YOHAM ORTIZ

Listening to the Language of the City: Understanding How Communities of Sounds Inform the Soundscape of New York City

Table of Contents

CHAPTER 1 - Understanding the Sonic Environment

Densely populated cities constantly bombard people with an array of sounds. These sounds encompass a wide audible frequency spectrum ranging from the low-pitched rumbling sounds heard at the surface of streets as subway trains traverse underground railways, to the high pitched squealing of taxi cabs' brakes. City sounds can be as loud as a jackhammer pounding on pavement, and as soft as a pigeon cleaning its feathers. Some sounds, like the wind blowing on trees, have a melodious cadence to them, while the screeching sounds of a subway train approaching a station are strident. Percussive sounds playing different rhythms and beats can be heard from peoples' shoes walking on sidewalks at various speeds, or the hammering of persons at work repairing a pipe in a manhole. Different tones and timbres add colors to the sounds permeating the city; the thick tones of a bus releasing the air out of its brakes, and the thin tone of one's own breathing are all part of this composition of sounds. In a single second of listening, one can hear hundreds of sounds. When listening for longer periods of time, city sounds become an unintended orchestration of audible information; the aggregate of sounds permeating the city has been termed the sonic environment, or soundscape (Schafer, 1977). This thesis investigates the information[1] that sounds emanating from urban environments convey to people living and traveling around cities.

Especially in densely populated cities like New York, where people interact with other people and objects at close proximity, sounds are at the forefront of the city experience. City sounds inform most dwellers and travelers of events unfolding in their environs, and influence how people perceive their surroundings using other available senses such as sight and touch. Environmental designers and city officials often try to control or eliminate undesirable sounds, or "noise" in cities by displaying signs such as No Honking, No Cellphones Please, and No Loitering. However, environmental designers and city officials seldom consider what we might call the "desirable sounds" permeating the city. This thesis examines the full range of sounds in the urban environment, not simply noise regulation. I explore design possibilities by making a link between understanding and categorizing the information conveyed by the sonic environment of cities, and acting to improve city living. Exploring the full spectrum of sounds in the sonic environment of the city may help environmental designers better understand the information these sounds convey, reflect upon how people comprehend them, and design better cities.

---

[1] A distinction needs to be made between the data conveyed by sounds, and how receivers interpret that data into information. When exclusively listening, two people can have vastly different interpretations of one sound. Person "A" may interpret a high-pitched chirp as a bird song, while person "B" may interpret the same sound as a car alarm. The difference in interpretation between person A and B may be due to a number of reasons including the similar frequency range, or pitch particular car alarms, and some bird chirps share. Another difference in interpretation may exist because persons "A" and "B" contextualize the sound very differently by having disparate memories, or emotions attached to high-pitched chirping sounds. In either case, the sound data is a constant and the information is a variable, in that, the data conveyed by a sound does not change, while the information interpreted from that audible data might vary according to the receiver.

I consider all sound to be audible data, because if one considers sound as data, then that data can be interpreted, yielding information. In order to explore the idea of sound as data that can be interpreted as information, I present music as an example of audible data that can convey different kinds of information. In order to explore the idea of how audible data is interpreted, I present the example of how humans listen to and comprehend spoken language, drawing upon theories of comprehension including mapping across domains, prediction, context and representation.[2] Of these, prediction emerges as a key element of language comprehension that can best be applied to understanding and anticipating patterns in the sonic environment.

This study focuses on the audible data conveyed by the sonic environment of New York City. I made field observations and recorded soundscapes in several locations in New York City. After careful consideration, I identified a specific location in Manhattan to make an extended sound recording: a second story window in the middle of the block of a busy mixed-use street in the Little Italy neighborhood. I selected this location both because of its iconic status in New York City's history, and because it represents the essence of the city today, with humans, vehicles, and other *anthrophonic*[3] sounds mingling with *biophonic* sounds. To record the sound I used a video camera, capturing video images together with the sound. I then was able to listen to the sound in isolation, view the images in isolation, or see and hear them together. This characteristic of the recording proved useful as a device for considering the interrelationship between aural and visual experience in the urban environment.

I decided to explore this soundscape recording in depth using techniques from sound engineering and musical composition. I used the software program Soundtrack Pro which allowed me to identify, isolate, and manipulate the audio and visual samples I was studying. I conducted three listening sessions during which I analyzed sounds, pitches, and duration of sounds and sought to identify the relationships these sounds have with the urban environment of Mulberry Street in New York City. In chapter 3, I share my reactions and experiences of watching and listening to this recording. Overall, I listened for different types of sounds traveling together in sound waves at particular moments, what I call *communities of sounds*.

This study is not based upon a scientific experiment or laboratory study. Rather it is exploratory research, intended to investigate an understudied subject within the field of urban studies and a topic that crosses multiple disciplinary boundaries. Using a variety of methods, I seek to develop new concepts as well as suggest design strategies and identify areas for possible interventions. My own experience as a composer and music producer in

---

[2] See, for example, Altman and Mirkovic, 2008.

[3] Pijanowski et al. (2011) developed a typology in which they group all sounds into one of three types: "biophonic" sounds which refer to sounds produced by non-human living organisms e.g., insect sounds, "geophonic" sounds refer to sounds produced by geophysical elements e.g., the sound of water streaming through a river, and "anthrophonic" sounds which refer to sounds produced by humans and things created by humans e.g., the sound of a car's engine.

New York City has also strongly shaped my approach as well as my writing. Throughout the thesis I draw upon my own experiences, observations, memories, personal reflections, and musical examples. By drawing on different academic disciplines and combining these with my own experience of living and moving around New York City, I suggest that understanding the information conveyed by the sonic environment of densely populated cities could contribute to designing better cities.

Jane Jacobs asserted that, “the way to get at what goes on in the seemingly mysterious and perverse behavior of cities is, I think, to look closely, and with as little previous expectation as is possible, at the most ordinary scenes and events, and attempt to see what they mean and whether any threads of principle emerge among them.” I am suggesting we also listen closely and attempt to hear!

CHAPTER 2 - Concepts and Terminology

I remember listening to the New York City subway as a child and trying to mimic the beat and the clanking sound as the wheels of the train clipped over the soldered track ends joining the rails together. The sound was loud! I always knew I was in the city when I heard that clan…clank…tararám…tararám...tararám …clan…clank and the loud squeak any time a train was approaching the station or on curved tracks. When I was a kid in the 1970's, subway trains sounded as if they were falling apart: rattle... rattle jolt…jolt, and then that loud squeak like a huge sea monster. When I stood under the elevated tracks, it sounded as if the whole thing was going to crumble down as the train went by- very scary, but exciting. When my family moved from New York City to other places like Dominican Republic or West Virginia, my older brother and I would laugh and joke about the sound of the New York City subway, with all its jolts and clanks. We identified New York City with the sounds of the subway trains. This was perhaps one of my earliest experiences in identifying a place by its sounds. I later realized that these sounds were conveying information.

Sound as Audible Data: The Example of Music

Music is one type of audible data with which most people are familiar. Audible music[4] conveys information through sound to its listeners. As a composer and music producer I'm interested in composing melodies, harmonies and forms[5] that tell a story, both through vocal and instrumental music. Melodies, harmonies and forms are the main ingredients that make music composition possible. The sequential order in which notes are placed and the duration of each note encompass the melody. The choice of how many and what notes are stacked on top of each other determine the harmony, while the duration and subdivisions of the composition encompass the form. The combinations of these elements comprise what is generally known as music. Lyrics are words that accompany the music.

These musical elements, in addition to the interpretation of the musicians that perform them, convey meanings and emotions, such that a song can tell a compelling story through its lyrics, through its music, or both. Lyrics in songs may convey a direct message by literally spelling out the intended meaning, or an indirect message through the use of metaphors and analogies. In the Beatles song " Blackbird," Paul McCartney uses a bird with broken wings as a metaphor. When asked, he explained that the song was about "black people's struggle in the southern states, and [he] was using the symbolism of a blackbird... It's not really about a blackbird whose wings are broken, you know, it's a bit more symbolic" (Douridas, 2002). A Google search turns up several internet forums focused on the question "what is the meaning of the song Blackbird," and respondents with very disparate ideas of the song's meaning. A consistent theme among all respondents is that the song is about liberation, but some interpret the song as being about youth liberation, while others relate it to being liberated by death, among others. The song's lyrics can assume many meanings.

---

[4] Audible music refers to music that is heard as opposed to read as is the case with notated music.

[5] In a general sense, form is the structure and sequential order with which musical compositions are constructed.

I am especially taken by the way instrumental musics, without the aid of lyrics, are able to communicate feelings of happiness, sadness, fear, intrigue and doubt. For example, no one associates Johann Sebastian Bach's "Toccata and Fugue in D" minor with being carefree, however Felix Mendelssohn's "Wedding March" conveys a happy feeling to most people. Music composers can intensify the amounts of happiness and sadness with *crescendos*[6], *diminuendos*[7] and other dynamics[8] effects. The ability to convey one's thoughts through this magical language of musical notes and sound textures is what inspired me to take on the study of music and its composition.

One of the ways music conveys emotions to listeners is through the use of chords, where two or more notes are played simultaneously. The first lesson I was taught when learning music theory was to recognize the sounds of major and minor triads. A triad in music theory is a three-note chord, in which the notes are stacked in thirds[9] from the root[10] of the chord to the highest note, which is a fifth[11]. The middle part, or harmony, of the triad is a major third when it is four notes (or steps) away from the root, and a minor third when it is three notes away. This middle part of the chord, or third, is imperative when determining the sound of the chord. Often musicians of the European tradition of music describe minor triads as sounding sad and major triads as sounding happy. Generally, songs in major keys are considered happy e.g., "Happy Birthday" often played in C major, and songs in minor keys are considered sad e.g., Beethoven's "Moonlight Sonata" in C# minor. However, when composers are looking to express thoughts and feelings that are more like shades of happiness, or sadness, or intrigue, or awkwardness, to inspire these emotions in listeners, they require more complex and sometimes unexpected melodies and harmonies.

Composers such as John Cage and Magnus Lindberg have employed sounds that come from objects that are not normally considered musical instruments in order to express a certain emotion. For example, Magnus Lindberg in his composition "Kraft" features stones, metallic scraps, and other unconventional instruments. Film composers and sound designers[12] emulate natural or abiotic sounds like wind, thunder, and rain in recording studios by striking, rubbing, and scraping an array of objects. Sound designer Ben Burtt in the animated film Wall-E creates the sound of thunder by striking and wobbling a metal sheet, and the sound of a gust of wind by dragging a cloth punching bag through a rug at various speeds to change the simulated sound (Wall-E DVD, 2008). Sound designers strive to express clearly the information that particular sounds are supposed to convey in a film.

