own experience with the interface, placing them within multiple temporalities: the now, and whatever *then* they might be listening to. Due to its size, the clock's movement is not easily perceptible from minute-to-minute, effectively obscuring the immediate passage of time and encouraging longer interactions. This inability to precisely segment time also resonates with my choice to excerpt each hour into five-minute slices (which is

about as precise as the clock hands). This blending of temporalities meshes with my

earlier analysis of complex narrative structures in puzzle or mind-game films. There is

always the 'now' of the film's viewer projected atop the duration of the film, combined

with all the previous 'nows' corresponding to other films (or earlier experiences of

watching the same film).[61] This somewhat troublesome notation of 'now' may pull some

listeners out of their experience with *168 Hours*, but I believe it reinforces our sense of

the durationality of the interface, and of how our understanding of place requires

listening *through* time, as well as space.

Durational Listening

As we learn to listen *through* time, we begin to create folds and creases between

space, place, locations, and publics using sound. The sound environment can tell us a

great deal about who is using or moving through space, as well as how and why. Taking

a durational approach to listening allows us to hear who is using place—showing how

and why various temporal publics are formed. Of course this process is not easy. We

need to consider the process of listening through time the same way we think about

unpacking a complex narrative, piecing together the puzzle of a long and complicated

story with backgrounds we'll never know, and futures we can only guess at.

If we return to thinking of *168 Hours* as a time machine (albeit a pretty limited

one, because it only goes backwards to the same location, and the same

time/temporality), this interface creates a unique opportunity to begin building a puzzle

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[61] For the past ten years, I have tried to watch *Groundhog Day* on repeat as many times as possible each February 2nd. As Connors' day loops, so does my own as the film ends only to restart again and again.

from some of these narrative pieces. It is possible to reconstruct a week in my life by listening carefully for the sounds of my apartment, or to unpack the use of the intersection below to think through political economies of time, using this map as the source material to extend Sharma's ethnographic approach. It is also possible to create a completely fictitious narrative, focussing on the sharp click of a particular pair of heels, or the rumble of a truck and imagine what other creases and folds have brought that particular individual to that particular location, and where they may be going. To listen through time is to construct an understanding of the ebbs and flows of a particular place, to begin to know how and why it works the way it does. *168 Hours* is mapping not just a place, but the *experience* of place. This experience is shared through time—with a durational listening approach to using the interface serving as the source for inscriptions, folds, and creases. By developing durational listening as a dedicated audile technique, listeners can begin to piece together not only the narrative pieces discussed above, but also deepen their understanding of sound's role in the environment. This durational listening approach is easily applied to longer soundwalks, and can help identify key sounds within the area and acoustic patterns that help shape our associations with place, beyond the 'official' representation.

Conclusion

> "It is not down on any map; true places never are."
> - Herman Melville, *Moby Dick*

A dissertation, like a map, is a processual document and a conduit for further exploration. It is constantly in the process of becoming, much like our experience of place. Throughout this document I have discussed the ways in which we can use sound-mapping interfaces to generate a new audile technique for listening to the sounds of the city, and how these techniques can uncover additional layers of meaning, power structures, and issues of mobility, access and accessibility. The processual nature of generating sound-based mappings has allowed me to use a research-as-creation framework to uncover how I believe a city represents itself through sound, and point to the ways in which this approach to the urban sound environment has ongoing impact on our understanding of sound as a form of intangible culture.

Throughout the writing of my dissertation, there has been a question on my mind above and beyond the research questions I laid out in the introduction surrounding re-presenting the aural aspects of lived experience and developing new listening practices. I keep asking myself: what stories do maps tell? And, more specifically, what stories do my maps tell? All maps tell a story, but that story may not be the one intended by those making the map.

One of the most interesting parts about looking at maps through a post-modern or deconstructivist framework—or, simply put, using maps with a critical eye—is the ability to look at ALL the stories they tell, not just the one intended by the cartographer.

With this framework it is possible to move beyond the objective, birds-eye point-of-view and strategic modes of plotting relationships among boundaries and objects (or spaces), and examine how the stories shift when there are breaks or tears in the map. These are not necessarily literal (although there are some interesting maps where the cartographer attempted to include areas that extend outside of the conventions of the map's borders or edges with interesting effects), but rather to examine how things change when we move beyond a reductive understanding of the relationship among objects in space to examine the things included or excluded, as well as when and why the map was made. A single map tries to tell a single (though sometimes complex) story: Here is this space as it exists now. It is roughly this big, with this many subdivisions, and this space exists in relationship to other spaces in roughly this proportion or arrangement. However, once more maps enter into the conversation, other narratives unfold, intertwine, and even collapse.

As an example of how maps can be re-read with a critical eye to tell alternative stories, I'd like to talk about one map in particular. In January of 2018 I had the opportunity to do some research in the British Library, and the earliest map of Montreal I found in their collection is from a second hand telling of Cartier's 1535 voyage to New France—conveniently contained in a larger volume published in 1604 that also recounts Columbus' travels to the New World, the colonization of Peru, and lists of all the animals found in India (see Appendix D-1 for a photograph). The map documents Hochelaga's encampment next to the somewhat ambiguously located "Monte Real" (perhaps an Italian distortion of the French Mont Royal that has forever changed out city's name).

The encampment is made up of a series of geometrically-arranged campsites inside a circle of tall wooden walls. The lack of (what I assumed to be the two) obvious landmarks—the mountain and the river— seems a bit disconcerting at first, but then again, the cartographer wasn't worried about locating the camp within the geographical space (that type of thinking came a bit later) he (and yes, I think it is fair to assume the cartographer was a 'he' even tho there is no name on the map) was interested in depicting the organization of daily life in a foreign land so he and his fellow voyagers could show their kings or patrons exactly what they were paying for. Almost the cartographic equivalent of a tourist's snapshot. What makes this map-as-snapshot particularly interesting are the other elements in the frame. Not just the details of how the encampment was organized: such as 3 tents/campsites to a communal fire pit/cooking area, the fact that Hochelaga's site was in a place of privilege—far from the entrance gates without being too close to any other outer walls, and surrounded by other campsites, but it's the other details: the 'photo-bombs' in this map-as-snapshot that start to tell these accidental stories.

The centre of the page is taken up with a pictorial representation of the encampment. The front and rear sections of the curved walls are shown in perspective with the circular layout of the campsites and other buildings in the campsite laid out in a bird's-eye view nestled in between these two sections. The tops of the walls (both front and back) are covered with men hurling large stones over the lip of the walls. Seemingly a form of self defense for the new 'owners' of the land. The gate to the entranceway is

bordered by a large fire. Combined with all the rocks raining down, this fire seems less of a beacon for the weary traveler, and a bit more of a defensive tactic.

In the bottom left of the map there is a group of well-dressed Europeans fully decked out in poofy pants and fancy hats, shaking hands and presumably marking the occasion of Cartier's visit to check in on Hochelaga. In contrast (and following what seem to be fairly strict rules of segregation), the bottom right contains all the indigenous peoples. They are all very calm (in contrast to the perceived danger that necessitates a barrage of stones), just standing around looking both toward and away from the encampment. The biggest difference in the framing of these two groups of people is in their garb. While all the Europeans are fully clothed in the appropriate style of the time, all the indigenous people are only clad from the waist down. They are all rather plump and smiling—and appear to be only women or children. In contrast, all the Europeans depicted are men. So who is telling this story? To whom, and why?

Moving past the fairly obvious Colonialist racism, my favorite photo-bombs in this map-snapshot are on the left hand side—the bulk of the right-hand side of the map is taken up with an alphabetical key denoting locations within the walled encampment. The left side, in contrast, is where we can see more of this map's work as a snapshot of daily life—presumably in an attempt to show the folks back home just how great this Monte Real back in New France really is (for a frame of reference, this volume was part of King George III's personal library), and potentially lure more visitors and/or immigrants (after all, look at all those curvy, semi-nude women—still part of Montreal's tourist draw). Moving down from the middle of the left hand side of the map, we see

"Monte Real" proudly emblazoned among some abstract geological features: fields, trees, a few fences, and some other indistinct hill-like features—there's lots of space to carve out your own slice of New France. Scattered throughout these features are a stag, a ram, and two bears. Just like land, game is abundant—a sportsman's paradise. Or so it seems at first glance. If there's a lot of game, why aren't there any birds or rabbits? And wait, TWO bears!? This snapshot has once again told us a little more than we initially assumed. It seems our intrepid explorers have encroached on several different populations. That, or their approaches to dealing with food scraps and other camp waste may have attracted the attention of some unwanted and rather curious visitors (all the more reason for the stones, I suppose). Yet another aspect of 16th Century Colonial life.

Just below this survey of wildlife, are two (or perhaps better said as four) figures. Two men in poofy pants and fancy hats are riding on the backs on two other figures—no poofy pants from them, however. This awkward-looking foursome are headed away from the encampment and toward the lower-left boundary of the map. This may actually be one of the first maps depicting public transit—perhaps an off-side quip—but an interesting thought nonetheless. Early nautical maps show boats (the primary means of transportation across the mapped surface), but boats are expensive, owned by large corporations or crowns, and require a skilled captain and navigator. Instead, this map shows two men using their class and power (members of an elite public, but a public nonetheless) about to go on a bit of an adventure in the wilderness. Not cut out for all the walking in New France? Don't worry, we've got transit options. How's that for an accidental story?

What stories (accidental or otherwise) do *my* mappings tell? As I have discussed earlier, once we start listening to these mappings, we can start to hear how issues of power geometries and the political economies of time become apparent when listening durationally to a single location, how navigating one space in order to listen to another highlights many of our expectations surrounding how we use geolocative devices (inverting assumptions surrounding both how we use mobile technology to access maps and 'soundtrack' our experience of the city), and how the listening to the acoustics of a particular place can generate new insight into the layers of history that are (literally) built into, and onto, the city.

As I listen to these mappings, I hear a very different story than anyone else. I hear my old apartment. My old job. I even hear my friends in the recordings they helped to make in the Old Port, or over at our place for a few beers. I can listen to the streets I used to walk along every day or the bus I used to wait for—then switch to my new apartment, and hear the birds on the banks of the St Lawrence or the slushy crunch of people out enjoying the beginning of Spring back in 2016. There is a specificity to my stories that exist only on the periphery for other listeners. However, each time I explore these mappings I also hear how these places have changed since I started the process of creating them. They re-present previous interactions among space, time, and sound, creating an archive of the aural experience of Montreal. Other listeners can use this archive in the same way: exploring the mappings and using that knowledge to generate a deeper appreciation for the dynamic nature of the aural environment of the city, and to

better understand how sound shapes who we are, and how we make sense of the places we occupy and move through.

These mappings are necessarily dynamic: the content within each interface can easily be modified, adding new layers of data for further analysis. The goal here is to subvert the assumptions surrounding the fixed nature and authoritative power of maps, and allow them to continue to reflect the processual nature of listening to the city. It is possible to include other people's jobs, apartments, or neighbourhoods and use that data to tease out some of their inscriptions or tactics and the power geometries that are at play in the places they move through. Most importantly, my mapping interfaces serve to draw attention to the phenomenological qualities of the urban sound environment, and refine new audile techniques that allow other future listeners to continue understanding how place is created *through* sound.

