CODA - Sound Urbanism

Michael Phaff

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This Thesis Proposal is presented to the Faculty of the Department of Architecture School of Architecture and Construction Management Kennesaw State University Atlanta, Georgia

By
Michael C. Phaff

Thesis Summary:
This thesis addresses how sound influences a pedestrian in the urban atmosphere and proposes a set of experiences inspired by music. The research of this thesis addresses connectivity, mobility, and identity through dynamic physical and auditory landscape, challenging the contemporary approach to the present typical urban design of linear mobility and affixed aesthetics.

Approved by:
Internal Advisor 1
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This thesis addresses how sound might influence a pedestrian in the urban atmosphere and proposes a set of experiences inspired by music.
The interstate connector was once a really exciting and cutting edge concept for Atlanta. It celebrated a vehicular lifestyle and addressed movement in and around the city with the development of I-75, I-85, and I-285. The lack of connectivity in the Midtown area is divisive as it limits travel from one side of the Connector to the other and ruins the local atmosphere and exchange of ideas. Connecting across this sixteen lane barrier is imperative to the future success of the city of Atlanta. As society moves towards a more sustainable environment focused in pedestrian and public transit, the city needs to take another exciting architectural position on future developments. There are about ten ways to cross the connector, eight of which are focused for cars. Only two of these options are pedestrian friendly with wide sidewalks, reduced traffic noise, and create a sense of safety to cross sixteen lanes of highway. One of these two pedestrian friendly routes is a tunnel under the Interstate Connector near Georgia Tech University. The other end of the tunnel was gated off with no access to the university. There is only one, reliable, pedestrian friendly way to cross the highway in a two mile stretch. This is a major problem in the Urban Fabric.

This thesis will explore sound in the solution to crossing the vast highway. There is currently a proposal for a minimal approach pedestrian bridge connecting the Home Park and Midtown neighborhoods as extensions of 15th Street. This bridge is a critical location as the gateway to the city from the North. The East end of the bridge flows toward the arts district of the city and Arts Center MARTA Station for access to public transit. Building such a noise polluted area with heavy traffic through most times of the day, addressing those in a natural progression to designing the space, however, the current proposal almost ignores the development of space inspired by sound and music to create not only a bridge and gateway image for the city, but a place to gather as a public amenity. The proposal provides the efficient connection across the highway to access public transit in a pleasing manner while respecting the fabric of the city. Coda is a musical concept referencing the beginning of the musical piece and the end as a satisfactory close. This concept is architecturalized by using the urban fabric to close the connection of the city at this 15th Street location, referring to the past. With this proposal, sound of the highway is not ignored as a condition but used in the pedestrian experience. Through research of resilient materials and sound, soundscape people into the project and develops a music inspired landscape appropriate for the musically inclusive design of the city and connects Home Park to this exciting environment. This bridge condition has the potential to expand along the entire connector, furthering the reconnection to the urban fabric.

The research of this thesis addresses connectivity, mobility, and identity through dynamic physical and auditory landscapes, challenging the contemporary approach to the present typical urban design of linear mobility and affixed aesthetics.
Sounds are understood in waves, derived from sine and cosine equations, as vibrations in a medium, typically air. The greater the amplitude, the louder the sound is and the greater the frequency the higher the pitch is of that sound. Shown above is a sound which starts as loud and high pitched sound and becomes quiet and low pitched over distance and time. The ear is the biologic resonator tool to help distinguish one sound from another. The outer ear captures the sounds around us and focuses them through the ear canal into the middle ear where the eardrum vibrates and three small bones, the malleus, incus, and stapes, transmit the sound vibrations to the inner ear where the cochlear amplifies and discriminate between music and other sounds. The portion of the audio cortex which deals with this discernment is called the ‘music room’ and was discovered by MIT students.

CHAPTER TWO
HOW SOUND WORKS

Our senses are crucial to observing the environment around us. The sense of sight is the most common way to interpret the environment, however not everyone has the ability of sight. The visually impaired rely on sound to receive auditory information from their surroundings. The source of sounds and reflection of sounds helps them navigate obstacles, find their way, and determine where things are. Blind canes are common tools to feel their environment as an extension of the arm, detect different surfaces, and create tapping sounds for auditory understanding. Shown above is an isovist and isovox to represent how these two situations occur.
Earthquake Sculpture
Luke Jerram
2011
Artist Luke Jerram created Earthquake Sculpture by creating a 3D form of nine minutes of a seismogram. This is related to Sonification discussed with Dr. Goller.