---

[6] Crescendo is the standard term for gradually increasing loudness in music.

[7] Diminuendo is the standard term for gradually decreasing loudness in music.

[8] In audible music dynamics are degrees or changes of loudness in music. Also in music notation words or signs that indicate changes of loudness are called dynamics e.g., piano, forte, crescendo, diminuendo.

[9] A third is an interval. An interval is the distance in pitch between two notes. A third is four steps of separation when it is major and three when it is a minor third.

[10] The root of a chord is the fundamental note upon which a chord is constructed.

[11] A fifth is the distance between two notes that have seven steps of separation.

[12] Sound designers: are persons that specialize in designing virtual and real sound environments for film, television and theater.

Most importantly, they are interested in the emotions and reactions these sounds produce in the people watching and listening. The core purpose of composers and sound designers is to convey certain information by manipulating sounds- musical and otherwise. In contrast, everyday sounds permeating an urban area, the sounds of the sonic environment, convey their own set of information without necessarily being manipulated to suggest certain meanings.

Communities of Sounds and the Soundscape Concept

Sound travels in waves just like water in the ocean. Each ocean wave that washes onto a beach drags objects it collects while traveling through the ocean. A wave can transport, in addition to water and sand, algae, a branch, or a dead fish, while seconds later a different wave in the same area might haul a completely different set of objects- a shoe, a box, or a crab. Much like ocean waves wash objects onto the beach, sound waves[13] transmit sounds[14] that are produced from different sources at different times and carry them together to the listener in what I call a *community of sounds*. I define a community of sounds as an amalgam of individual sounds from different sources that are transmitted together in a sound wave at a particular moment of the sonic environment. Listening to a moment of the sonic environment of a city street block, a community of sounds may include the sounds of a car's idling engine, shoes clopping on a sidewalk, and a loud jackhammer pounding on pavement, while seconds later on the same street block a different community of sounds may contain the sound of a train rattling and wheezing as it approaches a station, a person sneezing and a dog barking. In any given area, two separate sound waves can transmit two vastly different communities of sounds at different listening moments.

I am particularly interested in investigating groups of sounds produced at a particular moment of the sonic environment rather than individual sounds, because there is always more than one sound emanating from urban environments- and for that matter, any sonic environment. Individual sounds emanating from sonic environments are always perceived in combination with other sounds. In addition, sounds are altered by these other sound-producing sources in their environs and by the echo and reverberation produced by sound reflecting off other objects in the environment. Listening to a moment of the sonic environment allows me to categorize and distinguish what combination of sounds produce a certain sound texture, the relationship between these individual sounds and what kind of information a particular sound texture conveys to people. Analyzing communities of sounds, rather than individual sounds, enables me to subdivide the sonic environment into measurable portions of sound textures and patterns.

---

[13] A sound wave is a mechanical wave that caries audible data.

[14] Sound is "a succession in time of varying- intensity waves of pressure" (Kryter, 1994; pp.2). For example, loudspeakers produce sound by moving outward and pushing air particles forward, then quickly retracting and creating a vacuum and rarefaction of air particles. This movement creates waves that travel through the air and may stimulate a human ear with the same outward-inward motion- in which moment a sound is heard (Kryter, 1994).

I decided to name the types of sounds that travel in a sound wave a *community* of sounds because much in the same way that ecological communities share characteristics among their members, and are distinct in some respect from the larger society within which they interact and exist, a community of sound carries a group of sounds that travel and interact in a sound wave, and form a distinct part of a larger body of sound called the sonic environment. The Oxford English Dictionary defines community as used in the ecological sense as "a group of organisms growing or living together in natural conditions or occupying a specified area." If one recomposed this definition to define a community of sounds it would read, " a group of sounds interacting and traveling together in a particular sound wave."

As one can visually distinguish individual ocean waves when standing at a beach, one can audibly distinguish the boundaries between communities of sounds. I came to this realization by standing in the ocean with water up to my waist. I noticed how waves would crash into my body as they made their way to the beach, stretch out into the sand, and then retract into the ocean while a new wave made its way to the beach, as if starting a new cycle. As I stood there, facing the ocean, I could feel the waves that were making their way towards the beach pushing me back, while at the same time, the waves heading back into the ocean pushed me forward. It almost felt as if the waves were in a tug of war as they moved water with force back and forth. As each wave pushing me back became weaker, the wave force that was pushing me forward became stronger. A similar experience happens in the city as communities of sounds bombard people's ears from all directions, some louder than others as if the sounds were competing for sonic space.

Later that same week I was standing on the northeast sidewalk of a two way street: Broadway, between 121st and 122nd, in New York City. In this section of Broadway railways divide the northbound and southbound sides of the roadway. The subway comes up from underground to the street level, then gradually up into an elevated railway structure that continues on from 125th until 135th street. When viewed from the northeast or southwest sidewalk of Broadway, one can see the stone wall that separates the railways from the street gradually growing taller as Broadway goes downhill heading northbound from 122nd street to 125th; from 125th to 135th the edifice that holds the train tracks becomes an iron viaduct. Standing there, the swooshing sound of the cars' and buses' tires rolling up (north) and down (south) the street, and the occasional loud roar of the train traversing the area somehow reminded me of the time I spent at the beach; something about the way these sounds would come in and out of phase made me feel as if I was listening to ocean waves. Traffic would move faster and slower as vehicle drivers anticipated traffic lights and avoided ramming into swerving taxicabs with squeaking brakes. Then for a short moment the sound of rolling tires and roaring engines would subside, and I would be able to hear the chatter of people walking by. Seconds later the chatter would be interrupted by another stream of vehicles gusting through producing a Doppler effect[15]. Then, every so often, like the blast of a big wave breaking, the sound of the train would overpower all sounds for a

[15] Doppler effect is an increase (or decrease) in the frequency of sound, light, or other waves as the source and observer move towards (or away from) each other. The effect causes the sudden change in pitch noticeable in a passing siren (OED).

moment then fade away as the train receded to the distance. These short interims when loud sounds would subside and softer sounds could be heard allowed me to clearly sense the auditory boundaries between the communities of sounds, that permeated this area, in the same way that I had felt the distinction between one ocean wave and the next in the ocean.

The more detailed listening I did, the more the whole experience became analogous to my time standing in the ocean. The sound of the streaming traffic heading north made me feel as if I was being pushed forward, while the stream of traffic heading south felt as if it was pushing me back. The rhythmic pattern slowed down, moved faster, then slowed again, conducted like music by the timing of the traffic lights on 122nd and 124th streets. As I stood on this street block I noticed that this rhythmic pattern helped create a clear distinction between the successions of sounds that would temporally occur in this area; it created clear boundaries between these communities of sounds. The sound of the synchronized stream of traffic was overpowered every few minutes by the community of sounds produced by the roaring, rattling, wheezing and squeaking sounds of the subway resurfacing from the underground railway onto the elevated tracks. The sound of the train became even louder when the uptown and downtown trains would go by at the same time, one train on its way out of the tunnel as another train was on its way in.

Listening to moments of the soundscape of Broadway I heard hundreds of communities of sounds emanating from this urban environment. Communities of sounds created sound textures that were mixed, overlapped and morphed into other sound textures. If I were able to freeze and sustain the sounds in a moment of the sonic environment of Broadway, it would sound like a harmony composed of hundreds of notes, all at different levels of intensity. At different moments the order and intensity of each note would change, thus changing the harmony. At a particular moment of listening to the train resurfacing from the underground railway, I distinguished four loud types of sounds; roaring, rattling, wheezing and squeaking emanating from the subway. These four sounds (roaring, rattling, wheezing and squeaking), emanating from different parts of the train and rails, were part of a bigger and more complex combination of sounds produced at that particular moment. These sounds included vehicle horns honking, car brakes squeaking and all the consequent echoes- some sounds louder than others. This particular moment of the sonic environment composes a community of sounds. Seconds later, the train continues its trajectory, other communities of sounds are produced, and earlier communities of sounds vanish.

A *community of sounds* is the *soundscape* at a particular moment. The soundscape encompasses all sounds that permeate an area. Composer and environmentalist R. Murray Schafer in his 1977 book *The Tuning of the World* first coined the term soundscape, defining it as “any portion of the sonic environment regarded as a field of study” (Schafer, 1977: 274). Schafer’s definition raises the question of how we define the word environment. The Oxford English Dictionary defines environment as the area surrounding a place or thing: the environs, surroundings, or physical context. Spaces such as a room in a person’s home or an outdoor area where a person is walking are environments. Abstract constructions such as virtual spaces created with computer software are also considered environments.

In other words, environment is a word widely used to describe the space where living and non-living things exist and interact.

The use of the word environment allows the term soundscape to be malleable, with applications in the natural sciences as well as musical composition. Schafer's (1977) study of the relationships between living beings and their sonic environment resulted in the modern study of acoustic ecology, also called soundscape studies. Schafer does not limit the use of the term to describe natural environments; he also uses it to describe abstract constructions including musical compositions and tape montages. For example, "Presque rien, numéro 1," the 1970 composition by Barry Truax and Luc Ferrari, is stylistically referred to as a soundscape composition (Roads, 2001; Paynter, 1992). In the field of urban design, Michael Southworth (1969) has used the term *city sounds* similarly when describing the array of sounds permeating an urban area.

Etymologically the word soundscape is a compound of the words *sound* and the suffix *scape.* Both terms have ambiguous meanings. The Oxford English Dictionary has three definitions for (audible) sound:

> Sound is the sensation produced in the organs of hearing when the surrounding air is set in vibration in such a way as to affect these; also, that which is or may be heard; the external object of audition, or the property of bodies by which this is produced. Hence also, pressure waves that differ from audible sound only in being of a lower or a higher frequency.

Sound can be used interchangeably to mean any of these definitions. When we talk about the sound-scape, it is unclear to which definition of sound we are referring. The suffix *scape* has similarly been used with slightly different meaning in words such as landscape and cityscape. J.B. Jackson (1984) uses two general definitions for the suffix scape- one is the collective aspect of an environment while the other suggests organization and systems.

Following Schafer, I use *soundscape* to refer to the sonic environment and any portion of it regarded as a field of study. I am particularly interested in his definition because it relies on human-inquiry from the perspective of the human listener and researcher. In the context of my study, which is a reflexive, theoretical, and exploratory in nature, these elements prove to be crucial when describing my observations.