Throughout my dissertation I have referred to a new audile technique required to listen to sound in the urban environment, particularly one that doesn't create a value-based judgement system for or against certain sounds (as with Schafer's aversion to the the drones of airplanes or rumble of traffic). However, I have not yet provided a definitive example of this type of technique: one that treats all sounds equally within the eventscape, and allows their interrelationship to define our understanding of place. The development of this technique is part of the ongoing work that these three interfaces perform alongside this document, and requires dedicated attention to experiencing each mapping. Because dedicated listening is an individual, learned act, each listener will have to develop this technique for themselves. However, I believe this dissertation

serves as a template or guidebook for this new audile technique. Each interface I have constructed focuses attention on one particular aspect of this new technique. The *Acoustic Labyrinth* directs attention to how the physical environment shapes an individual sound event, by listening to the ways in which these bells reflect off the architecture of the square and surrounding streets. This technique can be expanded by applying Truax's listening-in-search in order to trace the source of a sound event, or generate an aural 'image' of the physical properties of a location. The fluid and dynamic mode of navigating through *Street Ears* highlights a mode of mobile, exploratory listening. By pointing to the tensions that occur in the transition points among sonotones (a portion of the eventscape, combining multiple sound fields) listeners are able to assign meaning to each sound event (and better understand each as an active part of the sonic eventscape), using their memories of these transitions to shape a relationship with each sound, shifting them from sound event to keynote sound to soundmark. The third aspect of this new audile technique is a durational approach to listening. *168 Hours* documents the subtle changes that occur within a single location over an extended period of time. In addition to the ability to rehearse and relisten over time, this interface strengthens the modes of listening found in the *Acoustic Labyrinth* and *Street Ears*, allowing listeners to develop a fluid understanding of how sound is shaped by the physical environment, and works within it to generate place.

I have drawn a number of links between contemporary art, locative media, film, and my mapping interfaces in order to tease out some of the ways in which we listen to the urban sound environment, and create inscribed narratives of place. Each project

brings out a unique perspective on urban listening and the sociality of such. While at times my arguments on the creation of place may seem overly personal or oriented toward the individual listener, I do believe listening is a communal experience—we just don't experience everything in the same way. However, we can learn to listen in similar ways, developing audile techniques through practice and repetition.

Heimbecker's idea of being able to listen in a way beyond the realm of normal human experience in *The Acoustic Line as the Crow Flies* serves as the inspiration for the *Acoustic Labyrinth* project, allowing the listener to instantaneously transport themselves through aural space. It also enables listeners to revisit the same moment in time from different perspectives, and affords the opportunity to compare and contrast the peal of the Basilica Notre Dame bells—something that is normally ephemeral, transitory, and quite simply impossible to do physically. *Street Ears* does something similar—it allows you to listen to two places at once. While this in and of itself is not particularly novel, the ways in which it uses our assumptions surrounding mobile listening practices (normally we use a mobile listening device to mask the sounds of the city) and geolocative augmented reality apps is new. *Street Ears* extends the work being done by Cardiff in her *Audio Walks* and *The City of Forking Paths* to create an experience of augmented aurality. *Street Ears* maintains the internal links between the re-presented sound/place, but applying it anywhere in the world. Taking a slightly different tactic, my chapter on *168 Hours* looked at how we can apply our ability to piece together non-linear narratives in puzzle films to the aural environment, not just listening through space, but through time as well. Rehearsing our experience of a place

time and time again like *Groundhog Day's* Phil Connors in order to understand how all the dynamic, interrelated layers of meaning (be it an Montreal intersection or a small Pennsylvania town) work together to create the whole.[62]

By bringing our stories of the sonic eventscape into conversation with the ways we share our experience of film, contemporary art, and geolocative augmented reality, the status of the aural environment as a part of cultural identity (although intangible, ephemeral, and transitory) is affirmed. Sound shapes our notions of self, and how we perceive space and place. As I have shown throughout this dissertation, by generating new forms of sound-based mappings, we can engage with the sound in the urban environment in new ways—moving away from the pinpoint accuracy and perceived authority of the point-click-listen ontology of Google maps API to use the process-oriented nature of mappings as a conduit for experience, by not just telling stories of the past or present, but shaping the stories we'll tell in the future as well.

I started this dissertation by talking about the official sound of the city, and how certain aspects of our shared experience of the city have been crystallized into parts of our cultural identity: the songs of Leonard Cohen, the vibrant outdoor festival circuit, and even the Formula One race cars. As our city moves on after spending an entire year celebrating its 375th anniversary, the buzz surrounding Montreal's cultural production may have died down, but the everyday sounds of the city continue. These are the sounds

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[62] This comparison to narrative strategies from film and television can be extended further. The recursive (or folded) temporality (with subtle changes to the individual's experience of a limited narrative in each iteration) exhibited in the *Acoustic Labyrinth* is very similar to the three cycles of action in Tom Tykwer's *Run Lola Run*. Additionally, the ability to occupy multiple locations simultaneously (and interact with/navigate through both) I described in using the *Street Ears* app has parallels to the Netflix original series *Sense8,* where a group of individuals can astrally project themselves around the globe, occasionally occupying one another's realities.

that actually make up Montreal in all its interrelated complexity. I have built three

mappings that trouble through some of the dynamic interconnections among place,

time, and sound, but this work is far from complete. The sound environment is

constantly changing. My mappings are a benchmark, an archive of these times and

places, but there is always more to listen to.

These maps share *my* sounds of Montreal. What are yours?

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Appendix A: *Old Montreal's Acoustic Labyrinth* Source Code and Documentation

1 - Arduino Code: Installed on Arduino Uno

```
#include <FatReader.h>
#include <SdReader.h>
#include <avr/pgmspace.h>
#include "WaveUtil.h"
#include "WaveHC.h"

SdReader card;    // This object holds the information for the card
FatVolume vol;    // This holds the information for the partition on the card
FatReader root;   // This holds the information for the filesystem on the card
FatReader f;      // This holds the information for the file we're play

WaveHC wave;      // This is the only wave (audio) object, since we will only play one at a
time

#define DEBOUNCE 5  // button debouncer

// here is where we define the buttons that we'll use. button "1" is the first, button "6" is
the 6th, etc
byte buttons[] = {14, 15, 16, 17, 18, 19};
// This handy macro lets us determine how big the array up above is, by checking the
size
#define NUMBUTTONS sizeof(buttons)
// we will track if a button is just pressed, just released, or 'pressed' (the current state
volatile byte pressed[NUMBUTTONS], justpressed[NUMBUTTONS],
justreleased[NUMBUTTONS];

// this handy function will return the number of bytes currently free in RAM, great for
debugging!
int freeRam(void)
{
  extern int __bss_end;
  extern int *__brkval;
  int free_memory;
  if((int)__brkval == 0) {
    free_memory = ((int)&free_memory) - ((int)&__bss_end);
  }
  else {
    free_memory = ((int)&free_memory) - ((int)__brkval);
  }
  return free_memory;
}
```

```
void sdErrorCheck(void)
{
  if (!card.errorCode()) return;
  putstring("\n\rSD I/O error: ");
  Serial.print(card.errorCode(), HEX);
  putstring(", ");
  Serial.println(card.errorData(), HEX);
  while(1);
}

void setup() {
  byte i;

  // set up serial port
  Serial.begin(9600);
  putstring_nl("WaveHC with ");
  Serial.print(NUMBUTTONS, DEC);
  putstring_nl("buttons");

  putstring("Free RAM: ");      // This can help with debugging, running out of RAM is
bad
  Serial.println(freeRam());     // if this is under 150 bytes it may spell trouble!

  // Set the output pins for the DAC control. This pins are defined in the library
  pinMode(2, OUTPUT);
  pinMode(3, OUTPUT);
  pinMode(4, OUTPUT);
  pinMode(5, OUTPUT);

  // pin13 LED
  pinMode(13, OUTPUT);

  // Make input & enable pull-up resistors on switch pins
  for (i=0; i< NUMBUTTONS; i++) {
    pinMode(buttons[i], INPUT);
    digitalWrite(buttons[i], HIGH);
  }

  //  if (!card.init(true)) { //play with 4 MHz spi if 8MHz isn't working for you
  if (!card.init()) {        //play with 8 MHz spi (default faster!)
    putstring_nl("Card init. failed!");  // Something went wrong, lets print out why
    sdErrorCheck();
    while(1);                        // then 'halt' - do nothing!
  }
```

```
  // enable optimize read - some cards may timeout. Disable if you're having problems
  card.partialBlockRead(true);

// Now we will look for a FAT partition!
  uint8_t part;
  for (part = 0; part < 5; part++) {    // we have up to 5 slots to look in
    if (vol.init(card, part))
      break;                    // we found one, lets bail
  }
  if (part == 5) {              // if we ended up not finding one  :(
    putstring_nl("No valid FAT partition!");
    sdErrorCheck();     // Something went wrong, lets print out why
    while(1);                   // then 'halt' - do nothing!
  }

  // Lets tell the user about what we found
  putstring("Using partition ");
  Serial.print(part, DEC);
  putstring(", type is FAT");
  Serial.println(vol.fatType(),DEC);    // FAT16 or FAT32?

  // Try to open the root directory
  if (!root.openRoot(vol)) {
    putstring_nl("Can't open root dir!"); // Something went wrong,
    while(1);                   // then 'halt' - do nothing!
  }

  // Whew! We got past the tough parts.
  putstring_nl("Ready!");

  TCCR2A = 0;
  TCCR2B = 1<<CS22 | 1<<CS21 | 1<<CS20;

  //Timer2 Overflow Interrupt Enable
  TIMSK2 |= 1<<TOIE2;

}

SIGNAL(TIMER2_OVF_vect) {
  check_switches();
}

void check_switches()
{
```

```
    static byte previousstate[NUMBUTTONS];
    static byte currentstate[NUMBUTTONS];
    byte index;

    for (index = 0; index < NUMBUTTONS; index++) {
      currentstate[index] = digitalRead(buttons[index]);   // read the button

      /*
      Serial.print(index, DEC);
      Serial.print(": cstate=");
      Serial.print(currentstate[index], DEC);
      Serial.print(", pstate=");
      Serial.print(previousstate[index], DEC);
      Serial.print(", press=");
      */

      if (currentstate[index] == previousstate[index]) {
        if ((pressed[index] == LOW) && (currentstate[index] == LOW)) {
          // just pressed
          justpressed[index] = 1;
        }
        else if ((pressed[index] == HIGH) && (currentstate[index] == HIGH)) {
          // just released
          justreleased[index] = 1;
        }
        pressed[index] = !currentstate[index];  // remember, digital HIGH means NOT
pressed
      }
      //Serial.println(pressed[index], DEC);
      previousstate[index] = currentstate[index];   // keep a running tally of the buttons
    }
}

void loop() {
  byte i;

  if (justpressed[0]) {
    justpressed[0] = 0;
    playfile("1.WAV");
  }
  else if (justpressed[1]) {
    justpressed[1] = 0;
    playfile("2.WAV");
  }
  else if (justpressed[2]) {
```

```
      justpressed[2] = 0;
      playfile("3.WAV");
    }
    else if (justpressed[3]) {
      justpressed[3] = 0;
      playfile("4.WAV");
    }
    else if (justpressed[4]) {
      justpressed[4] = 0;
      playfile("5.WAV");
    }
    else if (justpressed[5]) {
      justpressed[5] = 0;
      playfile("6.WAV");
    }
}

// Plays a full file from beginning to end with no pause.
void playcomplete(char *name) {
  // call our helper to find and play this name
  playfile(name);
  while (wave.isplaying) {
  // do nothing while its playing
  }
  // now its done playing
}

void playfile(char *name) {
  // see if the wave object is currently doing something
  if (wave.isplaying) {// already playing something, so stop it!
    wave.stop(); // stop it
  }
  // look in the root directory and open the file
  if (!f.open(root, name)) {
    putstring("Couldn't open file "); Serial.print(name); return;
  }
  // OK read the file and turn it into a wave object
  if (!wave.create(f)) {
    putstring_nl("Not a valid WAV"); return;
  }

  // ok time to play! start playback
  wave.play();
}
```

2 - Images:

Old Montreal's Acoustic Labyrinth mapping interface (Photo: Elise Windsor)

Recording the Source Audio (Pictured L-R: Margaret Thompson, Eric Powell, Casey McCormick, Nigel Taylor, Matt Griffin, Tony Massil. Photo: Pablo Alvarez)

A map of the area showing numbered Recording Locations.