CHAPTER TWO
SONIFICATION INTERVIEW

Dr. Bea Goller is an architect and professor in Barcelona, Spain. She does research in, teaches, and curates art with a focus on sound architecture. One of her latest explorations has been Sonification. Dr. Jerram came to our campus last year in a similar manner, for sound derived from form.

Q: What inspired you to look at sounds for form making?
A: When you look at everything around you, it has sound. Atoms vibrate and with that energy, there is sound. We all have a natural sound and rhythm.

Q: When you examined the text with the forethought of turning it into sounds, did you need a certain sequence?
A: No, the text was important to me, which is why I used it, but another text would produce another sequence of sounds even if I used the same code, which is the beauty. There are so many options and outcomes.

Q: When you have these sound models, what do they represent to you as an architect?
A: The models are representations of the sounds, my language, and this procession through space. The sounds are apparent in space as the waves and they can have volume. If it were a building, we have this large volume then a smaller volume, or whatever the sequence is, but experience the sound in more than one way. I hear, see, maybe touch.

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Hermann Helmholtz, author of *On the Sensations of Tone*, writes on sound and quality of sounds. He describes that sounds and music share the same quality in one instance; however, what differentiates musical sounds from other sounds is the quality of the sound waves. He accurately details resonators as a sound enhancement device to reduce noise and could amplify or reduce sounds depending on geometry. He even proves that resonators sized for specific sound frequencies could turn unbalanced sounds into pure tones, having what we hear as musical quality.

CHAPTER TWO

HELMHOLTZ AND RESONATORS

Helmholtz describes resonators as if they were the ear canal without the ear drum membrane. With the membrane to capture vibrations, resonators can be used as instruments, but would reduce the quality of single frequencies, like blowing across the opening of a bottle. Resonators, with two open ends, are tuned for specific frequencies. They can be used to amplify sound or dampen it. If you were to hold a resonator to your ear, as Helmholtz did, the desired frequency would be much more distinct amongst the dampened frequencies. Above is the successful results of an experiment showing the use of resonators to reduce unwanted noise in a room.

Small Room Resonances

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Ancient resonators, called echea, were heavily used in theatre construction. In *The Ten Books on Architecture*, Vitruvius writes on design of all kinds of ancient theatres and the mathematics used for placing the resonators. These ancient devices helped to reduce noise and purify vocalizations of the performance in the theatre to increase projection of sounds to be clearly heard in the upper most sections of the seating.
Utilizing the geometry of curved surfaces, Whispering Dishes focuses sound between two large hard surfaced dishes. The two dishes communicate with one another by facing each other. Artists can use the dishes to amplify music and sounds within the small space by playing between the dishes. This allows street musicians to create a highly experiential personal amphitheatre.

The two points of most concentrated sound are at the focal points of the curves and are where chairs are placed to encourage pedestrians to experience the local sound scape. Pedestrians can have clear conversations by whispering more than twenty feet apart if they sit at the focal points. This sensual experience is also determined by the materiality of the dishes. The benches flanking the dishes are wooden for a warm, soft touch and slightly reduce noise from the surrounding area. The dishes themselves are concrete covered high density foam allowing them to be portable and transfer sound more efficiently with their hard concrete surface.

CHAPTER TWO
WHISPERING DISHES
GEOMETRY

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Dance movement has been converted into notational systems for hundreds of years. Rudolf von Laban created his Kinetography in 1928 to record simple movements and develop the system into a complex movement documentation. It was designed with music and time for how the body moves. The music score can be read directly in line with the movement score. Long bars indicate the start of the staff and shorter bars indicate the beats of the music and are regularized. The body movements are indicated along the music in columns from the center of the staff outward. The leg is closest to the center and head is indicated on the right side of the outer most column. Symbols are placed on the staff and indicate angle, height, and direction of the movement of the body part in the column. The symbols are elongated to imply time of the stance or position. This system can get more complex with combinations of symbols, becoming more specific to angle, height, and direction of movements in space. This system of Kinetography Laban is able to record movements and provide instruction to recreate movements.
CHAPTER TWO
RECORDING THE BODY

Pieter Jan Pieters approached the creation of music through aspects of being human, motion, natural rhythm, writing, and proximity. He developed several devices to use in concert with the body. One device attaches to the foot and records the pressure of walking. Another device attaches to the finger to record movements in the joints of the finger and vibrations from touching surfaces. He amplifies the beating of the heart with a digital stethoscope, which is placed on the chest. He created a scanning device to interpret writing, which is controlled by the velocity of the hand motion. His final device measures the proximity to the sensor and could be used by any part of the body.