In order to describe the elements that compose the sonic environment succinctly, I adopt some of the language commonly used in the soundscape literature by thinkers and writers including, Pinjanowski et al. and Southworth. Krause introduced the term *biophony*, referring to "the collective sound vocal non-human animals create in each given environment" (Thompson, 2011). Schafer introduced the musical term *keynote* when referring to "those sounds [in the soundscape] which are heard by a particular society continuously or frequently enough to form a background against which other sounds are perceived." Other terms Schafer introduced include *soundmark*, which is a derivative of *landmark*, referring to "a community sound which is unique or possesses qualities which make it specially regarded or noticed by the people in that community," and *schizophonia*, when referring to the split between an original sound and its electroacoustic reproduction (Schafer, 1977).

Pijanowski et al. (2011) developed a model to identify the interactions and relationships between particular entities in the soundscape. They consider the three primary elements of sound propagation: *sender, propagation and receiver* (SPR). The term *sender* refers to entities producing sounds (e.g., engine idling, chatter of people, chirping of birds), *propagation* refers to mediums through which sound travels (e.g., water, air, a building's wall), and *receiver* refers to the entities that receive and interpret sound signals (e.g., a person, animal, microphone on an audio reproduction device) (Pijanowski, 2011). In general, the introduction and refining of terms has helped disciplines studying the soundscape to better categorize sounds permeating the sonic environment.

Listening to the sonic environment of New York City can be overwhelming, with sounds emanating from all directions. At first glance all these sounds seem cacophonous. However, as one listens more acutely one may start to notice patterns and rhythms created by all these sounds' interactions, including sound reflections, or echoes. Experiencing the waves in the ocean and comparing them to communities of sounds helped me classify some of the components of the sonic environment of New York City. The communities of sounds of the city are composed of trains, cars, buses, and people's chatter, with traffic lights conducting cars and pedestrians to stop or go at calculated time increments composing part of the patterns and rhythms. Listening to, identifying and investigating the information conveyed by these communities of sounds is a first step towards understanding the relationships and interactions people have with the sonic environment of cities.

Communities of Sounds in Urban Soundscapes

In this study, I categorize sounds according to the *source* that produced them in an urban setting- more specifically, which types of sounds characterize the soundscape of a particular area. For instance, in the area of Central Park South on 59th street, between Fifth and Sixth Avenue in New York City, numerous sounds permeate the area, including cars, buses, and people talking. However, the sound of horse-drawn carriages traversing 59th Street at Central Park South distinguishes this area from any other area in Manhattan. Horses' hoofs striking the ground, the clatter of reins, and the sound of the bits against horses' teeth, accompanied by the crackling sound of the carriages' shocks and wheels amidst the sounds of vehicle traffic defines the soundscape of this area of Manhattan. The voices of carriage drivers can be heard pitching their services to passersby. On busier days, the chatter of people can be heard- mostly tourists waiting in lines for carriage rides or negotiating carriage ride fees with the drivers. Street vendors selling everything from souvenirs to food line up along the wall that divides the south of Central Park from the sidewalk on 59th street, creating a soundscape that sounds more like an international airport terminal than a street block. On any given day, an array of languages is heard in this area. People speaking German, Arabic, French, English and other languages get all mixed up in the sonic environment, making it difficult to distinguish one language from the other, although at times a comment, laughter, a giggle, an "oh my God!," or the cry of a child will pop out of the amalgam of human utterances. Right across the street from the horse carriages, on the South Side of Central Park South, hotels and residences' doormen blow their metal pea whistles as they signal taxicabs to stop and pick up patrons. All these sounds emanating from all different sources characterize the soundscape of 59th Street and Central Park South.

Except for the sounds of horse-drawn carriages, most of the sounds that permeate Central Park South are commonly heard elsewhere in Manhattan, including traffic, and people's chatter. Although some mounted police patrol other areas of Manhattan, at Central Park South the sounds and sights of the carriages together produce a uniquely distinguishable audiovisual experience particular to this area- sonorously creating a *soundmark* (Schafer 1977), and visually a landmark. The contrast between foreground and background sounds is what makes soundmarks noticeable in the sonic environment of a place.

I noticed that the only way I could recognize the soundmark of Central Park South was by listening to the sound of the horse-drawn carriages accompanied by what I at first thought were background sounds, including the sound of traffic and people chattering. But as I listened closer, I noticed the sound of the horse-drawn carriage seemed no louder than what I was calling "background sounds." Moreover, the sounds that I considered background sounds put the sound of horse-drawn carriages into the context of this particular soundscape. The background sound gave the sound of horse-drawn carriages a sonorous dimension, like the background of a painting. These sounds along with the sound of horse-drawn carriages traveled and communed together in *communities of sounds*.

Audible data- whether it be the clank…tararám of a subway train, the music or lyrics of a familiar song, or the clop of a horse's hoof- can convey information. Communities of sounds can give the listener (receiver) information about the sources (senders) of sounds permeating an area, as well as information about the area itself. But in order to decipher the information that a community of sounds is conveying, the receiver must be listening.

CHAPTER 3 – Twenty-four Minutes on Mulberry Street

I made a twenty-four minute audio/visual recording of Mulberry Street with three goals in mind: 1) share and reflect on the experience of listening to the city from a fixed position, 2) identify the sounds that characterize Mulberry Street, and recognize how they stand out in contrast to other sounds in the sonic environment, 3) study the importance of context when it pertains to interpreting the audible data conveyed by communities of sounds.

Setting and Method

Located in the Little Italy area of Manhattan, Mulberry Street is a well-known place associated with the history and folklore of New York City. This narrow one-way street has appeared on maps of Manhattan since at least 1755, was once part of the core of New York's infamous Five Points, and was featured in the book *"How the Other Half Lives,"* by urban reformer Jacob Riis. In 2011, Mulberry Street is bustling with restaurants, most specializing in Italian food. People transiting the area are a combination of visitors from other parts of the city and the world, as well as local residents, some of whom have lived in the area for more than fifty years. The loudest and busiest time of the year for the Mulberry Street area is the Feast of San Gennaro, when the area is closed off to vehicular traffic and transformed into a lively street festival from September 15th until September 24th.

I recorded on the block between Hester and Grand Streets. I collected audio/visual data on the temperate sunny Saturday of March 26, 2011 at 2:05 pm. I recorded twenty four minutes of audio/visuals with a JVC GZ-MG330H hard drive camcorder, positioned in a 2nd floor apartment window facing Mulberry from the west side of the street. I assembled the camera on a tripod and situated it in the open window in such way that I could record a video of the street from the inside of the apartment, and the microphone of the camera was able to pick up the sounds that permeated the area. Positioning the camera inside the apartment allowed me to capture the audio and visual experience one would have when looking out the window of this 2nd floor apartment. Sitting inside an apartment by a window is a common way New Yorkers experience the soundscape of the city.

I decided to use a camera set on a fixed position because I felt it was important to establish the *senders* in the soundscape as a variable, and the *receiver* as a constant*;* in this case the receiver was the camera. This arrangement would allow me to 1) measure sound levels in the soundscape from the perspective of one position, and 2) contrast and compare the array of sounds permeating the area without having to compensate for the distance of a moving receiver. The distance between the *sender* and the *receiver* plays a major role in how a sound signal is perceived by the receiver. For example, a bird chirping at a distance of two feet from someone's ear is significantly louder than the same bird chirping at the same volume fifteen feet away- assuming that the acoustic environment remains the same in both scenarios. The camera at a fixed position simulates how an individual would experience the soundscape while standing in a fixed spot, as opposed to moving around the city.

The visual scope of the camera covered an area of about fifty-four square feet. One could see the east side of the street including Restaurant Mambo Italiano directly across the street, the sidewalk alongside the restaurant, and three quarters of the way across the street; the sidewalk directly below the window where the camera was positioned and the quarter of the street immediately next to that sidewalk are not visible in the frame. On the east side of the street two parked cars remained visible throughout the twenty-four minute recording. North of the parked cars, on the right side of the camera shot, appears a fire hydrant painted with the colors of the Italian flag- green, white and red. The west side of the street is not visible, but the hustle and bustle of D'Angelo's Restaurant on the first floor directly below the window could be heard, along with the sounds of cars, trucks, and people transiting the road way and sidewalk at the northern and southern end of the block.

Figure 1- Mulberry Street

Three Listening Sessions

After recording the twenty-four minutes of audio/video of Mulberry Street I imported the audiovisual files into Soundtrack Pro, and analyzed the audio with a time, frequency, and intensity measurement program application called a sound spectrogram. This technology allowed me to graphically monitor frequency (or pitches), and intensity (soft to loud sounds) changes at particular moments of the soundscape. I undertook three listening sessions. In the first session I listened and watched the full recording from beginning to end. Although the visual aspect of the video influenced part of what I heard, I specifically listened for keynote sounds that characterized the soundscape of Mulberry Street on that Saturday afternoon in particular. Having been present at the time of the recording I was partly influenced by the events I watched and heard while recording[16]. In analyzing the recording I noticed four predominant and distinct sounds in this area: road plates clanking, vehicle brakes screeching, the repetitive sales pitch of a man standing outside a restaurant, and people laughing and talking. The clanking of two sets of steel road plates were positioned outside the visual scope of the camera, but having heard and seen vehicles impacting road plates before I was able to recognize this sound without actually seeing the

[16] The relationship between an original sound and its electroacoustic reproduction is what Schafer terms Schizophonia. He argues, "original sounds are tied to the mechanism that produced them. Electroacoustic sounds are copies and they may be restated at other times or places" (Schafer, 1977; pp.273). Walter Benjamin also discusses this concept in his essay "The Work of Art in the Age of Mechanical Reproduction" (Benjamin, 1968).

plates. The screeching of cars' and trucks' brakes occurred on camera as well as out of view. The doorman of Restaurant Mambo Italiano stood on the side walk across the street in front of the restaurant calling out vociferously, and with a strong Italian accent, attempting to entice passers by to come in and enjoy the "lunch special and live music." He was within the visual scope of the camera. The chatter and laughter of people dining or strolling were primarily out-of-view.

The sequences and patterns created by these four sounds along with other less prominent sounds provided Mulberry Street with a joyous, yet paradoxically, also stress inducing, soundscape on this Saturday afternoon. In a time frame of twenty four minutes I counted sixty-four clanking sounds from cars' and trucks' tires impacting the loose road plates, 119 screeching brakes, thirty-four noticeable bursts of laughter by restaurant patrons and passers by, and a constant stream of vocal sounds from the Restaurant Mambo Italiano's doorman. Additionally, random comments in an array of languages, including English, Italian, and Chinese would pop up from groups of people walking up and down the street and standing on the sidewalks. The occasional clattering of porcelain from inside neighboring restaurants could be heard. The high-pitched squeaking from the restaurant door across the street produced *portamentos*[17] that slid up when the door was swung open, and down when the door was swung closed.