(Map courtesy of http://www.vieux.montreal.qc.ca/eng/localia.htm)

Installed at the VECTOR Festival, 2014. (Photo: Skot Deeming)

---

3 - Exhibition Record

- Communications Studies Department "Doing Research-Creation" Event, Concordia University. Montreal, QC (Nov 2013).

- *VECTOR Festival* "Net.Works 2.0: Emergence + Experimentation," Toronto, ON (Feb 2014).

- "Urban Soundscapes and Critical Citizenship" Conference, University of Limerick. Limerick, Ireland (March 2014),

- Communications Studies Department "50th Anniversary Research-Creation Showcase," Concordia University. Montreal, QC (Sept 2015)

- *Performigrations* "Mobile Interventions YUL" Installation, Montreal, QC. (April 2015).

Appendix B: *Street Ears* Source Code and Documentation

1 - Android Code:

```xml
<!-- MANIFEST -->

<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
  package="com.electricityismagic.www.simpleaudio">

  <uses-permission
android:name="android.permission.ACCESS_COARSE_LOCATION" />
  <uses-permission
android:name="android.permission.ACCESS_FINE_LOCATION" />

  <application
    android:allowBackup="true"
    android:icon="@mipmap/eim_launcher"
    android:label="@string/app_name"
    android:supportsRtl="true"
    android:theme="@style/AppTheme">
    <activity
      android:name=".MainActivity"
      android:label="Street Ears"
      android:screenOrientation="portrait"
      android:theme="@style/AppTheme.NoActionBar">
      <intent-filter>
        <action android:name="android.intent.action.MAIN" />

        <category android:name="android.intent.category.LAUNCHER" />
      </intent-filter>
    </activity>
    <!--
        ATTENTION: This was auto-generated to add Google Play services to
your project for
        App Indexing.  See https://g.co/AppIndexing/AndroidStudio for
more information.
    -->
```

```xml
    <meta-data
        android:name="com.google.android.gms.version"
        android:value="@integer/google_play_services_version" />
    <!--
        The API key for Google Maps-based APIs is defined as a string resource.
        (See the file "res/values/google_maps_api.xml").
        Note that the API key is linked to the encryption key used to sign the APK.
        You need a different API key for each encryption key, including the release key that is used to
        sign the APK for publishing.
        You can define the keys for the debug and release targets in src/debug/ and src/release/.
    -->
    <meta-data
        android:name="com.google.android.geo.API_KEY"
        android:value="@string/google_maps_key" />

    <activity
        android:name=".MapsActivity"
        android:label="@string/title_activity_maps"
        android:screenOrientation="portrait"
        android:theme="@style/AppTheme.NoActionBar" />
    <activity
        android:name=".VerdunMapActivity"
        android:label="@string/title_activity_verdun_map"
        android:screenOrientation="portrait"
        android:theme="@style/AppTheme.NoActionBar" />
    <activity
        android:name=".DubaiMapActivity"
        android:label="@string/title_activity_dubai_map"
        android:screenOrientation="portrait"
        android:theme="@style/AppTheme.NoActionBar" />
  </application>

</manifest>

<!-- LAYOUT -->
```

```xml
<?xml version="1.0" encoding="utf-8"?>

<RelativeLayout
xmlns:android="http://schemas.android.com/apk/res/android"
  xmlns:app="http://schemas.android.com/apk/res-auto"
  xmlns:tools="http://schemas.android.com/tools"
  android:layout_width="match_parent"
  android:layout_height="match_parent"
  android:paddingBottom="@dimen/activity_vertical_margin"
  android:paddingLeft="@dimen/activity_horizontal_margin"
  android:paddingRight="@dimen/activity_horizontal_margin"
  android:paddingTop="@dimen/activity_vertical_margin"
  app:layout_behavior="@string/appbar_scrolling_view_behavior"
  tools:context="com.electricityismagic.www.simpleaudio.MainActivity"
  tools:showIn="@layout/activity_main"
  android:background="#FFFFFF">

  <Button
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="Montreal"
    android:id="@+id/lowerplateaubutton"
    android:layout_centerVertical="true"
    android:layout_alignRight="@+id/eimLogo"
    android:layout_alignEnd="@+id/eimLogo" />

  <Button
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="Dubai"
    android:id="@+id/dubaibutton"
    android:layout_above="@+id/eimLogo"
    android:layout_centerHorizontal="true" />

  <Button
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:text="Verdun"
```

```xml
        android:id="@+id/verdunbutton"
        android:layout_alignTop="@+id/lowerplateaubutton"
        android:layout_alignParentLeft="true"
        android:layout_alignParentStart="true" />

    <TextView
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:textAppearance="?android:attr/textAppearanceLarge"
        android:text="Street Ears"
        android:id="@+id/hearingBlindTitle"
        android:layout_alignParentTop="true"
        android:layout_alignParentLeft="true"
        android:layout_alignParentStart="true"
        android:layout_alignParentRight="true"
        android:layout_alignParentEnd="true"
        android:textAlignment="center"
        android:textSize="48dp"
        android:typeface="serif" />

    <TextView
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:text="&quot;Hearing Blind&quot; is a project by Eric Powell
and Matthew Griffin. To begin, select from one of the location below. This
will bring you to a map."
        android:id="@+id/descriptionText"
        android:layout_below="@+id/hearingBlindTitle"
        android:layout_alignParentLeft="true"
        android:layout_alignParentStart="true"
        android:layout_alignRight="@+id/hearingBlindTitle"
        android:layout_alignEnd="@+id/hearingBlindTitle"
        android:typeface="serif"
        android:textSize="14dp" />

    <ImageView
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:id="@+id/eimLogo"
```

```xml
        android:src="@drawable/eimbars_lrg"
        android:layout_alignParentLeft="true"
        android:layout_alignParentStart="true"
        android:layout_below="@+id/lowerplateaubutton"
        android:layout_alignRight="@+id/descriptionText"
        android:layout_alignEnd="@+id/descriptionText"
        android:layout_alignParentBottom="true" />

</RelativeLayout>

<!-- SETUP -->
```

```java
package com.electricityismagic.www.simpleaudio;

import com.google.android.gms.maps.*;
import com.google.android.gms.maps.model.*;
import android.location.Location;
import android.net.Uri;
import android.os.Bundle;
import android.support.design.widget.FloatingActionButton;
import android.support.design.widget.Snackbar;
import android.support.v7.app.AppCompatActivity;
import android.support.v7.widget.Toolbar;
import android.view.View;
import android.view.Menu;
import android.view.MenuItem;
import android.media.MediaPlayer;
import android.widget.TextView;
import android.widget.Button;
import android.view.View.OnClickListener;
import java.lang.Math;
import android.content.Intent;

import com.google.android.gms.appindexing.Action;
import com.google.android.gms.appindexing.AppIndex;
import com.google.android.gms.common.ConnectionResult;
import com.google.android.gms.common.api.GoogleApiClient;
import com.google.android.gms.location.LocationRequest;
import com.google.android.gms.location.LocationServices;
```

```java
import com.google.android.gms.location.LocationListener;
import com.google.android.gms.common.api.GoogleApiClient.ConnectionCallbacks;
import
com.google.android.gms.common.api.GoogleApiClient.OnConnectionFailedListener;
import com.vstechlab.easyfonts.EasyFonts;

import org.w3c.dom.Text;

public class MainActivity extends AppCompatActivity {

  @Override
  protected void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    setContentView(R.layout.activity_main);

    String introText = new String();

    introText = "Select a map below, and you will be taken to that virtual
soundscape. You can then walk through it as you also walk through real
space. Change the size of your steps by clicking a button on the right. \n\n
Click the back button to head back to this screen and choose a new location
to explore. More information can be found at
electricityismagic.com/streetears.html";
//     introText = "Select a map from below. But actually only choose the Plateau map.
You can change the size of your 'steps' by choosing a button on the Right of the screen,
making it easier to cover a large distance more quickly.";


    TextView intro = (TextView) findViewById(R.id.descriptionText);
    TextView myTitle = (TextView) findViewById(R.id.hearingBlindTitle);

    myTitle.setTypeface(EasyFonts.robotoThin(this));
    intro.setTypeface(EasyFonts.robotoThin(this));

    intro.setText(introText);

    Button lowerPlateau = (Button) findViewById(R.id.lowerplateaubutton);

    lowerPlateau.setOnClickListener(new View.OnClickListener() {
```

```java
        @Override
        public void onClick(View v) {
            Intent intent = new Intent(MainActivity.this, MapsActivity.class);
            startActivity(intent);
        }

    });

    Button dubai = (Button) findViewById(R.id.dubaibutton);

    dubai.setOnClickListener(new View.OnClickListener() {

        @Override
        public void onClick(View v) {
            Intent intent = new Intent(MainActivity.this, DubaiMapActivity.class);
            startActivity(intent);
        }

    });

    Button verdun = (Button) findViewById(R.id.verdunbutton);

    verdun.setOnClickListener(new View.OnClickListener(){

        @Override
        public void onClick(View v) {
            Intent intent = new Intent(MainActivity.this, VerdunMapActivity.class);
            startActivity(intent);
        }

    });

  }


}
```