Figure 1.19
Figure 1.20
Figure 1.21
Figure 1.22
AIAIAI and OWOW collaborated as musicians and scientists in a social experiment to create a live conversation between the dancer and disc jockey. Using sensors placed on the body, the dancer can set the beat, rhythm, and frequency of the sounds which the disc jockeys utilize in creating music in the moment. The disc jockeys and dancers require each other to create the free form music.

Both experiments, Sound on Intuition and Real Booty Music, explore aspects of the human anatomy to create and interpret music in a scientific manner. They push the boundary of music creation as a social experience which activates the dialogue between multiple users.
The Human Body in Action was a series of examinations into the movements of the body through the medium of photography. Etienne Jules Marey was a scientist and not a professional photographer, although his work is highly held in not only the scientific field but the art world. His study on simple walking shows the space taken through time of someone walking, the movement of joints and body parts, and the cyclic fluctuation of body datums. I showed a Labanotation of this motion to contrast the dynamic elevation of datums to the consistent pattern of the notational system.

CHAPTER TWO
RECORDING THE BODY
The Philips Pavilion was designed for the 1958 World’s Expo in Brussels, Belgium. The structure and form of the pavilion was designed by Iannis Xenakis, an avid designer with music and architecture and close friend of Le Corbusier. The structure is a series of hyperbolic curves which direct the force loads to the ends and down to the ground. These curves make the building naturally interact with sound.

CHAPTER TWO
PHILIPS PAVILION
GEOMETRY

The interior of the pavilion was designed as a series of complex curves, an enclosure for which loud speakers and projections are cast. The curves direct the audience in a procession through the stomach of the building.
The interior of the pavilion uses light, film, and music for the experience of the audience. The three designers collaborated for the pavilion. Iannis Xenakis designed the curvature of the structure to interact with music. Edgard Varèse composed the concrete and vocal sounds for the Poème Électronique, which heavily effects the atmosphere of the space. Le Corbusier created the imagery, lighting, and two sculptures to compliment the music of Varèse.

CHAPTER TWO
PHILIPS PAVILION
LIGHT AND SOUND

The Philips Pavilion in Brussels, Belgium, designed by Le Corbusier, Iannis Xenakis, and Edgard Varèse, was a significant example of the integration of light, film, and music. The pavilion was a site for the exhibition of the Philips products and was designed to provide an immersive experience for the visitors. The pavilion was a structure of curved, organic shapes, which was designed to interact with the music of Varèse. Varèse composed the music with form and spatial movements in mind. Using three hundred and fifty loudspeakers placed along the curves, the music changes for a unique experience of every user based on their location in the pavilion due to the resonance of the curves. He used mechanical sounds, vocalese, filtered sound from musical instruments and synthetic tones. The piece of music is approximately eight minutes in length.

Figure 1.36
Figure 1.37
Figure 1.38
Figure 1.39
Figure 1.40
The site is located in Atlanta, Georgia, the United States of America. This site is a major barrier of the urban fabric and the social mobility in the city. The project proposes to set up stages of development to connect the urban fabric and embrace social fluidity through musical principles. The affected area will encompass surrounding neighborhoods, schools, parks, and commercial zones and has the potential to change the lifestyle of the city as well as the image it has for visitors on the global scale.
The City of Atlanta in 1847 was founded on transportation of goods, such as cotton, through the expansion of the railroad system. Railways and electricity within the city were a major technological advancement allowing Atlanta to grow in population over the other cities in the South. The growth in population and the use of vehicles for personal transportation necessitated the development of highways across the nation. Atlanta’s highway system began its development in the 1950s and by that time the city limits had expanded into a sprawling city. Construction began at 17th Street and moved South and the core of Atlanta developed along the spine of I-75 and I-85 highways.