Sound levels often play a key role when distinguishing one sound from another in a soundscape. Read from a meter with a range from ∞ to +6dB, most sounds in the soundscape of this area of Mulberry Street fell in the range between -30dB and -20dB. The loudest sound in the recording was produced by the impact of a car's tires on one of the road plates at -2.3 dB. This range from -30dB to -20dB does not mean that some of the more high-pitched sounds, like screeching car brakes, were not strident. Some of the screeching car brakes registered as soft as -27dB, while others registered at -7.6 dB; both were clearly distinguishable.

However, I noticed that the four predominant sounds on Mulberry Street were distinguishable not because they were louder than other sounds, but because they each had very distinguishable characteristics. The road plates stood out to me because of their abrupt percussive sound. At first, the sudden clanking sound felt interruptive, and unrelated to the soundscape of Mulberry. Later as I listened on, I expected the sound to occur momentarily, and thus accepted it as part of the rhythms and patterns of the street. I also anticipated the high-pitched, annoying wince of screeching brakes as cars traversed Mulberry. Although this is a commonly heard sound in New York City, the strident high pitch is bothersome to me every time. I had a different reaction with the monotonic utterances of the doorman of the restaurant. I unconsciously made an effort to understand the content of what he was saying, "lunch special, and live music." For me, the fact that he was uttering words in a language I understood rather than any other sounds influenced how I distinguished the sound of his voice from other sounds. Other human sounds were laughter and giggles from random people, some louder than others. These utterances I distinguished from others because of the special connections laughter and giggles have to

---

[17] Portamento is a manner of singing, with the voice gliding gradually from one note to the next.

having a joyous time (Gorman, 2011). The sound of laughter and giggles especially livened the sonic environment of Mulberry. These four sounds in particular influenced my listening experience of Mulberry Street on that Saturday afternoon.

The clanking road plates presented an auditory puzzle at first: where was the sound coming from, I wondered, and could I determine it simply by listening to what was on the recording? In fact, not only was I able to identify the approximate positions of the road plates by listening to the directions from which sounds were emanating, I also began to notice how listening to several instances of the sound made me aware of how a "fast" clank sounded (indicating a fast-moving vehicle) versus a "slow" clank (a slower-moving vehicle). One of the two sets of road plates was positioned at the southern end of the block proximate to the intersection at Hester Street, and the other was positioned at the north end of the block proximate to the intersection at Grand Street. As cars trundled over the southern most road plate two consecutive clanking sounds would occur; the impact of the front tires of the car on the road plate, followed by the impact of the back tires. From my position at the 2nd floor window, I could see neither the northern nor the southern road plates. However, I was able to determine if the car was traveling at a fast or slow speed by hearing the time lapse between the front and back tires as they impacted the plates.

After I became familiar with the sound patterns of the vehicles tires impacting the plates, I began to anticipate what sound would come next. When cars bumped over the first set of road plates at a speed averaging ten miles to fifteen miles per hour they were more likely to reach the second set of road plates quicker, thus making the time lapse between the clanks of the southern road plates and northern road plates shorter. This action produced a faster rhythmic pattern "ka-clank" rather than the slower rhythm "clank…clank." The quicker rhythmic pattern sounded to me like potential danger: pedestrians needed to be more alert crossing the street because a fast car, not willing to cede the right of passage, was approaching. The slower pattern indicated that a car was approaching more slowly, therefore giving me the impression that it was willing to cede the right of way to pedestrians.

As I got accustomed to hearing the clanking plates, I felt they were part of a rhythmic pattern that pulsated between the people's laughter and giggles, then overlapped by the repetitive words of the restaurant doorman "lunch special and live music." Then, sporadically, a long screech! Some screeches were very short and at times would occur intermittently while other were longer upward glissandos. Although I was unable to see the road plates, I noticed the screeching brake sounds would occur right before the sound of the plates. The laughing sounds would occur randomly, but at times it sounded like a person was laughing at something in a conversation. Although I could not hear the other person in the conversation, I could tell by the pauses between the laughter. Although I was visually familiar with Mulberry Street, the interaction between all these sounds informed me about the events unfolding on Mulberry Street on that Saturday afternoon. I could only see the restaurant doorman in the view of the camera. The assessment I made about the remaining three sounds was based solely on what I heard.

Sampling and Looping Soundscape Moments

In the second listening session, I experimented with the recording using two techniques known as “sampling” and “looping.” Sampling is the process by which a part of a sound recording is extracted. Looping is a process in which a sample or section of recorded sound is repeated over and over again. These techniques are often used in music production to superimpose repeated parts of one song into another song. For example, the two first measures of the original sound recording of Steely Dan’s song “Black Cow,” was sampled and looped into the song “Deja-Vu” by the rap group Lord Tariq and Peter Gunz. By looping (or repeating) Tariq and Gunz were able to extend a five seconds sample of the song “Black Cow” for approximately three and a half minutes- the duration of “Déjà vu.”

I made forty-seven short sound samples from different parts of the original audio/video recording- the shortest sample being nineteen milliseconds and the longest twenty seconds and six milliseconds. I selected samples composed of communities of sounds that characterized the sonic environment of Mulberry Street. These communities of sounds had different durations and represented different moments of the Mulberry soundscape. They can be observed visually using a spectrogram; Figures 2 and 3 show two different communities of sounds recorded at the same location on Mulberry Street nine minutes apart.

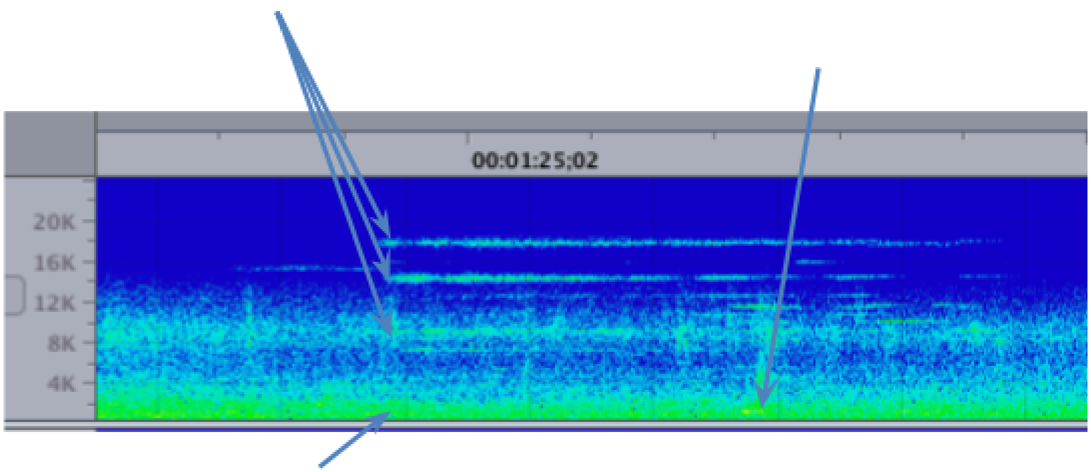

Figure 2 The spectrogram shows an eight second moment of the soundscape of Mulberry Street, or a community of sounds. In this sample from the twenty-four minute recording of Mulberry Street, the sound of brakes squeaking, people’s chatter and an unidentified clank show greater intensity or loudness than other sounds permeating the area. Intensity or loudness is indicated by the light green color.

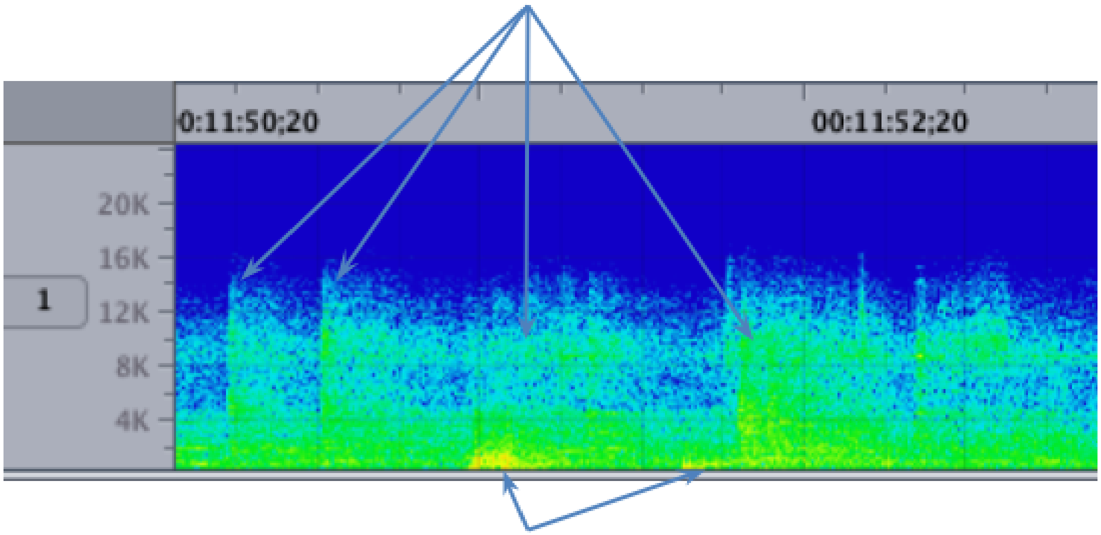

Figure 3: A two second moment of the soundscape of Mulberry Street, or a community of sounds, recorded at the same position as the sample shown in Figure 2. This sample was taken from the recording nine minutes after the sample shown in Figure 2. Here a different community of sounds is present; the rattling of a truck and road plates are the predominant sounds in the soundscape.

First, I listened to each sound sample individually. Then I looped each sample and listened again. As I listened to these individual loops I started to perceive them outside the context of the soundscape of Mulberry Street. The *community of sounds* in each loop became their own compositions with their own rhythmic pulses, accents, tones, textures and meanings. After listening to the isolated loops several times, some of the otherwise identifiable sounds became unidentifiable. The information conveyed changed when I listened to them in a different context, but the types of sounds, or data expressed remained the same. The sample of road plates impacted by car's tires when looped sounded like an industrial printer. The sample of people's chatter became a wavy sound that could barely be recognized as conversation. The sample of a car's tires impacting one of the road plates taken from a different part of the recording sounded like a snare drum in a hip-hop beat. However samples that included the voice of the doorman at Restaurant Mambo Italiano could always be clearly distinguished from all other sounds, even when looped and played outside the context of the Mulberry Street soundscape. I attribute this distinction to the special relationship humans have with spoken language. Humans and are often drawn towards trying to comprehend spoken language when they hear it, especially if they understand that particular language. Words rather than sounds that are not spoken language play a key role in human speech recognition (Scharenborg, 1983), so despite all the sounds permeating Mulberry Street, I may have unconsciously tried to find meaning in the spoken language I was hearing.