<!-- PLATEAU COORDINATES -->

```java
package com.electricityismagic.www.simpleaudio;

import com.google.android.gms.maps.*;
import com.google.android.gms.maps.model.*;

import android.content.Intent;
import android.location.Location;
import android.net.Uri;
import android.os.Bundle;
import android.support.design.widget.FloatingActionButton;
import android.support.design.widget.Snackbar;
import android.support.v7.app.AppCompatActivity;
import android.support.v7.widget.Toolbar;
import android.util.Log;
import android.view.View;
import android.view.Menu;
import android.view.MenuItem;
import android.media.MediaPlayer;
import android.widget.TextView;
import android.widget.Button;
import android.view.View.OnClickListener;
import java.lang.Math;


import com.google.android.gms.appindexing.Action;
import com.google.android.gms.appindexing.AppIndex;
import com.google.android.gms.common.ConnectionResult;
import com.google.android.gms.common.api.GoogleApiClient;
import com.google.android.gms.location.LocationRequest;
import com.google.android.gms.location.LocationServices;
import com.google.android.gms.location.LocationListener;
import com.google.android.gms.common.api.GoogleApiClient.ConnectionCallbacks;
import
com.google.android.gms.common.api.GoogleApiClient.OnConnectionFailedListener;

public class MapsActivity extends AppCompatActivity implements
    ConnectionCallbacks,
    OnConnectionFailedListener,
    LocationListener,
```

```java
OnMapReadyCallback {

    private double plateauCoordinatesLat[] = {45.510130, 45.509541, 45.509301,
45.508490, 45.510572, 45.511649, 45.512653, 45.512217, 45.511281, 45.511401};
    private double plateauCoordinatesLong[] = {-73.573006, -73.573551,
-73.570986, -73.571330, -73.573890, -73.574515, -73.573748, -73.572385, -73.570154,
-73.572079};
    private int plateauNumCoords = 10;

    private int numCoords;

    private MediaPlayer[] mediaPlayer = new MediaPlayer[100];

    // Coordinates for Jeanne-Mance and Milton, a good starting point for this test
    private double defaultLatitude = 45.510212;
    private double defaultLongitude = -73.573012;
    private double userStartLat = 45.510200;
    private double userStartLong = -73.573012;
    private double scaledLat = 45.510200;
    private double scaledLong = -73.573012;
    private double mapLat = scaledLat;
    private double mapLong = scaledLong;
    private float scaleVariable = 1;
    private double scaler = 0.00003;

    // starting location 45.487229, -73.589491 (my office)
    // alternate starting location 45.458969, -73.562978 (eric's house)
    // latDiff and longDiff need to be added to getLatitude() and getLongitude() to make
the math work
    // getLatitude() + latDiff will equal defaultLatitude, which isn't actually used
anywhere
    private double latDiff = 0.051243;
    private double longDiff = 0.010034;
    private float volMultiplier = 1000;
    private double startLatitude[] = new double[100];
    private double startLongitude[] = new double[100];
    private float vol[] = new float[100];
    private float distanceFrom[] = new float[100];
    private Button buttonPlay;
```

```java
    private Button buttonStop;
    private Button fullVolume;

    private String mLatitudeLabel;
    private String mLongitudeLabel;

//   private TextView audioText[] = new TextView[10];

    private GoogleApiClient mGoogleApiClient;
    private Location startLocation;
    private Location mLastLocation;
    private LocationRequest mLocation;
    private GoogleMap mMap;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_maps);
        // Obtain the SupportMapFragment and get notified when the map is ready to be
used.
        SupportMapFragment mapFragment = (SupportMapFragment)
getSupportFragmentManager()
            .findFragmentById(R.id.map);
        mapFragment.getMapAsync(this);

        final Button scale_equal = (Button) findViewById(R.id.scalebutton_equal);
        final Button scale_large = (Button) findViewById(R.id.scalebutton_large);
        final Button scale_medium = (Button)
findViewById(R.id.scalebutton_medium);
        final Button scale_small = (Button) findViewById(R.id.scalebutton_small);

        final Button recenter = (Button) findViewById(R.id.recenter);

        scale_equal.setBackgroundColor(0xFFF0000);
        scale_large.setBackgroundColor(0xF999999);
        scale_medium.setBackgroundColor(0xF999999);
        scale_small.setBackgroundColor(0xF999999);

        recenter.setBackgroundColor(0xF999999);
```

```java
recenter.setOnClickListener(new View.OnClickListener() {
    @Override
    public void onClick(View v) {
        mapLat = 45.510200;
        mapLong = -73.573012;
        scaledLat = 45.510200;
        scaledLong = -73.573012;

        LatLng currentPosition = new LatLng(mapLat,mapLong);
//      mMap.addMarker(new
MarkerOptions().position(currentPosition).title(curPosTitle));
        mMap.moveCamera(CameraUpdateFactory.newLatLng(currentPosition));

    }
});

scale_equal.setOnClickListener(new View.OnClickListener() {

    @Override
    public void onClick(View v) {
        scaleVariable = 1;
        scale_equal.setBackgroundColor(0xFFF0000);
        scale_large.setBackgroundColor(0xF999999);
        scale_medium.setBackgroundColor(0xF999999);
        scale_small.setBackgroundColor(0xF999999);
    }

});

scale_large.setOnClickListener(new View.OnClickListener() {

    @Override
    public void onClick(View v) {
        scaleVariable = 2;
        scale_equal.setBackgroundColor(0xF999999);
        scale_large.setBackgroundColor(0xFFF0000);
        scale_medium.setBackgroundColor(0xF999999);
        scale_small.setBackgroundColor(0xF999999);
```

```java
        }

    });

    scale_medium.setOnClickListener(new View.OnClickListener() {

        @Override
        public void onClick(View v) {
            scaleVariable = 5;
            scale_equal.setBackgroundColor(0xF999999);
            scale_large.setBackgroundColor(0xF999999);
            scale_medium.setBackgroundColor(0xFFF0000);
            scale_small.setBackgroundColor(0xF999999);
        }

    });

    scale_small.setOnClickListener(new View.OnClickListener() {

        @Override
        public void onClick(View v) {
            scaleVariable = 10;
            scale_equal.setBackgroundColor(0xF999999);
            scale_large.setBackgroundColor(0xF999999);
            scale_medium.setBackgroundColor(0xF999999);
            scale_small.setBackgroundColor(0xFFF0000);
        }

    });

    numCoords = plateauNumCoords;

    for(int i = 0; i < numCoords; i++) {
        startLatitude[i] = plateauCoordinatesLat[i];
        startLongitude[i] = plateauCoordinatesLong[i];
    }

    /*
    audioText[0] = (TextView) findViewById(R.id.audio01test);
```

```java
    audioText[1] = (TextView) findViewById(R.id.audio02test);
    audioText[2] = (TextView) findViewById(R.id.audio03test);
    audioText[3] = (TextView) findViewById(R.id.audio04test);
    audioText[4] = (TextView) findViewById(R.id.audio05test);
    audioText[5] = (TextView) findViewById(R.id.audio06test);
    audioText[6] = (TextView) findViewById(R.id.audio07test);
    audioText[7] = (TextView) findViewById(R.id.audio08test);
    audioText[8] = (TextView) findViewById(R.id.audio09test);
    audioText[9] = (TextView) findViewById(R.id.audio10test);
    */

    // ATTENTION: This "addApi(AppIndex.API)"was auto-generated to implement
the App Indexing API.
    // See https://g.co/AppIndexing/AndroidStudio for more information.
    mGoogleApiClient = new GoogleApiClient.Builder(this)
        .addConnectionCallbacks(this)
        .addOnConnectionFailedListener(this)
        .addApi(LocationServices.API)
        .addApi(AppIndex.API).build();

    mediaPlayer[0] = MediaPlayer.create(this, R.raw.jeannemancemilton);
    mediaPlayer[1] = MediaPlayer.create(this, R.raw.parcmilton);
    mediaPlayer[2] = MediaPlayer.create(this, R.raw.jeannemancesherbrooke);
    mediaPlayer[3] = MediaPlayer.create(this, R.raw.parcsherbrooke);
    mediaPlayer[4] = MediaPlayer.create(this,
R.raw.jeannemancegalerieduparc);
    mediaPlayer[5] = MediaPlayer.create(this, R.raw.princearthurstfamilie);
    mediaPlayer[6] = MediaPlayer.create(this, R.raw.princearthursturbain);
    mediaPlayer[7] = MediaPlayer.create(this, R.raw.sturbain);
    mediaPlayer[8] = MediaPlayer.create(this, R.raw.sturbainsherbrooke);
    mediaPlayer[9] = MediaPlayer.create(this, R.raw.parkinglotavetarahall);

    for(int i = 0; i <numCoords; i++){
      mediaPlayer[i].setLooping(true);
      mediaPlayer[i].start();//Start playing the music
    }

  }
  /**
```

```java
 * Manipulates the map once available.
 * This callback is triggered when the map is ready to be used.
 * This is where we can add markers or lines, add listeners or move the camera. In
this case,
 * we just add a marker near Sydney, Australia.
 * If Google Play services is not installed on the device, the user will be prompted to
install
 * it inside the SupportMapFragment. This method will only be triggered once the
user has
 * installed Google Play services and returned to the app.
 */
@Override
public void onMapReady(GoogleMap googleMap) {
    mMap = googleMap;

    // Add a marker in Sydney and move the camera
    float zoomLevel = 17; //This goes up to 21
    LatLng lowerPlateau = new LatLng(defaultLatitude, defaultLongitude);
    LatLng[] markerPositions = new LatLng[10];
//      mMap.addMarker(new
MarkerOptions().position(lowerPlateau).title("Montreal's Beautiful Lower Plateau"));
    mMap.moveCamera(CameraUpdateFactory.newLatLngZoom(lowerPlateau,
zoomLevel));
    //mMap.getCameraPosition().zoom;

    for (int i = 0; i < 10; i++) {
        markerPositions[i] = new LatLng(plateauCoordinatesLat[i],
plateauCoordinatesLong[i]);
        mMap.addMarker(new MarkerOptions().position(markerPositions[i]).title(""));
    }
}

@Override
protected void onStart() {
    super.onStart();
    // Connect the client.
    mGoogleApiClient.connect();
    // ATTENTION: This was auto-generated to implement the App Indexing API.
    // See https://g.co/AppIndexing/AndroidStudio for more information.
```

```java
    Action viewAction = Action.newAction(
        Action.TYPE_VIEW, // TODO: choose an action type.
        "Main Page", // TODO: Define a title for the content shown.
        // TODO: If you have web page content that matches this app activity's content,
        // make sure this auto-generated web page URL is correct.
        // Otherwise, set the URL to null.
        Uri.parse("http://host/path"),
        // TODO: Make sure this auto-generated app deep link URI is correct.

Uri.parse("android-app://com.electricityismagic.www.simpleaudio/http/host/path")
    );
    AppIndex.AppIndexApi.start(mGoogleApiClient, viewAction);
  }

  @Override
  public void onConnected(Bundle connectionHint) {

    mLocation = LocationRequest.create();
    mLocation.setPriority(LocationRequest.PRIORITY_HIGH_ACCURACY);
    mLocation.setInterval(1000); // Update location every second

LocationServices.FusedLocationApi.requestLocationUpdates(mGoogleApiClient,
mLocation, this);
    //audioText[0].setText("CONNECTION HAS BEGUN");

    //userStartLat = startLocation.getLatitude();
    //userStartLong = startLocation.getLongitude();
  }

  @Override
  protected void onDestroy() {

    for(int i = 0; i <numCoords; i++){
      mediaPlayer[i].stop();//Stop playing the music
    }
    mGoogleApiClient.disconnect();
```

```java
        super.onDestroy();
    }
    @Override
    protected void onStop() {
        // Disconnecting the client invalidates it.
        super.onStop();

        // ATTENTION: This was auto-generated to implement the App Indexing API.
        // See https://g.co/AppIndexing/AndroidStudio for more information.
        Action viewAction = Action.newAction(
            Action.TYPE_VIEW, // TODO: choose an action type.
            "Main Page", // TODO: Define a title for the content shown.
            // TODO: If you have web page content that matches this app activity's content,
            // make sure this auto-generated web page URL is correct.
            // Otherwise, set the URL to null.
            Uri.parse("http://host/path"),
            // TODO: Make sure this auto-generated app deep link URI is correct.

Uri.parse("android-app://com.electricityismagic.www.simpleaudio/http/host/path")
        );
        AppIndex.AppIndexApi.end(mGoogleApiClient, viewAction);
    }

    @Override
    public void onConnectionSuspended(int i) {
        // Log.i(TAG, "Location services suspended. Please reconnect.");
        //audioText[o].setText("CONNECTION SUSPENDED");
    }

    @Override
    public void onConnectionFailed(ConnectionResult connectionResult) {
        // audioText[o].setText("CONNECTION FAILED");
    }

    public void onLocationChanged(Location location) {
        mLastLocation = location;
```

```
//      LatLng currentPosition = new
LatLng(mLastLocation.getLatitude(),mLastLocation.getLongitude());
//      mMap.addMarker(new MarkerOptions().position(currentPosition).title("You
are Here"));
//
//
//      for(int i = 0; i < numCoords; i++){
//         distanceFrom[i] = (float) Math.sqrt(Math.pow(startLatitude[i] -
(mLastLocation.getLatitude() + latDiff), 2) + Math.pow(startLongitude[i] -
(mLastLocation.getLongitude() + longDiff), 2));
//         vol[i] = 1 - (volMultiplier*distanceFrom[i]);
//         //audioText[i].setText("vol01 is " + String.valueOf(vol[i]) + " and distance01 is
" + String.valueOf(distanceFrom[i]));
//         mediaPlayer[i].setVolume(vol[i], vol[i]);
//      }
//      if ((mLastLocation.getLatitude() - scaledLat) < 0.00000001) {
//         scaledLat = scaledLat;
//      } else
    if (mLastLocation.getLatitude() > scaledLat) {
      // scaled lat PLUS scalefactor
      mapLat = mapLat + scaleVariable*scaler;
      scaledLat = mLastLocation.getLatitude();
    } else if (mLastLocation.getLatitude() < scaledLat) {
      // scaled lat MINUS scalefactor
      mapLat = mapLat - scaleVariable*scaler;
      scaledLat = mLastLocation.getLatitude();
    }

//      if ((mLastLocation.getLongitude() - scaledLong) < 0.00000001) {
//         scaledLong = scaledLong;
//      } else
    if (mLastLocation.getLongitude() > scaledLong) {
      // scaled long PLUS scalefactor
      mapLong = mapLong + scaleVariable*scaler;
      scaledLong = mLastLocation.getLongitude();
    } else if (mLastLocation.getLongitude() < scaledLong) {
      // scaled long MINUS scalefactor
      mapLong = mapLong - scaleVariable*scaler;
```

```java
        scaledLong = mLastLocation.getLongitude();
    }

//      String curPosTitle = String.valueOf(mLastLocation.getLatitude()) + " " +
String.valueOf(userStartLat) + " " + String.valueOf(mLastLocation.getLongitude()) +
" " + String.valueOf(userStartLong);
    LatLng currentPosition = new LatLng(mapLat,mapLong);
//      mMap.addMarker(new
MarkerOptions().position(currentPosition).title(curPosTitle));
    mMap.moveCamera(CameraUpdateFactory.newLatLng(currentPosition));

    for(int i = 0; i < numCoords; i++){
        distanceFrom[i] = (float) Math.sqrt(Math.pow(startLatitude[i] - (mapLat),
2) + Math.pow(startLongitude[i] - (mapLong), 2));
        vol[i] = 1 - (volMultiplier*   distanceFrom[i]);
        //audioText[i].setText("vol01 is " + String.valueOf(vol[i]) + " and distance01 is "
+ String.valueOf(distanceFrom[i]));
        mediaPlayer[i].setVolume(vol[i], vol[i]);
    }

 }

 @Override
 public boolean onCreateOptionsMenu(Menu menu) {
    // Inflate the menu; this adds items to the action bar if it is present.
    getMenuInflater().inflate(R.menu.menu_main, menu);
    return true;
 }

 @Override
 public boolean onOptionsItemSelected(MenuItem item) {
    // Handle action bar item clicks here. The action bar will
    // automatically handle clicks on the Home/Up button, so long
    // as you specify a parent activity in AndroidManifest.xml.
    int id = item.getItemId();

    //noinspection SimplifiableIfStatement
    if (id == R.id.action_settings) {
        return true;
```

```java
        }

        return super.onOptionsItemSelected(item);
    }
}
```