CHAPTER THREE
URBAN DEVELOPMENT OF ATLANTA

The aesthetically displeasing and disrupted urban fabric condition is being addressed with a number of proposals. The neighborhoods and organizations are developing ideas to remedy the poor conditions of the Connector going forward. This is a necessity as the city grows and will rely on the connectedness of the communities. The Atlanta Connector Transformation Project is addressing beautification, connectivity, and sustainability in a multi-programmed scheme. The Stitch is a capping project to continue the urban fabric across the Midtown to Downtown section of the Connector. CODA would be expanding upon the qualities of these proposals and focused in a sensual experience of the pedestrian derived from sound theory for the increased connectivity of the Connector.
Ms. Jennifer Ball is the Vice President in Planning and Economic Development of the Central Atlanta Progress (CAP) in Atlanta, Georgia. She works with the rest of the CAP board, the Atlanta Downtown Improvement District, and design teams to promote sensible design proposals for the City of Atlanta to increase livability, urban aesthetics, connectivity, and economic prosperity. The immediate project in focus is “The Stitch” located in downtown Atlanta. Ms. Jennifer Ball was generous enough to talk to me about CAP’s goals and future for Atlanta.

Q: How long would you say Atlanta has been considering a project of this scope?
A: It has been a while since a project of this scale has been proposed for the center of Atlanta, but what makes this project different is that it is finally making sense to consider this type of project. The Stitch is located over the I-75/I-85 Connector and that location has been a topic of conversation for the city for at least fifteen years.

Q: What does The Stitch mean to the future of Atlanta?
A: The Stitch is almost fifteen acres of new development, setting it apart from other similar projects in different cities. It will revitalize the land taken by the expansive highway and underdeveloped land surrounding the connector for the city. The Connector, historically, creates a major problem to those neighborhoods surrounding it and The Stitch will reconnect them and provide essential amenities to those neighborhoods. Atlanta will be strengthened by a project like this, and create interconnected communities in identity.

Q: When CAP thinks of connectivity, what does that look like?
A: The Central Atlanta Progress is focused on creating as many connections people can access to. Historically, Atlanta places the need of vehicles in priority. This attitude has reduced the accessibility of people walking, biking, and any other form of transit. There are numerous paths that we desire to aid in making more accessible and increase mobility in the city. The Beltline is focused within city limits, but the PATH Foundation, the Silver Comet Trail, the Freedom Park Trail, the Stone Mountain Trail, and several more go beyond the city and connect outer neighborhoods, lovers, and Atlantaites. We would like to re-envision the city in a way that the Connector was built in a modern future.

Q: What kind of spaces will be incorporated into the downtown project?
A: With several new prospective buildings, there are new outdoor spaces that would be essential. The City of Atlanta is lacking in the ratio of park space to built space in comparison to other comparable cities, even though we are considered a heavily vegetated city. Just beyond the Stitch’s influence are larger parks which provide the ample large park space need for the city. Beyond all of these, we want to have intimate park spaces and plazas to create close knit and tight communities. The Stitch is still in design phase, but will create park and open space for the local community rather than just a large park cap over the highway.

CHAPTER THREE
CAP INTERVIEW

The Stitch
Atlanta, United States of America
Central Atlanta Progress/Atlanta Downtown Improvement District
609,840 sqft [14 acres]
Proposed in 2015

CHAPTER THREE
THE STITCH

Atlanta has many barriers dealing with its urban fabric. The most affective barrier and infrastructural challenge is the I-75/I-85 Highway Connector running through downtown Atlanta. The major disconnect of the urban core is between the Midtown neighborhood from the Downtown neighborhood and the Stitch is a proposal to remediate that zone. The Stitch focuses on visual appearance, human experience, and economic potential. The incentive is to create more accessible pedestrian zones and parks with development opportunities bringing urban residents and commercial buildings into the core. It also transitions the circulation of vehicular traffic, providing gateways for vehicles to more efficiently come from one neighborhood to the next. Parks, sets, and nodes will create a sense of place for the human experience.
The Atlanta Connector Project is the voice of the transformation for the image of the City of Atlanta. They are talking about the highway as a multi-use amenity for the communities directly adjacent to the Connector. The goal of the project is to celebrate the culture of the city through public art, create a pleasing environment of the highway through urban foresting, collect water and reuse storm water runoff, and finally connect the city through a few additional bridges for pedestrians to access the rest of the city outside of their distinct neighborhoods. While this approach is creating an amenity for the city through a multi-use environment, the project is neglecting the harmful noise of the highway.

CHAPTER THREE
ATLANTA CONNECTOR PROJECT

The Connector was built for vehicles, but what if…

- we “greened” the corridor,
- captured and reused storm water,
- gave people places to walk, jog, and run,
- expressed our artistic and cultural side,
- and reconnected the City?