Listening to Communities of Sounds in Different Contexts
In the third and final listening session, I listened to the complete Mulberry Street soundscape recording again, and noted changes in the way I perceived the sound samples I isolated in the second listening session as they played in the context of the original audio/visual recording. I noticed that when the sections I had looped played, they stood out from the rest of the recording. Although I was listening to the original recording, at times it sounded as if the original recording was interrupted by the samples I had looped earlier. The *communities of sounds* that I had sampled and looped conveyed a different set of information when they were isolated. The experience of listening to the original audio/visual recording of Mulberry Street after having listened to samples and loops of various parts changed my perception of the twenty-four minute recording. The parts that I had sampled stood out; it felt as if I had shared a special experience with these communities of sounds in a different context. The samples popped out at me.

Listening to the recording of Mulberry Street gave me a chance to reflect on and investigate a moment of the sonic environment of New York City. Despite the array of sounds emanating from Mulberry Street I was able to identify four keynote sounds that characterized this urban soundscape; road plates clanking, vehicle brakes screeching, restaurant doorman's spoken language, and people laughing and talking. I examined the different communities of sounds composed of different combinations of these four sounds and other sounds in the sonic environment. While listening to samples and loops of parts of the soundscape of Mulberry Street I noticed that understanding the information conveyed by the audible data of these four sounds depended on the context in which these sounds were heard. The context in which a sound is heard provides a backdrop from which one can assess not only the source of the sound, but also the environment from which the sound is emanating from. Most human listeners consciously and unconsciously choose how they want to interpret audible data. But how do humans cognitively achieve the transformation of data into information?

CHAPTER 4 - Interpreting the Soundscape: Theorizing How Communities of Sounds May Convey Information to Individuals and Groups

Isolating a sample of recorded sound from Mulberry Street, listening to the sample in a loop, and then listening back to the original recording, led me to investigate further how one comprehends audible data expressed by communities of sounds. In order to comprehend the information conveyed by the soundscape, we parse. Parsing is a commonly used term in the field of psycholinguistics to describe how humans comprehend language. Parsing refers to the action of resolving a sentence into its component parts and analyzing their syntactic roles (OED). Cognitive scientists and linguists such as Ray Jackendoff (1991) have conducted extensive studies suggesting that humans parse in order to comprehend audible data such as spoken language and music.

One way to understand parsing in the context of communities of sounds is to compare a community of sounds to a grammatical sentence. A sentence relies on words to gain meaning, while a community of sounds is comprised of different types of sounds. In a sentence, every individual word has meaning. For example, the word "look" or "go." When arranged in a sentence, words in combination convey full thoughts and relay information in a more specific manner. For example, "Look at that car," or "Go to the store." In a community of sounds, each individual sound contributes audible data that influences how a receiver interprets that particular community of sound into information. One or more sounds traveling together in a group, heard together in a moment or in a brief sequence as a community of sounds, may reveal more information about the audible data heard. For example, the sound of a bird chirping along with the sound of ocean waves may lead one to picture a seagull. Also, if we listen to the sound of an idling engine with a loud rattle, we may assume that the engine is old or damaged.

Listening to the sonic environment without the aid of sight can reveal a lot of information about a place. I went back and listened to an eight second and twenty-one millisecond sound sample from the recording of Mulberry Street- this time without the visual aspect of the video. Although the fact that I had watched the video previously influenced my auditory perception, I noticed that I parsed the audible information conveyed by the soundscape nonetheless. The first thing I listened for was the type of sounds I was hearing. I wanted to get an idea of place and time. I knew beforehand that I was listening to Mulberry Street at 2:18 pm on a Saturday, however the isolated eight seconds and twenty-one milliseconds sound sample did not make this so clear. As I started to parse the communities of sounds I was able to contextualize the information conveyed by the audible data emanating from Mulberry Street. Different combinations of sounds, or communities of sounds, including the four keynote sounds I examined in chapter 2, each provided a piece of information about the place. As I put these pieces together I started to form a mental image of Mulberry Street. The sound of tires rolling against pavement, roaring engines, and screeching brakes communicated "vehicular traffic." Adults laughing and talking and children crying communicated "people on the sidewalk or on the street." The sound of porcelain clanking together and the voice of a man saying, "lunch special" communicated "restaurant." The more I listened, the more I found myself classifying the sounds as loud, soft, strident or short, and trying to find some kind of rhythmic pattern in the way these sounds popped, cracked, whistled, and hummed against each other as in a musical composition. Moreover, I found myself trying to predict the outcome of some of the successions of sounds I was hearing.

As I watched and listened to the playback of the twenty-four minutes of audio/video of Mulberry Street, by parsing the audible data I was able to predict certain actions outside the scope of the camera, and establish a precedent in terms of what sounds to expect next, based on the information the soundscape conveyed to me. For example, anytime I heard the sound of tires impacting road plates, I began to anticipate that a car or truck was about to enter the camera frame. The patterns of sound also informed me that there were two sets of road plates laid on the street. In addition, the fact that these sound patterns always occurred from south to north (Hester Street to Grand Street) was concurrent with the fact that this was a one way street heading north, rather than a two way street. So, by parsing the types of sounds, or communities of sounds, I was receiving from the soundscape, I extracted specific information about Mulberry Street.

In an effort to contextualize the audio data I was receiving, I tended to create temporal patterns in my head that would function like grammatical phrases; the phrases were separated by pauses between the end of one idea, or community of sounds, and the start of the next. These pauses inbetween communities of sounds- like imaginary commas and periods- enabled me to better understand the relationship between all the sounds permeating the area, as opposed to hearing the Mulberry Street soundscape as one big cacophony of sounds.

How Humans Interpret Audible Data as Information: The Example of Language

Receiving audible data from the soundscape to one's ear, identifying which communities of sounds from that audible data to focus on, then interpreting the audible data of the communities of sounds into information, and finally reacting to that information, involves a specific set of cognitive processes- some of which I will not focus on in this study. Extensive comparative studies have been made by psycholinguists such as Aniruddh D. Patel and Stephen Handel to ascertain how the brain categorizes linguistic, nonlinguistic and musical sounds. Patel suggests that, "sound category learning is a fundamental aspect of human cognition" (Patel, 2008). Handel posits that the mechanisms that cognitively help us process linguistics and music "depend on a mental framework of *learned* sound categories" (Handel, 1989). The soundscape bombards people with audible data comprised of the full spectrum of audio frequencies sounded at different levels of loudness. If humans did not categorize this audible data into a framework of learned sound categories, as well as associate them to a source, this array of audible data would be incomprehensible.

In order to understand how humans make sense of the audible data in communities of sounds I think it is important to acknowledge the similarities in how humans express and receive information from each other through spoken language. Often the audible data conveyed by communities of sounds is not considered language, unless it includes spoken language, or Morse code. However, the variables of perceiving spoken language and communities of sounds are somewhat similar i.e., there is a *sender*, a *propagation* system and a *receiver*, who interprets audible data into information and has a reaction- including a null or neutral reaction. Some of the general principles that explain spoken language are consistent with those that enable humans to comprehend non- linguistic audible data received from the soundscape. Altman and Mirkovic (2008) posit four principles that underpin adult language comprehension: mapping across domains, prediction[18]**,** context[19] and representation[20].

Altman et al. (2008) consider these four principles in the context of the relationship between language, events, and attention to the external world. I suggest that these four principles can be applied when ascertaining how humans comprehend the soundscape. The principle of *mapping across domains* suggests that structure in language has significance only insofar as it covaries[21] with, and enables predictions of, structure in the external world (Altman & Mirkovic, 2008). If we apply the principle of *mapping across domains* to soundscape comprehension, one might theorize that a moment of listening to the soundscape (or community of sounds) has significance only insofar as it covaries with, and enables predictions of, subsequent moments about to unfold in the sonic environment. In the example of the vehicle sounds on Mulberry Street, the audible data emanating from the front tires of a vehicle hitting the road plates only gained significance when I as the *receiver* could use that data to predict subsequent events. The sound of a second clank of the road plates, from the back tires hitting the same object, provided structure, or a context to the information conveyed by the initial sound. In this case, the variables that covary are the audible data in the communities of sounds and the events that are unfolding in the area.

Altman and Mirkovic (2008) use the term "prediction" when referring to prior learning. They examine prediction on the premise that "knowledge emerges through experience and is distributed within a dynamical system across a representational substrate supporting spreading activation" (cf. Elman et al., 1996; Rogers & McClelland, 2004; Rumelhart & McClelland, 1986). In terms of comprehending the information conveyed by the soundscape, predicting on the basis of the current and prior context gives persons acting as *receivers* an opportunity to anticipate not only subsequent sounds, but also the subsequent

---

[18] Prediction- "knowledge" of the language can be operationalized as the ability to predict on the basis of the current and prior context (both linguistic and, if available, non-linguistic) how the language may unfold subsequently, and what concomitant changes in real-world states are entailed by the event structures described by that unfolding language. Such predictions constitute the realization of the mapping between sentence structures and event structures (Altman 2008).

[19] Context- Concurrent linguistic and nonlinguistic inputs, and the prior internal states of the system (together comprising the context), each "drive" the predictive process, and none is more privileged than the other except insofar as one may be more predictive than the other with respect to the subsequent unfolding of the input (Altman 2008).

[20] Representation across time: The representation of prior internal states enables the predictive process to operate across multiple time frames and multiple levels of representational abstraction. The "grain size" of prediction is thus variable, with respect to both its temporal resolution and the level of representational abstraction at which predictions are made (Altman 2008).

[21] Covary- to change together with something else so as to preserve certain interrelations unchanged (OED).

events that are about to unfold. This can be crucial when trying to navigate a place that requires a high sense of alertness e.g., crossing a busy street.