<!-- VERDUN COORDINATES ➜

```java
package com.electricityismagic.www.simpleaudio;

import com.google.android.gms.maps.*;
import com.google.android.gms.maps.model.*;

import android.content.Intent;
import android.location.Location;
import android.net.Uri;
import android.os.Bundle;
import android.support.design.widget.FloatingActionButton;
import android.support.design.widget.Snackbar;
import android.support.v7.app.AppCompatActivity;
import android.support.v7.widget.Toolbar;
import android.util.Log;
import android.view.View;
import android.view.Menu;
import android.view.MenuItem;
import android.media.MediaPlayer;
import android.widget.TextView;
import android.widget.Button;
import android.view.View.OnClickListener;
import java.lang.Math;

import com.google.android.gms.appindexing.Action;
import com.google.android.gms.appindexing.AppIndex;
import com.google.android.gms.common.ConnectionResult;
import com.google.android.gms.common.api.GoogleApiClient;
import com.google.android.gms.location.LocationRequest;
```

```java
import com.google.android.gms.location.LocationServices;
import com.google.android.gms.location.LocationListener;
import
com.google.android.gms.common.api.GoogleApiClient.ConnectionCallback
s;
import
com.google.android.gms.common.api.GoogleApiClient.OnConnectionFaile
dListener;

public class VerdunMapActivity extends AppCompatActivity implements
    ConnectionCallbacks,
    OnConnectionFailedListener,
    LocationListener,
    OnMapReadyCallback {

  private double plateauCoordinatesLat[] = {45.457350, 45.454692,
45.451745, 45.450040, 45.450548, 45.452826, 45.454393, 45.455862,
45.458165, 45.458782, 45.460681, 45.462386, 45.462910, 45.458618,
45.459774, 45.460956, 45.462604, 45.461859, 45.461061, 45.459136};
  private double plateauCoordinatesLong[] = {-73.562041, -73.563701,
-73.565564, -73.567419, -73.568062, -73.567519, -73.566101, -73.564433,
-73.563454, -73.560457, -73.560666, -73.561164, -73.565747, -73.562525,
-73.563126, -73.562461, -73.564424, -73.567246, -73.567342, -73.567258};
  private int plateauNumCoords = 20;

  private int numCoords;

  private MediaPlayer[] mediaPlayer = new MediaPlayer[100];

  // Coordinates for De L'Eglise Station, a good starting point for this test
  private double defaultLatitude = 45.4576105;
  private double defaultLongitude = -73.5649384;
  private double userStartLat = 45.4576105;
  private double userStartLong = -73.5649384;
  private double scaledLat = 45.4576105;
  private double scaledLong = -73.5649384;
  private double mapLat = scaledLat;
  private double mapLong = scaledLong;
  private float scaleVariable = 1;
```

```java
    private double scaler = 0.00003;

    // starting location 45.487229, -73.589491 (my office)
    // alternate starting location 45.458969, -73.562978 (eric's house)
    // latDiff and longDiff need to be added to getLatitude() and
getLongitude() to make the math work
    // getLatitude() + latDiff will equal defaultLatitude, which isn't actually
used anywhere
    private double latDiff = 0.051243;
    private double longDiff = 0.010034;
    private float volMultiplier = 1000;
    private double startLatitude[] = new double[100];
    private double startLongitude[] = new double[100];
    private float vol[] = new float[100];
    private float distanceFrom[] = new float[100];
    private Button buttonPlay;
    private Button buttonStop;
    private Button fullVolume;
    private String mLatitudeLabel;
    private String mLongitudeLabel;

//    private TextView audioText[] = new TextView[10];

    private GoogleApiClient mGoogleApiClient;
    private Location startLocation;
    private Location mLastLocation;
    private LocationRequest mLocation;

    private GoogleMap mMap;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_maps);
        // Obtain the SupportMapFragment and get notified when the map is
ready to be used.
        SupportMapFragment mapFragment = (SupportMapFragment)
getSupportFragmentManager()
            .findFragmentById(R.id.map);
```

```
    mapFragment.getMapAsync(this);
    final Button scale_equal = (Button)
findViewById(R.id.scalebutton_equal);
    final Button scale_large = (Button)
findViewById(R.id.scalebutton_large);
    final Button scale_medium = (Button)
findViewById(R.id.scalebutton_medium);
    final Button scale_small = (Button)
findViewById(R.id.scalebutton_small);
    final Button recenter = (Button) findViewById(R.id.recenter);

    scale_equal.setBackgroundColor(0xFFF0000);
    scale_large.setBackgroundColor(0xF999999);
    scale_medium.setBackgroundColor(0xF999999);
    scale_small.setBackgroundColor(0xF999999);
    recenter.setBackgroundColor(0xF999999);
    recenter.setOnClickListener(new View.OnClickListener() {
      @Override
      public void onClick(View v) {
        mapLat = 45.4576105;
        mapLong = -73.5649384;
        scaledLat = 45.4576105;
        scaledLong = -73.5649384;

        LatLng currentPosition = new LatLng(mapLat,mapLong);
//      mMap.addMarker(new
MarkerOptions().position(currentPosition).title(curPosTitle));

mMap.moveCamera(CameraUpdateFactory.newLatLng(currentPosition));

      }
    });

    scale_equal.setOnClickListener(new View.OnClickListener() {

      @Override
      public void onClick(View v) {
        scaleVariable = 1;
        scale_equal.setBackgroundColor(0xFFF0000);
```

```java
      scale_large.setBackgroundColor(0xF999999);
      scale_medium.setBackgroundColor(0xF999999);
      scale_small.setBackgroundColor(0xF999999);
   }

});

scale_large.setOnClickListener(new View.OnClickListener() {

   @Override
   public void onClick(View v) {
      scaleVariable = 2;
      scale_equal.setBackgroundColor(0xF999999);
      scale_large.setBackgroundColor(0xFFF0000);
      scale_medium.setBackgroundColor(0xF999999);
      scale_small.setBackgroundColor(0xF999999);
   }

});

scale_medium.setOnClickListener(new View.OnClickListener() {

   @Override
   public void onClick(View v) {
      scaleVariable = 5;
      scale_equal.setBackgroundColor(0xF999999);
      scale_large.setBackgroundColor(0xF999999);
      scale_medium.setBackgroundColor(0xFFF0000);
      scale_small.setBackgroundColor(0xF999999);
   }

});

scale_small.setOnClickListener(new View.OnClickListener() {

   @Override
   public void onClick(View v) {
      scaleVariable = 10;
      scale_equal.setBackgroundColor(0xF999999);
```

```java
        scale_large.setBackgroundColor(0xF999999);
        scale_medium.setBackgroundColor(0xF999999);
        scale_small.setBackgroundColor(0xFFF0000);
    }

});


numCoords = plateauNumCoords;

for(int i = 0; i < numCoords; i++) {
    startLatitude[i] = plateauCoordinatesLat[i];
    startLongitude[i] = plateauCoordinatesLong[i];
}


/*
audioText[0] = (TextView) findViewById(R.id.audio01test);
audioText[1] = (TextView) findViewById(R.id.audio02test);
audioText[2] = (TextView) findViewById(R.id.audio03test);
audioText[3] = (TextView) findViewById(R.id.audio04test);
audioText[4] = (TextView) findViewById(R.id.audio05test);
audioText[5] = (TextView) findViewById(R.id.audio06test);
audioText[6] = (TextView) findViewById(R.id.audio07test);
audioText[7] = (TextView) findViewById(R.id.audio08test);
audioText[8] = (TextView) findViewById(R.id.audio09test);
audioText[9] = (TextView) findViewById(R.id.audio10test);
*/

    // ATTENTION: This "addApi(AppIndex.API)"was auto-generated to
implement the App Indexing API.
    // See https://g.co/AppIndexing/AndroidStudio for more information.
    mGoogleApiClient = new GoogleApiClient.Builder(this)
        .addConnectionCallbacks(this)
        .addOnConnectionFailedListener(this)
        .addApi(LocationServices.API)
        .addApi(AppIndex.API).build();

    mediaPlayer[0] = MediaPlayer.create(this, R.raw.pathsecondedition);
```

```java
    mediaPlayer[1] = MediaPlayer.create(this, R.raw.pathcrescoresto);
    mediaPlayer[2] = MediaPlayer.create(this, R.raw.pathfourth);
    mediaPlayer[3] = MediaPlayer.create(this, R.raw.woodlandpark);
    mediaPlayer[4] = MediaPlayer.create(this, R.raw.lasallebeatty);
    mediaPlayer[5] = MediaPlayer.create(this, R.raw.lasalleargyle);
    mediaPlayer[6] = MediaPlayer.create(this, R.raw.lasalledesmarchais);
    mediaPlayer[7] = MediaPlayer.create(this, R.raw.lasallefifth);
    mediaPlayer[8] = MediaPlayer.create(this, R.raw.lasallefirst);
    mediaPlayer[9] = MediaPlayer.create(this, R.raw.riverwillibrord);
    mediaPlayer[10] = MediaPlayer.create(this, R.raw.pathgordon);
    mediaPlayer[11] = MediaPlayer.create(this, R.raw.behindaud);