Existing Condition
Single-use Highway

Urban Forest
Collecting Storm Water
Create Pedestrian Paths
Urban Art
Multi-use Highway

PROBLEMS BEING ADDRESSED
Unattractive
Inhospitable
Hot
Polluting
Barrier
Noisy

The City of Atlanta is considering extensive measures to improve the conditions of the I-75/I-85 Connector. In their plans, they are refacing bridges with more attractive safety measures and lighting, while utilizing as much of the open space in and around the highway for urban forestry including green-living walls, and creating opportunities for public art work to embrace the culture of the city. These measures are similar to which a city would approach a river barrier as an amenity for the city. There would be multiple modes of transport, gathering places for pedestrian activation, and a unique image of city.

Atlanta Connector Project
Atlanta, United States of America
SWA Group, City of Atlanta
2 miles

Figure 2.10
Figure 2.11
Figure 2.12
Figure 2.13
Figure 2.14
Figure 2.15
Figure 2.16

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The Rose Fitzgerald Kennedy Greenway was developed as part of the Big Dig project in downtown Boston, MA. The greenway is a capping project over the I-90 interstate which divided the city as a major pedestrian barrier. The park space made it a pleasurable space to be as a pedestrian, bicyclist, and motorist with nature gardens, open spaces, and public art. The Big Dig project has been criticized as an economic failure, massing debt to $24 billion and actual costs of $14 billion. This is a major problem, as the entire project is completely public with minimal development opportunities to pay the project off to the city.

Positively, the project was completely successful in design goals. It connects neighborhoods, provides dynamic public space, increases mobility, and gives identity to the neighborhoods around it.
According to the U.S. Census Bureau’s 2010 Summary File 1 dataset, the downtown area is heavily populated in terms of population density. Every dot represents one person and the darker the area, the more dense that area was in population. The proposal would not only serve these neighborhoods to the people that crucially need the connections, but also has the potential to increase sustained population density.

The Connector is a critical location for Atlanta. There are six major communities with minimal connections which will benefit from a redevelopment of the Interstate Connector; Atlantic Station, Midtown, Old Fourth Ward, Downtown, Georgia Tech, and Home Park. Although these communities are directly adjacent to one another, they behave as completely separate entities. The uniting of the core through the Connector will mend the social issues.
The most specific census data is derived from Zip Codes. Population per zip code has a great range of density. The median age is within fifteen years of each other. Income indicates the correlation of education and poverty line. These neighborhoods are separated by these categories, while they all share the core of Atlanta.

### Zip Code - Neighborhood

<table>
<thead>
<tr>
<th>Zip Code</th>
<th>Neighborhood</th>
<th>Population</th>
<th>Density</th>
<th>Median Age</th>
<th>Education</th>
<th>Median Income</th>
<th>Poverty Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>30318</td>
<td>West Midtown</td>
<td>21,845</td>
<td>0.61</td>
<td>35.2</td>
<td>94.5%</td>
<td>$71,174</td>
<td>$19,224</td>
</tr>
<tr>
<td>30309</td>
<td>Midtown</td>
<td>15,413</td>
<td>0.42</td>
<td>36.7</td>
<td>94.5%</td>
<td>$52,424</td>
<td>$23,889</td>
</tr>
<tr>
<td>30308</td>
<td>Old Fourth Ward</td>
<td>5,934</td>
<td>0.42</td>
<td>32.4%</td>
<td>94.5%</td>
<td>$30,613</td>
<td>$15,383</td>
</tr>
<tr>
<td>30303</td>
<td>Downtown</td>
<td>21,934</td>
<td>0.92</td>
<td>34.6%</td>
<td>92.3%</td>
<td>$63,284</td>
<td>$21,574</td>
</tr>
<tr>
<td>30313</td>
<td>Downtown</td>
<td>9,450</td>
<td>0.72</td>
<td>34.6%</td>
<td>92.3%</td>
<td>$38,672</td>
<td>$15,383</td>
</tr>
</tbody>
</table>

The most specific census data is derived from Zip Codes. Population per zip code has a great range of density. The median age is within fifteen years of each other. Income indicates the correlation of education and poverty line. These neighborhoods are separated by these categories, while they all share the core of Atlanta.
Public transportation in Atlanta is severely underdeveloped for the scale and sprawl of the city. Shown in green above is the public subway, train system and in yellow is the public bus transportation. The development of the connector would increase pedestrian access to the current system and has the potential to expand upon the system for the core of Atlanta.
Soft scapes refer to the tree canopy, parks, and pathways for which Atlanta is known. Atlanta is considered a green city, as we have a prolific tree canopy. However, in comparison to many other cities, Atlanta has a low park space to built space ratio. Much of the open space and tree canopy is on private land. The tree canopy reduces in density toward the interstate connector, as does the frequency of park space. This provides an ideal situation for the redevelopment of the Connector with CODA to increase park space and tree canopy for the core of Atlanta. This would improve aesthetics of the core of Atlanta, air quality from vehicular pollution, city heat island effect, mobility and the health of the population.