Prediction in Action: Crossing the Street

Crossing the street is one of the most common activities in navigating a densely populated city, yet it is also one of the most attention demanding. When crossing a street, pedestrians have to use whatever perceptual senses they have available to guide them from one side of the street across to the other side. Prediction is part of the mechanism that helps pedestrians and drivers navigate city streets safely. By mere observation one cannot tell what predictions pedestrians make as they cross the street. Considering the vast amounts of stimulation provided by the environment of densely populated cities, one can assume that pedestrians are having to predict many different scenarios as they act on their decisions to move, stop, look, or run while crossing the street. For example, pedestrians predict when negotiating the right of way with drivers to decide who will cede the right of way. This process requires the driver and the pedestrian to try to predict every possible outcome, and the negotiations sometimes become heated when both parties claim they have the right of way. More than often these exchanges do not involve spoken language, they are resolved by displaying visual cues like signaling with a hand, or audible cues like the driver racing the engine, or honking the horn to get the attention of the pedestrian.

In the audio/video recording of Mulberry Street, individual pedestrians crossed the street in view of the camera a total of sixty four times. Reviewing the video recording, I began to notice how they crossed the street, specifically what direction, if any, they looked before entering the roadway or attempting to cross. Forty-six pedestrians faced exclusively towards the south while crossing, ten towards the north, and eight turned their heads both ways. In addition, I noticed that all pedestrians crossing alternated the position of their heads quickly by switching between facing forward and facing towards the south, north, or both ways. Based on the body language I observed in the video, these pedestrians seemed as if they were trying to anticipate, or predict any dangers. One of the reasons fifty four out of sixty four pedestrians crossing the Mulberry Street chose to face south, before and while crossing, was likely because Mulberry Street is a one way street with traffic heading north bound. More than likely, the pedestrians predicted that any vehicles that could potentially harm them on impact would be coming from the south. Some of the pedestrians who faced exclusively towards the south or turned their heads both ways accompanied the remaining ten crossing pedestrians who had faced exclusively towards the north before and while crossing the street. More than likely, the ten that faced exclusively north relied on their crossing partners to check for any incoming traffic- which in this case means some of these ten pedestrians may have predicted that their partners were trustworthy. In areas where sidewalks are extremely crowded, such as Times Square in Manhattan, I have noticed that when crossing the street, often people rely on others to lead them across by following a person or following a group of people crossing the street. I have observed this while walking across streets, and while standing at an intersection while driving waiting for pedestrians to cross the street.

The soundscape of a particular area also provides auditory cues that help pedestrians anticipate or predict events that may unfold in their way. In the audio/video of Mulberry Street, I noticed four women stepping off the sidewalk into the street. The transition from standing on the sidewalk where there is exclusively pedestrian traffic to stepping into the roadway where there is vehicular traffic seemed to change their level of alertness. Initially, the women were standing in front of a parked car on the west side of the street, as the one woman leading the group quickly alternated her head left to right as she got further from the sidewalk. Suddenly, the sound of a loud clank could be heard on the recording, from outside the field of view. I noticed that all four women stopped abruptly and the three that were the furthest from the sidewalk quickly focused their sight towards the south, while the one closest to the sidewalk just stopped along with the others, without seeming to devote her attention to anything in particular. Three seconds later the high-pitched squeaking sound of car brakes appears on the recording. Then I saw the four women in the video, along with another group of eight people, quickly cross the street. One second later, I saw a slow moving SUV fill the lower portion of the camera frame, as shown in Figure 4.

Figure 4-(Left) Camera shot of four women crossing Mulberry Street. (Right) Four seconds later a vehicle enters the scope of the camera.

As far as I can tell, the clanking sound alerted the women of a vehicle coming, which in turn seems to have alerted them to look south. I wasn't able to identify what produced the clanking sound, but at that particular moment it must have meant something to those four women crossing Mulberry Street- because of their abrupt body movements after the sounds. As these women quickly faced towards the south, they made no comments to each other, as if they comprehended what those audible cues were conveying to them. They only seemed to be confirming the message with their eyesight by turning towards the south and seeing that a vehicle was coming towards them. Audible cues play a key role when one navigates city streets, however, not everyone is capable of assessing them.

Studies conducted at the Deshon Army Hospital expose some of the experiences that people who have lost their hearing have as they relate to the world (Knapp, 1948). The studies describe patients that have suffered sudden deafness as having a difficult time maintaining the feeling of being part of the world i.e., the world had lost its motion, was less demanding and seemed timeless. The absence of important auditory *danger cues* made these patients experience great anxiety when in crowds and traffic. As a result, most suffered deep depression, lack of alertness, and paranoia (Southworth, 1969). This study is not suggesting that all deaf people suffer from these ailments. Most members of the Deaf community view deafness as experiencing live in a different way, rather than having a disability (Ladd 2003).

Representation: Types and Tokens

Whatever senses are used, the ability to recognize audible cues in the soundscape emerges from the *representations* humans create for and from different experiences. Humans identify and categorize concurrent sounds by comparing them to sounds they've already experienced in the past, for example, the sound of the ring of a rotary phone. If one had never heard the ring of a rotary phone, then one would not associate the sound of it ringing to the telephone. The sound would be associated to something else, or it would be considered a novel unfamiliar sound. Similarly, in representational theories of mind this kind of thinking process is believed to occur within a cognitive system of *representation*. We access "reality" through representation (Laurence & Margolis, 2007).

In philosophy the distinction that separates an abstract concept from a visible or tangible representation of an object is called a *type-token distinction* (Peirce, 1931-58) For example, the particular watch that I am wearing on my wrist is a *token* of the *type* of thing called a "wrist watch." Type-token distinctions can be applied to describe how individuals and groups make mental representations of sounds when they *receive* them. For example, the particular sound of my car's idling engine would be the *token*, while the *type* of sound would be called "the sound of an idling engine." Type-token distinctions help individuals and groups of people classify types of sounds homogenously i.e., most people would have the same mental representation of what type of sound is permeating an area. Consequently, the more individuals in a group have the same mental representation of particular sounds, the more they will have a homogenous interpretation of those sounds, thus making *type-token distinctions* in the context of the soundscape distinguishable. For example, if a rotary telephone rings in a room full of adult people in the United States, more than likely everyone in that room would identify that particular sound as a *token* of the *type* of sound known as a "telephone ring" (Krulwich, 2011).

When a group of people typifies a certain *community of sounds* by the same *token*, that community of sounds acquires a shared meaning to that particular group of people- in which case type-token distinctions, in the context of the soundscape, become more apparent. Moreover, a sound can have a different mental representation and meaning for different groups of people. For example, the Coqui (*Eleutherodactylus*), which is a small frog endemic to Puerto Rico, is distinguished for making a loud chirping "koh-kee…koh-kee" sound that can be heard at night in all areas of the island. For most Puerto Ricans the Coqui has become an icon of the Puerto Rican (or Boricua) culture, and its sound is considered a sleeping aid for most in the island. The chirping sound of the Coqui is so much a part of the Puerto Rican (Boricua) culture, that it is often used metaphorically in songs as the voice of the Puerto Rican people, e,g, the song "El Coqui" by Luis Guillermo Ortiz . However, in Hawaii the Coqui is considered to be at best annoying and at worst a major noise disturbance. Noise complaints about the Coqui chirping became so aggressive that the Hawaiian government has taken action to eradicate these small frogs from the islands (Lowe, 2000). In this case, it is safe to assume that most Puerto Ricans and Hawaiians attribute vastly different mental representations and meaning to the chirping of the Coqui frog.

One of the reasons most Puerto Ricans are not bothered by the Coqui, is that they grew up hearing the frog's chirping sound. Most Puerto Ricans long for the "singing" of the Coqui when they relocate elsewhere. By contrast, Coquis were accidently brought to the Hawaiian Islands during the late 1980's, most likely in a plant shipment from Puerto Rico (Lowe, 2000). Hawaiians, who were unfamiliar with the chirping "koh-kee" sound of the Coqui, thus considered the sound unpleasant and bothersome (Lowe 2000). Rather than considering the Coquis' chirping sound as a *token* of the *type* "the voice of the people," Hawaiians consider this chirping sound a *token* of the *type* "invasive alien species" (Lowe 2000).

When many people share the same type token relationship with a sound, that sound can be used to convey a particular message. *Anthrophonic* sounds are often purposely expressed in a soundscape to give people specific information. Civil defense sirens, which include air raid sirens, tornado sirens, tsunami sirens, fire sirens/whistles, flood sirens, weather sirens, and time/curfew sirens, have been sounded to specifically alert groups of people of dangers to come. Different groups of people have learned the tones, timbres and sounded time increments, specific to each siren and the meaning of their alert message, or *danger cue*. Some of the accounts of World War II survivors express the key role air raid sirens played during war. Muriel Simkin a worker in a munitions factory in Dagenham, England during the war, shared one of her experiences:

> We had to wait until the second alarm before we were allowed to go to the shelter. The first bell was a warning they were coming. The second was when they were overhead. They did not want any time wasted. The planes might have gone straight past and the factory would have stopped for nothing. Sometimes the Germans would drop their bombs before the second bell went. On one occasion a bomb hit the factory before we were given permission to go to the shelter. The paint department went up. I saw several people flying through the air and I just ran home. I was suffering from shock. I was suspended for six weeks without pay. They would have been saved if they had been allowed to go after the first alarm (Simkin, 1987).

However, in order for the audible data produced by the air raid sirens at Dagenham to have meaning, the town's people had to be taught previously what each sound produced by these sirens meant e.g., first ring "be alert," second ring " run to a bomb shelter." One of the ways people were educated about what the sounds of the sirens meant was through informative pamphlets distributed by the Ministry of Home Security to the town. These pamphlets provided detailed information about "how to survive an air raid" (World War II Today). Even in places where air raids never occurred but were a threat during World War II, people were provided with training and information about what specific sirens sounds meant. For example, Police quarters at 300 Mulberry Street housed the New York City air raid warden during WW II (Diehl, 2010). During this time of war the National Education Department of New York issued the "*Air Raids, Blackouts, First Aid: A Handbook for Civilians in Wartime*" which included information on what to do in the event an air raid siren was rung. The audible data produced by these sirens conveyed specific information to people *receiving* communities of sounds from the soundscape of particular areas. In this case, these sirens were deliberately rung to trigger a specific behavior from a targeted group of people who had been trained to react a certain way when they heard the sound of that particular siren.

In the air raid example, a type-token distinction was previously established before the sirens were rung i.e. the tone, timbre and pitch contour[22] of a particular siren in a town would be the *token* of the *type* of thing known as a siren sound. Before the sound of sirens was introduced as a warning mechanism in the 1900s, some sirens were even considered musical instruments, and part of the mechanism of some pipe organs (Cagniard de la Tour, 1819). However, sounds that convey specific information about events unfolding in certain areas are not always produced with the intention of triggering a specific behavior from people. Often sounds produce the same reaction in a group of people without deliberate instructions on what the sound means- in which case it is safe to assume that this particular group has a similar mental *representation* of what that particular sound means in that particular context. For example, the rumble, screeching, and sizzling sound of the subway train in New York City often means to New Yorkers that a train is making its way into the station. Even if they are standing at street level unable to see the subway train underground, most New Yorkers can recognize the particular sound the train makes when it is braking to stop at a station. This phenomenon is particularly apparent during the morning rush when groups of people are running down the stairs to the subway station from street level because the sounds of a train can be *heard* (and not seen) arriving to the station- and they want to catch the train.