    mediaPlayer[12] = MediaPlayer.create(this, R.raw.metrodeleglise);
    mediaPlayer[13] = MediaPlayer.create(this, R.raw.balcony);
    mediaPlayer[14] = MediaPlayer.create(this, R.raw.lasallerielle);
    mediaPlayer[15] = MediaPlayer.create(this, R.raw.lasallemcd);
    mediaPlayer[16] = MediaPlayer.create(this, R.raw.deleglisetims);
    mediaPlayer[17] = MediaPlayer.create(this, R.raw.wellingtongalt);
    mediaPlayer[18] = MediaPlayer.create(this, R.raw.wellingtongordon);
    mediaPlayer[19] = MediaPlayer.create(this,
R.raw.wellingtonwillibrord);

    for(int i = 0; i < numCoords; i++){
      mediaPlayer[i].setLooping(true);
      mediaPlayer[i].start();//Start playing the music
    }
  }

  /**
   * Manipulates the map once available.
   * This callback is triggered when the map is ready to be used.
   * This is where we can add markers or lines, add listeners or move the
camera. In this case,
   * we just add a marker near Sydney, Australia.
   * If Google Play services is not installed on the device, the user will be
prompted to install
   * it inside the SupportMapFragment. This method will only be triggered
once the user has
   * installed Google Play services and returned to the app.
   */
```

```java
    @Override
    public void onMapReady(GoogleMap googleMap) {
        mMap = googleMap;
        // Add a marker in Sydney and move the camera
        float zoomLevel = 17; //This goes up to 21
        LatLng lowerPlateau = new LatLng(defaultLatitude, defaultLongitude);
        LatLng[] markerPositions = new LatLng[10];
//      mMap.addMarker(new
MarkerOptions().position(lowerPlateau).title("Montreal's Beautiful
Lower Plateau"));

mMap.moveCamera(CameraUpdateFactory.newLatLngZoom(lowerPlateau, zoomLevel));
        //mMap.getCameraPosition().zoom;

        for (int i = 0; i < 10; i++) {
            markerPositions[i] = new LatLng(plateauCoordinatesLat[i],
plateauCoordinatesLong[i]);
            mMap.addMarker(new
MarkerOptions().position(markerPositions[i]).title(""));
        }
    }

    @Override
    protected void onStart() {
        super.onStart();
        // Connect the client.
        mGoogleApiClient.connect();
        // ATTENTION: This was auto-generated to implement the App
Indexing API.
        // See https://g.co/AppIndexing/AndroidStudio for more information.
        Action viewAction = Action.newAction(
            Action.TYPE_VIEW, // TODO: choose an action type.
            "Main Page", // TODO: Define a title for the content shown.
            // TODO: If you have web page content that matches this app
activity's content,
            // make sure this auto-generated web page URL is correct.
            // Otherwise, set the URL to null.
            Uri.parse("http://host/path"),
```

```java
        // TODO: Make sure this auto-generated app deep link URI is
correct.

Uri.parse("android-app://com.electricityismagic.www.simpleaudio/http/host/path")
    );
    AppIndex.AppIndexApi.start(mGoogleApiClient, viewAction);
  }

  @Override
  public void onConnected(Bundle connectionHint) {

    mLocation = LocationRequest.create();

mLocation.setPriority(LocationRequest.PRIORITY_HIGH_ACCURACY);
    mLocation.setInterval(1000); // Update location every second


LocationServices.FusedLocationApi.requestLocationUpdates(mGoogleApiClient, mLocation, this);
    //audioText[0].setText("CONNECTION HAS BEGUN");

    //userStartLat = startLocation.getLatitude();
    //userStartLong = startLocation.getLongitude();
  }

  @Override
  protected void onDestroy() {

    for(int i = 0; i <numCoords; i++){
      mediaPlayer[i].stop();//Stop playing the music
    }
    super.onDestroy();

  }

  @Override
  protected void onStop() {
    // Disconnecting the client invalidates it.
```

```java
        mGoogleApiClient.disconnect();
        super.onStop();

        // ATTENTION: This was auto-generated to implement the App
Indexing API.
        // See https://g.co/AppIndexing/AndroidStudio for more information.
        Action viewAction = Action.newAction(
                Action.TYPE_VIEW, // TODO: choose an action type.
                "Main Page", // TODO: Define a title for the content shown.
                // TODO: If you have web page content that matches this app
activity's content,
                // make sure this auto-generated web page URL is correct.
                // Otherwise, set the URL to null.
                Uri.parse("http://host/path"),
                // TODO: Make sure this auto-generated app deep link URI is
correct.

Uri.parse("android-app://com.electricityismagic.www.simpleaudio/http/host/path")
        );
        AppIndex.AppIndexApi.end(mGoogleApiClient, viewAction);
    }

    @Override
    public void onConnectionSuspended(int i) {
        // Log.i(TAG, "Location services suspended. Please reconnect.");
        //audioText[o].setText("CONNECTION SUSPENDED");
    }

    @Override
    public void onConnectionFailed(ConnectionResult connectionResult) {
        // audioText[o].setText("CONNECTION FAILED");
    }

    public void onLocationChanged(Location location) {
        mLastLocation = location;

//      LatLng currentPosition = new
LatLng(mLastLocation.getLatitude(),mLastLocation.getLongitude());
```

```java
//      mMap.addMarker(new
MarkerOptions().position(currentPosition).title("You are Here"));
//
//
//      for(int i = 0; i < numCoords; i++){
//         distanceFrom[i] = (float) Math.sqrt(Math.pow(startLatitude[i] -
(mLastLocation.getLatitude() + latDiff), 2) + Math.pow(startLongitude[i]
- (mLastLocation.getLongitude() + longDiff), 2));
//         vol[i] = 1 - (volMultiplier*distanceFrom[i]);
//         //audioText[i].setText("vol01 is " + String.valueOf(vol[i]) + " and
distance01 is " + String.valueOf(distanceFrom[i]));
//         mediaPlayer[i].setVolume(vol[i], vol[i]);
//      }
//      if ((mLastLocation.getLatitude() - scaledLat) < 0.00000001) {
//         scaledLat = scaledLat;
//      } else
    if (mLastLocation.getLatitude() > scaledLat) {
      // scaled lat PLUS scalefactor
      mapLat = mapLat + scaleVariable*scaler;
      scaledLat = mLastLocation.getLatitude();
    } else if (mLastLocation.getLatitude() < scaledLat) {
      // scaled lat MINUS scalefactor
      mapLat = mapLat - scaleVariable*scaler;
      scaledLat = mLastLocation.getLatitude();
    }

//      if ((mLastLocation.getLongitude() - scaledLong) < 0.00000001) {
//         scaledLong = scaledLong;
//      } else
    if (mLastLocation.getLongitude() > scaledLong) {
      // scaled long PLUS scalefactor
      mapLong = mapLong + scaleVariable*scaler;
      scaledLong = mLastLocation.getLongitude();
    } else if (mLastLocation.getLongitude() < scaledLong) {
      // scaled long MINUS scalefactor
      mapLong = mapLong - scaleVariable*scaler;
      scaledLong = mLastLocation.getLongitude();
    }
```

```java
//      String curPosTitle = String.valueOf(mLastLocation.getLatitude()) +
" " + String.valueOf(userStartLat) + " " +
String.valueOf(mLastLocation.getLongitude()) + " " +
String.valueOf(userStartLong);
    LatLng currentPosition = new LatLng(mapLat,mapLong);
//      mMap.addMarker(new
MarkerOptions().position(currentPosition).title(curPosTitle));

mMap.moveCamera(CameraUpdateFactory.newLatLng(currentPosition));

    for(int i = 0; i < numCoords; i++){
        distanceFrom[i] = (float) Math.sqrt(Math.pow(startLatitude[i] -
(mapLat), 2) + Math.pow(startLongitude[i] - (mapLong), 2));
        vol[i] = 1 - (volMultiplier*distanceFrom[i]);
        //audioText[i].setText("vol01 is " + String.valueOf(vol[i]) + " and
distance01 is " + String.valueOf(distanceFrom[i]));
        mediaPlayer[i].setVolume(vol[i], vol[i]);
    }
  }
  @Override
  public boolean onCreateOptionsMenu(Menu menu) {
    // Inflate the menu; this adds items to the action bar if it is present.
    getMenuInflater().inflate(R.menu.menu_main, menu);
    return true;
  }

  @Override
  public boolean onOptionsItemSelected(MenuItem item) {
    // Handle action bar item clicks here. The action bar will
    // automatically handle clicks on the Home/Up button, so long
    // as you specify a parent activity in AndroidManifest.xml.
    int id = item.getItemId();
    //noinspection SimplifiableIfStatement
    if (id == R.id.action_settings) {
      return true;
    }
    return super.onOptionsItemSelected(item);
  }
}
```
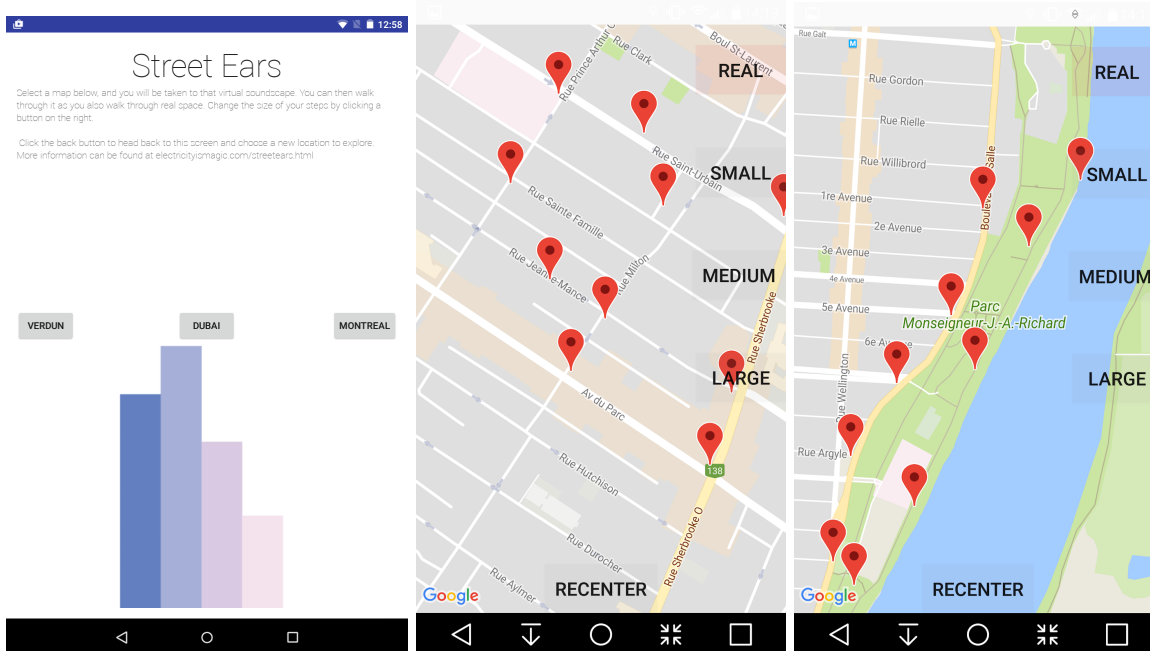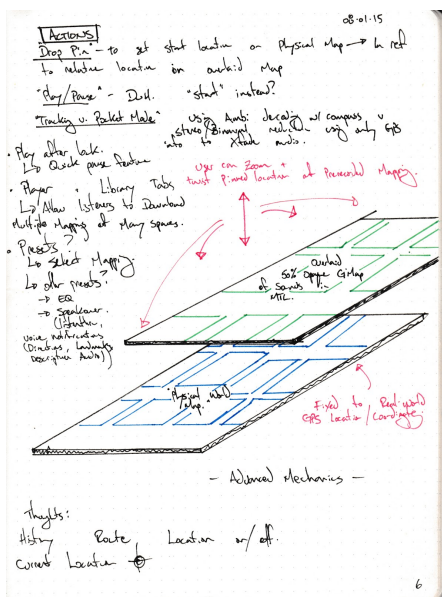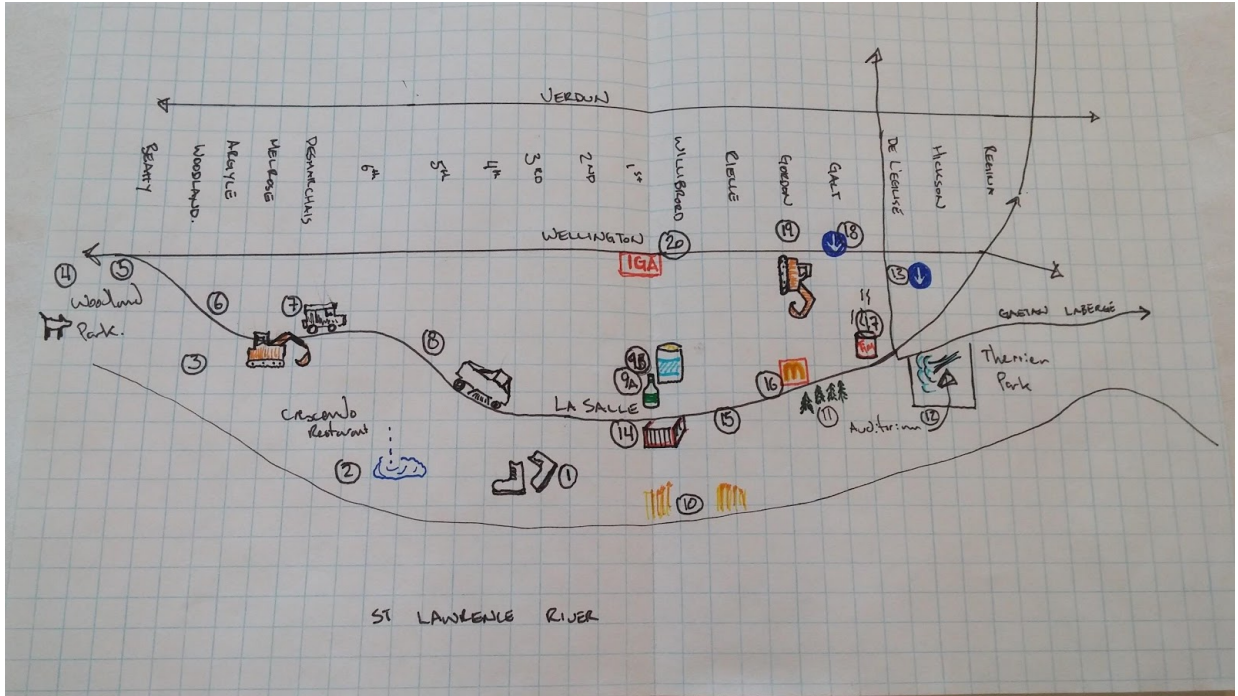
2 - Images