CHAPTER THREE
SOFT SCAPES

Hard scapes refers to non-permeable surfaces; buildings, sidewalks, streets, etc. As the density increases toward the core and site location, there are more impervious surfaces. There is a neighborhood of primarily residential use which attempts to counteract this occurrence.
During my site visit, I encountered difficult conditions and unappealing environments. The entire walking distance was 8.8 miles and I made as many attempts as I could to cross the connector. Over a two mile stretch of highway, there were ten opportunities, three of which were unsuccessful and caused me to re-route. Eight of these opportunities were in favour of vehicles. The two pedestrian friendly opportunities were both associated with Georgia Tech University, one being Fifth Street Bridge and the other an underground tunnel near the bridge, but an unsuccessful crossing. In conclusion, opportunities to cross the connector to simply get from one place to another were insufficient and inhospitable to pedestrians.
CHAPTER FOUR
HONORS CAPSTONE

CODA - Determining the sounding chamber
Author - Michael C. Phaff
Honors Research Capstone accompanying CODA - Sound Urbanism Thesis
Kennesaw State University - Honors Program

Abstract
This research is in direct relation to the accompanied thesis proposal conducted within the Department of Architecture by author, Michael Phaff, under the guidance of Thesis Advisor, Marietta Monaghan. Upon examining local problems with urban fabric and traffic networks, a site was selected to address these issues. Examining the site, acoustic and architecturally related history and projects, this capstone addresses a condition not yet publicly identified of the site, sound quality of the pedestrian experience in high-traffic environments. Studies have shown health problems of residents living in close proximity to high traffic environments. The goal of this research is to determine the best design parameters of a sounding device through the exploration of acoustics and how to impact the experience of the pedestrian in an inhospitable urban environment. The research will aid in determining whether the work of Helmholtz could become an architectural expression. Upon conclusion, a sounding chamber in the form of piping will provide the most interactive experience for the pedestrian. Piping captures sound and transports the sound waves in an auditory experience over larger distances as the frequencies separate into their distinct characteristics. Piping with open ends and punctures has the opportunity to create sounds. Architectural expression can be observed with the muti-utilization of structure and the sonorous bodies performing multiple functions together.
Looking at the Urban Atmosphere of Atlanta

As an urban planner, I took an objective view of the city of Atlanta to address an architectural issue. One of the most argued topics for development and improvement since its inception is the I-75/I-85 Connector (SWA, 2012). The Connector began construction in the early 1960s, over 1200 acres of green space, including highway development projects as part of the interstate construction. The intent of the Connector was to move traffic through and around the city, removing a barrier for vehicles. The Connector has a total length of 7 miles and is one of the largest highway projects in the United States. Atlanta aims to have a green wall along the Connector, accompanied by superficial additions to the bridges.

The Connector is the most prominent contributor to this frequency is traffic noise. According to the Atlanta Connector Project, 80 percent of the Connector for Atlanta is not aesthetically pleasing amenity based in multiple functions, I looked towards the Atlanta Connector Transformation Project. The project is organized by six key concepts to improve the Connector. The first concept is an Urban Forest. The project intends these plants to be native and exotic, but sustainable and resilient. Within this zone of plantings, the plant textures will be adjusted to the site. The planting is a response to the community's desire to make traveling through and around the city easier and faster for vehicles. The Connector has a mild success through developing a multipurpose highway in a similar fashion to how society interacts with a river as a city barrier. The Connector Transformation Project aims to improve the Connector and make it a more pleasant and safe means of separating the pedestrian from the highways. For each bridge, the preservation of the work. Lighting and urban furniture would be used to increase appeal of bridges in the day and huge part of culture in several of Atlanta's neighborhoods and is also being used in a similar fashion on the Beltline.

The Connector is now not only a grotesque image for the City of Atlanta, but also is becoming a worsening health risk through harmful noise to its citizens (Berg, 2012). We found that exposure to low-frequency (10–200 Hz) traffic noise may produce hypertension as the response to noise intensity, where people exposed to sound intensity at 63, 125 and 1000 Hz had a significantly higher risk of hypertension. The findings at 63 and 125 Hz related to the specific frequency that develops this harsh reaction is 125 Hz (Hertz) and the most prominent contributor to this frequency is traffic noise.