Other sounds express a more ambiguous meaning. Referring back to the example of the four women crossing Mulberry Street, three out of four of these women in the video recording reacted promptly to the loud clank sound by stopping and swiftly turning their heads towards the direction the sound was coming from, while the fourth woman turned towards the opposite direction. These observations prompted me to ask two questions; what did the information conveyed by that loud clank mean to these four women? Why did three out of these four women have the same reaction? I proceeded to examine that segment of the audio/video closer. As the four women step off the sidewalk and onto the street, they seem very calm. Their walking pace is slow and cautious, but nonchalant. When the loud clank sounds, all four women stop abruptly. Regardless of what direction they are looking at the time the clank sounded, their body gestures suggested an apprehensive demeanor. Even as they later cross the street they seem frantic and hurried, looking towards the south as if to reassure themselves that it is ok to cross at that time. As far as I can ascertain, the loud clank startled the four women and made them more alert of their actions, exclusively because of the volume of the sound. Aside from loudness, it didn't seem to me as if the women knew right off hand what that sound meant- as the people running for the subway know about the train approaching the station from repeated experience related to the everyday routine of commuting.

---

[22] Pitch contour refers to a pattern of continuous variation in pitch; a graphic representation of this (OED).

By applying the principles of mapping across domains, prediction, context and representation when listening to familiar and unfamiliar sounds, listeners assign particular meaning to the communities of sounds they experience. In some cases, interpreting audible data may be aided by instructions about what information a certain sound is intended to convey, as in the case of the air raid siren. In densely populated cities, people are bombarded with sounds from every direction. Shared interpretation of the information conveyed by these sounds is often reflected in the patterns of daily life for people living and traveling around the city. I believe that the concept of modifying the soundscape, or influencing the way people interpret certain communities of sounds could be applied to urban design.

CHAPTER 5 - Conclusion

Millions of people live, work, and visit Manhattan every day. Over the past century, in order to accommodate its growing population, city officials and environmental designers have continuously expanded Manhattan's infrastructure vertically: building skyscrapers upwards and excavating for infrastructure and transportation downwards. People live in apartment buildings with neighbors living above them, beneath them, and on every side. In parts of Manhattan such as Columbus Circle, people walking at ground level may have four subterraneous floor levels of people traversing subway stations below them. Even when people think they are by themselves in Manhattan there is usually someone they can't see, but may be able to hear, nearby- like a neighbor on the other side of an apartment wall.

With so many people in such a small space, "a seemingly chaotic or random constellation of stimuli or events" (Wohlwill, 1974: 134) happens in Manhattan from all orientations, all the time. An incredible network of carefully orchestrated norms, rules, signals and design brings order to the cacophonous chaos, and makes the island a livable space. One common type of signal is the street sign, which is a visual signal. Street signs are posted all over the city to inform residents and visitors of the rules of their environs- No Standing, No Parking, Tow Away Zone, Pedestrian Traffic Only- and keep the city flowing smoothly. Some of these visual signals, or signs, are intended to regulate undesirable sounds- usually known as "noise;" No Honking, No Cellphones Please. In New York City, sounds are also regulated by official noise regulations that indicate the volume and nature of noise that is considered acceptable, and when noise can be considered disruptive or menacing. Finally, audible cues not only communicate but also contribute to city sounds, like the bell sound that rings as an elevator rises or descends through a building's floors, the siren of an ambulance, the beeping sound as a truck is in reverse gear. Unlike silent street signs, these audible cues often startle people into alertness. Schafer (1977) poses the question, "why must an acoustic attention-getter always be abominable?" Most of these sounds are unnecessarily high-pitched, loud and strident. Many of them could be modified to have a softer tone.

If communities of sounds in the soundscape convey information, and certain sounds such as the air raid siren, can be manipulated to propagate information, and if further it may be possible to predict how groups of people react to sounds, then it is a great missed opportunity to ignore the potential of harnessing sound as a tool in designing urban environments. Regulating only "noise" fails to recognize the potential the remainder of sounds in the soundscape of the city poses. Indeed, "The general acoustic environment of a society can be read as an indicator of social conditions which produce it and may tell us much about the trending and evolution of that society" (Schaffer 7).

I am not suggesting that more sounds be incorporated into the soundscape of densely populated cities, which many people would argue are already loud enough! I am suggesting that the sounds that are already permeating the city soundscape should be studied in such way that they can be categorized based on the type of information they convey and the patterns of behavior they produce in people. Some sounds could be explicitly associated with certain actions or behaviors. Then, just as individuals have been encouraged to obtain instructions from visual cues such as street signs, people could be taught to decipher the information in sounds, such that sounds become audible signals. Sounds that currently blend into the soundscape would then stand out with their own meaning, much like the samples that I looped stood out when I reinserted them into the recorded soundscape of Mulberry Street.

Audible data and visual signals are not exclusive, nor are they independent of each other. Humans commingle all available senses to perceive information in their environs (Allen & Schwartz, 1940), so that when humans listen, other senses like sight, smell, and touch influence how they perceive sound. Southworth (1969) in “The Sonic Environment of Cities,” studies how auditory perception relates to vision. He focuses on how *anthrophonic* sounds influence people’s perception of space when comparing the visual to the auditory. He also suggests that the blind are forced to listen more acutely to their surroundings than the sighted because the images the blind build from the sonic environment are more generalized than those built by the sighted. Southworth argues that one reason for this lack of detail is that “the sonic environment is less informative and the ear is far less effective than the eye in gathering information.” Although I disagree[23] with Southworth’s suggestion that the sonic environment and the ear provide less information than the eye, or sight, I do agree that a blind person’s mental representations of audible data may be vastly different than a sighted person’s. Often the blind use auditory cues and acoustic wayfinding when traversing physical spaces in order to move around without the aid of visual cues.

One of the techniques of acoustic wayfinding is *echolocution*, which involves detecting objects in an environment by sensing echoes from objects. In this technique the blind produce sounds such as tapping with a cane or vocal clicking with the tongue. They are able to use these sounds to create a mental image of their environs by interpreting the echoes that they receive back from objects in that particular environment. Using this technique, people without the aid of visual cues can detect both objects that are at close proximity, and objects beyond a distance of thirty feet- even an object as small as a softball (Sutter, 2011).

Shaping the ways people comprehend the language of the soundscape may require unconventional ways of listening, and even communicating with the soundscape. When the blind use echolocution, they essentially ask the soundscape questions; the community of sounds they receive as the sound reflects off the objects around them is the soundscape

[23] The Southworth study states that in terms of relying on sound to traverse a space, “even a light rain or a layer of snow can transform a known sonic city into a foreign one” (Southworth, 1969). However, one can argue the same of sighted persons if visibility in a city became difficult due to fog, or rain. In either case a person would be forced to resort to other available senses to enable predictions about the events unfolding. It would be almost as if one was watching a movie with the audio and subtitles turned on, and suddenly the audio would drop out (or be turned off). More than likely, one would immediately resort to the subtitles to comprehend the dialog of the movie. In other words, humans commingle all available senses to perceive information in their environs (Allen & Schwartz, 1940). They can use this information to make predictions and establish relationships between the information conveyed by their environs, including the soundscape, and the concurrent events unfolding.

answering back. Echolocutioners use this answer to create a mental image of their environs, and identify specific objects. I believe echolocution should not be used exclusively by the blind. Sighted people could also learn and use it as an alternative to relying primarily on visual signals. This may serve not only to create a more balanced perceptual experience when traversing and living in densely populated cities, it may also make cities safer. Traffic engineer Hans Monerman argues that in the absence of visual signaling on the road, pedestrians and drivers are forced to be more cautious as they are walking or driving, rather than just following the instructions of a particular sign (Vanderbilt 28).

If environmental designers pay closer attention to the audible data in the soundscape, the way people comprehend the information conveyed by this data, and how groups and individuals react to this information, they may identify city sounds that could be modified or eliminated. Just as urban landscapes are visually shaped and designed, urban soundscapes could be balanced and harmonized by increasing or decreasing the sound level of existing communities of sounds, and by adding new sounds that may enhance or attenuate these. Designers could, in a way, purposefully compose communities of sounds in the city. I believe these compositions could help make a better city.

References

Ahead of its time: *A clocktower press anthology* (1997). In McLean D. (Ed.),. London: J. Cape.

Air raids, blackouts, first aid: A handbook for civilians in wartime (1942). In International Workers Order (Ed.), New York: National Education Dept., International Workers Order.

Allen, F., & Schwartz, M. (1940). The effect of stimulation of the senses of vision, hearing, taste, and smell upon the sensibility of the organs of vision. *The Journal of General Psychology*, pp. 105.

Altman, G. T. M. (2002). Learning and development in neural networks: The importance of prior experience. *Cognition*, 85, 43–50.

Altman, G. T. M., & Mirkovic, J. (2009, 2008). Incrementality and prediction in human sentence processing. *Cogntive Science*, 583. DOI: 10.1111/j.1551-6709.2009.01022.x

Benjamin, Walter (1968) Illuminations. Schocken Books. New York.

Bijsterveld, K. Sage Publications, Ltd. (Feb., 2001)). The diabolical symphony of the mechanical age: Technology and symbolism of sound in European and North American noise abatement campaigns, 1900-40. *Social Studies of Science*, Vol. 31(No. 1), pp. 37-70.

Bijsterveld, K. (The University of Chicago Press on behalf of The History of Science Society (December 2009)). Mechanical sound: Technology, culture, and public problems of noise in the twentieth century. *Isis,* Vol. 100(No. 4), pp. 942-943.

Cagniard de la Tour, C. (1819). *"Sur la sirène, nouvelle machine d'acoustique destinée à mésures les vibrations de l'air qui contient la son"* (on the siren, new acoustic machine to be used for measuring the vibrations of sound in air). Annales de Chimie et de Physique, vol. 12, pp. 167-171.

City noise (1930). In Laird D. A., Brown L. I., Pendray G. E. (. E., Henry J., Dennis E. B.,Jr and Brown E. F. (Eds.),. *New York: New York Noise abatement commission, Department of health, city of New York.*

Corbin, A. (1998). *Village bells: Sound and meaning in the 19th-century French countryside.* New York: Columbia University Press.