Initial testing of the *Street Ears* app (Pictured: Casey McCormick. Photo: Eric Powell).

The *Street Ears* "Home" screen, the "Montreal," and "Verdun" mappings

Initial sketch of the *Street Ears* app (Illustration: Eric Powell).

Reference map of the "Verdun" recording locations (Photo and Illustration: Eric Powell).

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3 - Report on *Street Ears* Programming by Matthew Griffin

Street Ears is built on the Android platform, and is compatible with all devices running Android 4.4 or later. The app functions primarily using the capabilities provided by Google Location Services, an essential component of all location-based applications which allows developers to access the Global Positioning System (GPS) coordinates (latitude and longitude) of a given user.

Latitude and Longitude as Variables

The main conceit of *Street Ears* is that a user will be able to move through his or her current environment while hearing the sounds of a different space. The programmatic challenge, then, was to take the *absolute* location of the listener and treat is as a *relative* location (ie - using the user's latitude and longitude as variables in a number of equations.). There were a number of steps in this process.

1) Our pre-recorded maps needed to be tracked extremely precisely in their latitude and longitude. Since the locations we are using are, on a global scale, quite small, losing an order of magnitude in our precision would render our equations functionally meaningless.

2) Each pre-recorded map needed to be inputted into our program as a separate dataset. There was no shortcut to this. Each dataset was a separate array variable, as seen below using the example of Montreal's Plateau neighbourhood:

private double plateauCoordinatesLat[] = {45.457350, 45.454692, 45.451745, 45.450040, 45.450548, 45.452826, 45.454393, 45.455862, 45.458165, 45.458782, 45.460681, 45.462386, 45.462910, 45.458618, 45.459774, 45.460956, 45.462604, 45.461859, 45.461061, 45.459136};

private double plateauCoordinatesLong[] = {-73.562041, -73.563701, -73.565564, -73.567419, -73.568062, -73.567519, -73.566101, -73.564433, -73.563454, -73.560457,

-73.560666, -73.561164, -73.565747, -73.562525, -73.563126, -73.562461, -73.564424,

-73.567246, -73.567342, -73.567258};

private int plateauNumCoords = 20;

Note also that the number of coordinates is stored in a separate variable. If and when the software becomes sophisticated enough to allow users to add their own datasets, the location arrays will need to be of variable size.

3) We now know the locations of all the pre-recordings, and, as mentioned, we know the current latitude and longitude of our user. As such, we can now calculate the **current distance** between the user and each of the pre-recorded points. This gets us close to the result we want, but for the user to feel as though they are *in* the sounds, their location needs to be translated to a *given origin point* for the pre-recordings.

(For example, if the user was in Montreal, facing due North, and the recordings were all from Vancouver, all sounds would appear entirely in the left channel, until such time as the user has walked all the way to Vancouver.)

The starting latitude and longitude are then defined as separate variables:

private double defaultLatitude = 45.4576105;

private double defaultLongitude = -73.5649384;

4) Given the above starting information and the current location information for the

user, we can then create a *relative position* for them by finding the *difference*

between the default latitude and the current latitude. As such, when a user moves

one degree north, for example, from their starting location, we can move them

one degree north from the *virtual* location.

From this point, it then became possible to *scale* this virtual movement. The factors by

which we scaled were (and still are) being tested, and are chosen by us (ie - the user can

not choose an arbitrarily large or small scaling factor).

5) Now that the user can be placed in this virtual space, we can use a simple

inverse-square equation to define the appropriate volumes for each of the

pre-recordings:

```
for(int i = 0; i < numCoords; i++){
  distanceFrom[i] = (float) Math.sqrt(Math.pow(startLatitude[i] - (mapLat), 2) +
Math.pow(startLongitude[i] - (mapLong), 2));
  vol[i] = 1 - (volMultiplier*distanceFrom[i]);
  mediaPlayer[i].setVolume(vol[i], vol[i]);
}
```

This *for loop* uses most of the variables we've seen above. numCoords is the pre-defined number of pre-recordings in the dataset. The distanceFrom[] line calculates the distance from each pre-recording, and then vol[] defines the volume at which to play each recording. It is worth noting that currently each recording is treated as a *point source* (as is the position of the user). This leads to a few things:

1) There is no directionality. A recording on the left and a recording on the right will sound the same. While calculating angle for correct panning is straightforward, we cannot guarantee that a user's device will be pointed in a given direction. Panning only works if we know which was a user is facing, and with devices often being placed in pockets, this is not a useful piece of data.