Looking at the architectural proposals in remedying the Atlanta Connector for creating an aesthetically pleasing amenity based in multiple functions, I looked towards the Atlanta Connector Transformation Project. The project is organized by six key concepts to improve the Connector. The first concept is an Urban Forest. The project intends these plants to be native and exotic, but sustainable and resilient. Within this zone of plantings, the plant textures will be adjusted to the site. The planting is a response to the community's desire to make traveling through and around the city easier and faster for vehicles. The Connector has a mild success through developing a multipurpose highway in a similar fashion to how society interacts with a river as a city barrier. The Connector Transformation Project aims to improve the Connector and make it a more pleasant and safe means of separating the pedestrian from the highways. For each bridge, the preservation of the work. Lighting and urban furniture would be used to increase appeal of bridges in the day and huge part of culture in several of Atlanta's neighborhoods and is also being used in a similar fashion on the Beltline.

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Our study is the first to show the association between the prevalence of hypertension and frequency components of road traffic noise. Our study looks at sound intensity for individuals exposed to traffic noise. This activity of transportation could have been local for farms to get food to the city or long distance for traveling to other lands. Rivers provided a source of food, transportation by boat, navigation of the globe, hygiene of people and cities, and are now considered to be an aesthetic amenity. The Connector Transformation Project aims to improve the Connector and make it a more pleasant and safe means of separating the pedestrian from the highways. For each bridge, the preservation of the work. Lighting and urban furniture would be used to increase appeal of bridges in the day and huge part of culture in several of Atlanta's neighborhoods and is also being used in a similar fashion on the Beltline.

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...
Sound and Architecture - Architecture and Sound

Helmholtz has made a brief mention that music has been heavily emphasized whether it be for religious or warrior purposes. There are a few common factors that are designed in the form of a building. Sound, color, and certain materials are used. However, the focus of this chapter is on Architecture, describing such qualities in the 17th Century BC. In this book, we discuss the different forms of music and the social structures that shape the auditory environment, including how design principles can be applied to create music-resonant environments. This includes how the design of spaces can influence the way we perceive sound and how we respond to different auditory experiences.

The study of music and architecture has been an ongoing one, with architects and musicians working together to create environments that both acoustically and visually enhance the musical experience. This is evident in the design of concert halls, opera houses, and churches, where the goal is to create an acoustically ideal environment for the performance of music. However, the relationship between music and architecture is not limited to the design of performance spaces. It is also evident in the way that music is used to complement the architectural environment, such as through the use of soundscapes or ambient music.

The relationship between music and architecture is a complex one, with both disciplines influencing each other. As music continues to evolve, so too must the design of spaces that accommodate it. This is particularly relevant in the context of contemporary architecture, where technology and innovation are shaping new ways of experiencing music. With the rise of digital technologies and the increasing use of sound in architecture, the relationship between music and architecture is likely to continue to evolve in the years to come.

What Helmholtz describes about music and general noise or multiple sonorous bodies occurring at the same time, is something we try to understand in how music and sound collaborate in our daily lives. For example, in an MD students. To Music Development, has focused on understanding how technology research students analyzed brain activity in reaction to sound and music and discovered that the brain can respond more positively to music than to other sounds. This response is different among different people and may also vary depending on the type of sound. In general, music is more positively received by the brain than other sounds.
Sounding Architecture Conclusion

Taking into consideration of resonators and their different forms, flexible conditions, existing precedent to expand upon, and the new consideration of the audioscape of the pedestrian, a series of cylindrical pipe resonators will be explored for architectural expression. The decision for flexible and organic forms to provide sensory interactive experiences, reduce heat island effect of the highway, provide an aesthetic identity for the city, reconnect the city and the streets in the 1950s, and combine the experience is an architectural expression through structure. Essentially a system of these organic form flowing pipe resonators will turn the entire project into a street organ, adding the new vibrancy produced by the vehicles and the natural wind patterns of the area. The densification of the urban fabric and the smart landscape design will reduce noise seepage into the adjacent communities. To further the experiment, I have created ceramic resonators to aid in understanding of a prototype for resonators. I first began making ceramic organic forms that evolve from a long neck bottle to a system of cylindrical pipes flowing through the site. The vessels are thrown on a potter's wheel, then dried to bone dry before first kiln firing. The vessels are then glazed with mineral, non-toxic glazes using the Kennesaw State University Ceramics Studio. The vessels are then bisque fired in a kiln, then glazed with mineral, non-toxic glazes. The vessels are then glaze fired in a kiln, forming a glass-like surface for aesthetic appeal and provide durability to the vessels. In the final firing, the glaze changes in color when the coloring minerals and silica combine at high temperatures. The glazed surface makes pottery non-porous and more conducive to resonating sound.