Cox, V. J. (1990). *An investigation of the origin of bells in the western Christian church based upon a study of musical instruments used within worship services at major religious shrines of Europe and the Middle East* (500 B.C.E.-800 C.E.): The parthenon, the Jewish temple, Hagia Sophia, and St. Peter's. Thesis (Ph.D.)--Florida State University, 1990).

Diehl, L. (2010). *Over here!* : New York City during World War II. New York: Smithsonian Books: Harper Collins.

Dienes, Z., Altman, G. T. M., & Gao, S. (1999). Mapping across domains without feedback: A neural network model of transfer of implicit knowledge. *Cognitive Science*, Vol.23 (No.1), pp. 53-82.

Douridas, C. (2011). KCRW: *New ground interview with Paul McCartney may 25, 2002*. Retrieved 12/1, 2011, from http://www.kcrw.com/music/programs/gz/gz020525paul_mccartney

Elman, J. L., Bates, E. A., Johnson, M. H., Karmiloff-Smith, A., Parisi, D., & Plunkett, K. (1996). *Rethinking innateness: A connectionist perspective on development*. Cambridge, MA: MIT Press/Bradford Books.

Feeling is believing, or landscape as a way of being in the world. (2007). Geografiska Annaler. Series B. *Human Geography*, 89(3), 219-231.
Feld, S. (2004). *The time of bells. 2* [sound recording]. S.l. : Vox Lox.
Flatow, I. (2011). NPR: *Listening to wild soundscape.* Retrieved 12/1, 2011, from http://www.npr.org/2011/04/22/135634388/listening-to-wild-soundscapes
Flint, A. *Wrestling with Moses: How Jane Jacobs took on New York's master builder and transformed the American city.* New York: Random House.
Flyvbjerg, B. (2006). From Nobel Prize to project management: Getting risks right. *Project Management Journal*, 37(3), pp. 5-15.
Foregrounding sound: New (and old) directions in sound studies. (2008). *Cinema Journal*, 48(1), 115-117.
Fundamentals of noise and vibration (1998). In Walker J. G. (. G. (Ed.),. New York: London: E & FN Spon.
Gilluly, R. H. (Society for Science & the Public (Mar. 18, 1972)). Noise: The unseen pollution. *Science News*, Vol. 101(No. 12), pp. 189-191.
Goldstein, E. *Cognitive psychology: Connecting mind, research, and everyday experience*. Australia: Belmont, CA: Wadsworth Cengage Learning.
Grimaldi, F. M. (1665). *Physico mathesis de lumine, coloribus, et iride, aliisque annexis libri duo Bologna* ("Bonomia"), Italy: Vittorio Bonati,.
Gunderlach, J. (Association for Preservation Technology International (APT) 2007). Sound: Exploring a character-defining feature of historic places. *APT Bulletin*, Vol. 38(No. 4), pp. 13-20.
Handbook for acoustic ecology (1999). In Cambridge Street Records (Ed.). Burnaby, B.C. : Cambridge Street Records.
Handel, S. *Listening: An introduction to the perception of auditory events*. Cambridge, Mass.: MIT Press.
Harvey, M. E., Frazier, J. W., & Matulionis, M. (Oct., 1979). Cognition of a hazardous environment: Reactions to buffalo airport noise. *Economic Geography*, 55(4), pp. 263-286.
Hillery, G. A. (1968). *Communal organizations; a study of local societies*. Chicago, University of Chicago Press.
Jackendoff, R. (Winter, 1991). *Music Perception: An Interdisciplinary Journal*, Vol. 9(No. 2), pp. 199-229.
Jacobs, J. (1961). *The death and life of great american cities*. New York: Random House.
Jones, H. H., & Cohen, A. (Association of Schools of Public Health (Jul., 1968)). Noise as a health hazard at work, in the community, and in the home. *Public Health Reports* (1896-1970), Vol. 83 (No. 7), pp. 533-536.
Jones, H., 1954-. (2006). *British civilians in the front line: Air raids, productivity and wartime culture, 1939-45*. Manchester; New York : Manchester University Press.
Knapp, P. H. (1948). "Emotional aspects of hearing loss". *Psychosomatic Medicine*, 10, 203-222.
Knudsen, V. O., 1893-1974. (1978). In Harris C. M. (Ed.), *Acoustical designing in architecture*. New York: Published by the American Institute of Physics for the Acoustical Society of America.
Kryter, K. D. (1994). *The handbook of hearing and the effects of noise: Physiology, psychology, and public health*. San Diego: Academic Press.

Ladd, P. *Understanding deaf culture: In search of deafhood*. Clevedon, England: Multilingual Matters.
Laurence, S., & Margolis, E. (2007). The ontology of concepts—abstract objects or mental representations? *Noûs*, 41(4), 561--593.
Lowe S., Browne M., Boudjelas S., De Poorter M. (2000). *100 of the world's worst invasive alien species: A selection from the global invasive species database*. The Invasive Species Specialist Group (ISSG), a Specialist Group of the Species Survival Commission (SSC) of the World Conservation Union (IUCN).
Noise control code (1972). *New York: City of New York, Dept. of Environmental Protection*.
NYC Department of City Planning. (2007). *New York City bicycle lane and trail inventory*. No. PTCP06G00.05). New York, NY: NYC Department of City Planning, Transportation Division Member of New York Metropolitan Transportation Council.
Orlando, P., Perdelli, F., Cristina, M. L., & Piromalli, W. (Springer (Oct., 1994)). Environmental and personal monitoring of exposure to urban noise and community response. *European Journal of Epidemiology*, Vol. 10(No. 5), pp. 549-554.
Patel, A. D. (2008). *Music, language, and the brain*. New York: Oxford University Press.
Paynter, J. (1992). *Encyclopedia of government and politics, volume 2*. London New York: Routledge.
Peirce, C. S. (Ed.). (1953-58). *Collected papers of Charles Sanders Peirce* (Hartshorne and Weiss (ed.) Cambridge, MA: Harvard University Press.
Peterson, J. A. (2009). The birth of organized city planning in the United States, 1909-1910. *Journal of the American Planning Association*, Vol. 75(No. 2), pp. 123.
Physiological effects of noise (1970). In International Symposium on the Extra-Auditory Physiological Effects of Audible Sound (Boston,Mass.) (Ed.), New York, Plenum Press.
Pijanowski, B. C.; Villanueva-Rivera, L. J.; Dumyahn, S. L.; Farina, A.; Krause, B. L.; Napoletano, B. M.; Pieretti, N. ((March 2011)). Soundscape ecology: The science of sound in the landscape. University of California Press on Behalf of the American Institute of Biological Sciences, *BioScience*. Vol. 61(No. 3), pp. 203-216. Retrieved from http://www.jstor.org/stable/10.1525/bio.2011.61.3.6
Pinker, S., (1995). *The language instinct*. New York: Harper Perennial.
Psychotherapy; *a course of reading in sound psychology, sound medicine and sound religion.* (1908).
Rettinger, M., (1977). *Acoustic design and noise control*. New York, NY: Chemical Pub. Co.
Roads, C. (2001). *Microsound*. Cambridge, Mass.: MIT Press.
Rogers, T. T., & McClelland, J. L. (2004). *Semantic cognition: A parallel distributed processing approach*. Cambridge, MA: MIT Press.
Rumelhart, D. E., & McClelland, J. L. (1986). *Parallel distributed processing: Explorations in the microstructure of cognition (vol. 2)*. Cambridge, MA: MIT Press.
Schafer, R. M. (1992). *A sound education: 100 exercises in listening and sound-making*. Indian River, Ont., Canada: Arcana Editions.
Schafer, R. M. (1994). *The soundscape: Our sonic environment and the tuning of the world*. Rochester, Vt.: United States: Rochester, Vt.: Destiny Books ; United States : Distributed to the book trade in the United States by American International Distribution Corp.
Schechter, S. L. (Oxford University Press (Winter, 1978)). The concorde and port noise

complaints: The commerce and supremacy clauses enter the supersonic age. *Publius,* Vol. 8(No. 1, The State of American Federalism, 1977), pp. 135-158.
Schmelzkopf, K. (American Geographical Society (Jul., 1995)). Urban community gardens as contested space. *Geographical Review*, Vol. 85(No. 3)
Simkin, J. (1987). *Voices from the past*: The blitz Spartacus Educational Publishers.
Sound in the age of mechanical reproduction (2010). In Strasser S. (Ed.),. Philadelphia, Pa.: PENN - University of Pennsylvania Press.
Southworth, M. F. (1967). *The sonic environment of cities*. Cambridge: Massachusetts Institute of Technology.
Disney (Producer), & Stanton, A. (Director). (2008). Wall-E DVD: *Ben Burtt special animation sound design: Building worlds from the sound up.* [Video/DVD] USA: Pixar Animation Studio.
Sutter, J. D. (2011). Blind man uses his ears to see: *What's next CNN*. Retrieved 12/1, 2011, from http://whatsnext.blogs.cnn.com/2011/11/09/blind-man-uses-his-ears-to-see/
Thiessen, G. J. (1976). *Effects of noise on man*. Ottawa : National Research Council of Canada, NRC Associate Committee on Scientific Criteria for Environmental Quality.
Thompson, C. (8/01/2011). *Clive Thompson on how man-made noise maybe altering earth's ecology*. Retrieved, 2011, from http://www.wired.com/science/planetearth/magazine/16-06/st_thompson
Thompson, E. A. (2002). *The soundscape of modernity: Architectural acoustics and the culture of listening in America, 1900-1933*. Cambridge, Mass.: MIT Press.
Tough, R., & MacDonald, G. D. (University of Wisconsin Press (Feb., 1965)). The new zoning and New York City's new look. *Land Economics*, Vol. 41,(No. 1), pp. 41-48.
U.S. Census Bureau. (2010). Retrieved from http://www.census.gov
Vanderbilt, T. (2008). The traffic guru. *The Wilson Quarterly (1976-)*, 32(3), 26-32.
Watt, H. J. (. J., 1879-1925. (1917). *The psychology of sound*. Cambridge: Cambridge, University Press.
Wetzel, L. (2011). *Type and tokens*. Retrieved 11/30, 2011, from http://plato.stanford.edu/archives/spr2011/entries/types-tokens
Wirtz, P., & Ries, G. (Nov. 1992). The pace of life - reanalysed: Why does walking speed of pedestrians correlate with city size? *BRILL, 123*(1/2), p. 77-83.
World War II Today. (2011). *How to survive an air raid*. Retrieved 11/30, 2011, from http://ww2today.com/how-to-survive-an-air-raid