2) Stereo/binaural recordings are not particularly useful. Again, because we cannot with any certainty know the direction a user is facing, the recordings will ultimately be flattened to mono. This does not mean the user's *experience* is mono, as the separation of the recordings themselves will ultimately lead to a rich stereo experience.

For the time being, the above points are not seen as shortcomings of the application. There may be a point when we can incorporate a dependable sensor (something like a VR headset), at which point more sophisticated panning will be added.

Current Issues & Future Development

This system currently checks *whether or not the user has moved in a given direction*, and if it returns a yes, the user's relative position is changed accordingly (and scaled by the appropriate factor.). The major issue with this is something called GPS drifting, which means that the GPS coordinates will not necessarily return the same result each time the system is polled. Since the system is polled nearly-constantly, this can mean a user will be *virtually moving* even if they are standing still in their physical space. This can be particularly problematic if the scale factor is quite large. GPS drifting is also not consistent on a place-by-place basis. To counter this, we will be testing and implementing a number of additional testing and polling systems. Hopefully by increasing the amount for which the system will return "no movement" this problem will be solved. It is primarily a factor of our scaling system, which, if it is unsatisfactory in the long term, may have to be scrapped.

4 - Description of Use - *Street Ears*

Street Ears is an android soundmapping application that uses relative GPS locativity to track the user's real-time movement through an alternate, augmented aural environment. This app allows users to listen to prerecorded mappings of 2 areas within Montreal (the lower Plateau, and Verdun) from anywhere in the world. The GPS information from each real-world step is tracked by the app and used to crossfade between the pre-recorded audio from the various points within the mapping. The *Street Ears* project goals are derived from the Acoustic Ecology practice of Soundwalking. Users are encouraged to explore this augmented aural environment with an attention to the dedicated act of listening, engaging with the tensions, disruptions, or serendipitous convergences that occur when listening to one space while moving through another.

To download the *Street Ears* app (Android only), visit:

http://electricityismagic.com/streetears.html

or, for the direct dropbox link:

https://www.dropbox.com/s/ve3qdf5l1enttw0/StreetEars_02.apk?dl=0

Nb. the .apk file will not automatically open/install. You will need a file manager app on your phone to open it, and will need to authorize opening apps from outside the Google Play Store.

Using the *Street Ears* app is very simple. First: ensure that location services are enabled, then click on the *Street Ears* icon. The app's home screen will allow the user to select

which aural environment they would like to explore. At present one can choose from three mappings. There are two areas within Montreal: The lower Plateau near Downtown, or the smaller island of Verdun in the South-West. There is also the option of exploring the sounds of Dubai, arranged around the light rail mass transit system. Once the user has selected their mapping of choice, they will enter into the aural environment. Audio will begin immediately, and they will see their relative location as represented by a google map. Red pins indicating the source location of each recorded sound are spread out across the map. In order to explore the sounds within each mapping, it is essential to begin walking. Swiping up or down across the screen will not change the audio.

For example, if the user walks one kilometer due North in their physical environment, they would be listening to a blend of sounds from the mapping, which could include a sound from the South growing fainter, a sound from the East or West getting louder, then fading as the user continues North, and finally, sounds to the North continually growing louder as the user moves toward them. It is also possible to change the scale of their real-world movement - exploring the 35 km breadth of Dubai in only a few hundred meters. There are four scales to choose from: Real, Small, Medium and Large. Real represents a 1:1 ratio between the alternate environment movement and the real world. Small enlarges the user's footsteps to a ratio of 3:1, Medium to 5:1, and Large allows for seven league steps with a ratio of 10:1.

If the app freezes or does not play audio, it is necessary to close and clear the app, then restart. While audio will play through the phone's speakers, for the best listening experience it is recommended to plug in headphones before opening the app.

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5 - Presentations / Workshops (Under working title: *Hearing Blind*)

- "Hearing Blind: Practical applications for sound-based mapping." (Paper) Music, ageing, technology, 20th Finnish Music Researchers Symposium. May 11-13, 2016. Joensuu, Finland.

- "Hearing Blind" (Workshop) Music, ageing, technology, 20th Finnish Music Researchers Symposium. May 12, 2016. Joensuu, Finland.

- "Sound, Environment, and Mapping" (Workshop). SciFest. May 13, 2016. Joensuu, Finland.

- "Hearing Blind as a New Interface for Exploring the Urban Soundscape." (Paper) International Symposium for the Electronic Arts. May 16-22, 2016. Hong Kong. Published in conference proceedings.

Appendix C: *168 Hours* Source Code and Documentation

1- Arduino Code: Installed on Arduino Mega

```
#include <MIDI.h>
#include <midi_Defs.h>
#include <midi_Message.h>
#include <midi_Namespace.h>
#include <midi_Settings.h>

const int buttonOne = 48; // assign input pin to variable
const int buttonTwo = 25;
const int buttonThree = 27;
const int buttonFour = 29;
const int buttonFive = 31;
const int buttonSix = 33;
const int buttonSeven = 35;
const int buttonEight = 37;
const int buttonNine = 39;
const int buttonTen = 41;
const int buttonEleven = 43;
const int buttonTwelve = 45;
const int buttonThirteen = 47;
const int buttonFourteen = 49;
const int buttonFifteen = 51;

//Define Pots
int cc = 0;
int pot[] = {0, 0, 0, 0, 0, 0, 0};
int lastpot[] = {0, 0, 0, 0, 0, 0, 0};
//Define cc number of each pot
int midi_cc[] = {31, 32, 33, 34, 35, 36, 37};

MIDI_CREATE_INSTANCE(HardwareSerial,Serial, midiOut); // create a MIDI object
called midiOut

void setup() {
  pinMode(buttonOne,INPUT); // setup button as input
  pinMode(buttonTwo,INPUT);
  pinMode(buttonThree,INPUT);
  pinMode(buttonFour,INPUT);
  pinMode(buttonFive,INPUT);
  pinMode(buttonSix,INPUT);
```

```
  pinMode(buttonSeven,INPUT);
  pinMode(buttonEight,INPUT);
  pinMode(buttonNine,INPUT);
  pinMode(buttonTen,INPUT);
  pinMode(buttonEleven,INPUT);
  pinMode(buttonTwelve,INPUT);
  pinMode(buttonThirteen,INPUT);
  pinMode(buttonFourteen,INPUT);
  pinMode(buttonFifteen,INPUT);
  Serial.begin(31250); // setup MIDI output
}

void loop() {
  if(digitalRead(buttonOne) == HIGH) { // check button state
    delay(10); // software de-bounce
    if(digitalRead(buttonOne) == HIGH) { // check button state again
      midiOut.sendControlChange(41,127,1); // send a MIDI CC – 41 = note, 127 =
velocity, 1 = channel
      delay(1000); // wait 1 sec to allow Live to cue tracks
    }
  }

  if(digitalRead(buttonTwo) == HIGH) {
    delay(10);
    if(digitalRead(buttonTwo) == HIGH) {
      midiOut.sendControlChange(42,127,1);
      delay(1000);
    }
  }
  if(digitalRead(buttonThree) == HIGH) {
    delay(10);
    if(digitalRead(buttonThree) == HIGH) {
      midiOut.sendControlChange(43,127,1);
      delay(1000);
    }
  }
  if(digitalRead(buttonFour) == HIGH) {
    delay(10);
    if(digitalRead(buttonFour) == HIGH) {
      midiOut.sendControlChange(44,127,1);
      delay(1000);
    }
  }
  if(digitalRead(buttonFive) == HIGH) {
    delay(10);
```

```
    if(digitalRead(buttonFive) == HIGH) {
      midiOut.sendControlChange(45,127,1);
      delay(1000);
    }
  }
  if(digitalRead(buttonSix) == HIGH) {
    delay(10);
    if(digitalRead(buttonSix) == HIGH) {
      midiOut.sendControlChange(46,127,1);
      delay(1000);
    }
  }
  if(digitalRead(buttonSeven) == HIGH) {
    delay(10);
    if(digitalRead(buttonSeven) == HIGH) {
      midiOut.sendControlChange(47,127,1);
      delay(1000);
    }
  }
  if(digitalRead(buttonEight) == HIGH) {
    delay(10);
    if(digitalRead(buttonEight) == HIGH) {
      midiOut.sendControlChange(48,127,1);
      delay(1000);
    }
  }
  if(digitalRead(buttonNine) == HIGH) {
    delay(10);
    if(digitalRead(buttonNine) == HIGH) {
      midiOut.sendControlChange(49,127,1);
      delay(1000);
    }
  }
  if(digitalRead(buttonTen) == HIGH) {
    delay(10);
    if(digitalRead(buttonTen) == HIGH) {
      midiOut.sendControlChange(50,127,1);
      delay(1000);
    }
  }
  if(digitalRead(buttonEleven) == HIGH) {
    delay(10);
    if(digitalRead(buttonEleven) == HIGH) {
      midiOut.sendControlChange(51,127,1);
      delay(250); // shorter wait for AM/PM buttons
```

```
    }
   }
   if(digitalRead(buttonTwelve) == HIGH) {
     delay(10);
     if(digitalRead(buttonTwelve) == HIGH) {
       midiOut.sendControlChange(52,127,1);
       delay(250); // shorter wait for AM/PM buttons
     }
   }
   if(digitalRead(buttonThirteen) == HIGH) {
     delay(10);
     if(digitalRead(buttonThirteen) == HIGH) {
       midiOut.sendControlChange(53,127,1);
       delay(1000);
     }
   }
   if(digitalRead(buttonFourteen) == HIGH) {
     delay(10);
     if(digitalRead(buttonFourteen) == HIGH) {
       midiOut.sendControlChange(54,127,1);
       delay(1000);
     }
   }
   if(digitalRead(buttonFifteen) == HIGH) {
     delay(10);
     if(digitalRead(buttonFifteen) == HIGH) {
       midiOut.sendControlChange(55,127,1);
       delay(1000);
     }
   }

  if (lastpot[0] != -1){
   for (byte i = 0; i < 7; i++)
   {
    pot[i] = analogRead(i);
    cc = pot[i] / 8;
    if (lastpot[i] != cc) {

       midiOut.sendControlChange(midi_cc[i],cc,1);
       lastpot[i] = cc;
    }
     delay(50);
   }
  }
 }
```

2- Images

The *168 Hours* interface (Photo: Elise Windsor)

The intersection of Av. du Parc (L to R) and Rue Milton (Photo: Eric Powell).

The recording process, supervised by a helpful Triceratops (Photo: Eric Powell).

A screenshot of Ableton Live running the *168 Hours* session.

Appendix D: *Conclusion*

Map of Hochelaga's Encampment

La terra de Hochelaga nella Nova Francia. Giovanni Battista Ramusio, 1606.
British Library System number: 014880559 (Photo: Eric Powell).