CHAPTER FOUR
HONORS CAPSTONE
CHAPTER FIVE
DESIGN DEVELOPMENT DOCUMENTATION
On either side of the Connector are fragments of 15th Street which was truncated in the development of the Interstate Connector. On either side of the Highway are underdeveloped building sites which are either unmaintained or unsightly commercial establishments under utilizing their sites. This thesis proposes a connection be made in this urban block to connect Home Park Neighborhood to Midtown and public transit in a pedestrian friendly environment.

As documented in SWA's proposal, Atlanta Connector Project, there is intention for a pedestrian bridge to make a connection across the Interstate Connector at 15th Street. This thesis will challenge the minimal approach by creating a pleasant experience considering noise and sounds of the pedestrian path while creating amenities for Atlantans and economic opportunities to fund maintenance and construction. This area is slowly developing on the Midtown side, increasing housing and mixed use buildings. There are several more opportunities to expand the potential across the highway.
The extension of 15th Street has been designed with curvilinear paths to encourage people to utilize the spaces. Sound has been infused into the design of the bridge with the abstracted curving promenade, use of geometry and mechanical structures to create unique sounds, implementation of vegetation for dampening highway noise, and a Consonant Sound Garden. An outlier bridge (9) is an opportunity for the pedestrian to experience the noise of the highway in contrast to the alternate experiences of the sound scape.

Circulation has been focused in traveling efficiently in the West to East directions on an easy curve, while secondary paths are traveling North to South for potentially connecting to other neighborhoods with slightly more curve in procession. Tertiary paths intersect at interesting points and social spaces for various activities and paths. Entering the site from either end, you arrive in a plaza which has amplified sound from the Urban Organ and could be used for activities such as food truck events or public protests and gatherings. In the center of the site is a theater which could be used for various concerts or conferences and is connects the neighborhoods on either side while pulling the arts district towards Home Park.
The structure of the site plan was developed in the idea of radiation of sound from spaces to create curvilinear circulation. Curved geometry has the opportunity to create amplified sound of a space, while also making it more difficult for sound to travel from one space to another in contrast to a straight path where sound has no obstructions. Once points of radiation were determined for the master plan of the project, and translated to the masterplan organization from where the rest of the site was developed with sound spaces.

CHAPTER FIVE

GEOMETRY

DEVELOPMENT DIAGRAM

The resonators within the project are activated by wind and wind resulting from vehicular motion. The project is activated by traffic traveling in both directions, North and South. In theory, the more vehicles traveling at faster speeds would activate the resonators more and the occurrence of stopped traffic may be equal to no traffic at all, with no vehicular activation of the resonators. It must rely on natural wind patterns.

CHAPTER FIVE

SOUND VEHICLE

ACTIVATION DIAGRAM
The project will implement the use of various materials: concrete, graffiti art, glass, steel, wood, and foliage. These materials will be crucial to the interaction with the environment of the project. Concrete will be used in the structure of the project and provide sound barriers from the highway noise. Graffiti painting will be used to provide cultural uniqueness and contribute to the aesthetic sense of place to the project. Glazing will be necessary to enclose the theater while maintaining visual connection to surroundings and nature. Steel and metals will be used to create the resonators to best transmit sounds industrially. Wood will provide a softness to the interaction with the project and will be used in furniture and light pavilion structures. Foliage and landscaping provides a natural surrounding, absorbs noise, and reduces the heat island effect of the project.

CHAPTER FIVE
MATERIAL DIAGRAM

Ample softs capes provide a comfortable environment for people to gather in and experience the crossing of the connector, possibly without noticing the highway below. Softs capes are planted areas of grass and landscape foliage and provide a visual enclosure to the project. The hard scapes are path and building. These provide not only access from either side of the project, but additional amenities otherwise not thought about in other proposals for crossing a highway.

CHAPTER FIVE
SOFTSCAPE AND HARDSCAPE DIAGRAM
CHAPTER FIVE
EXPERIENCE VIGNETTES
From Home Park neighborhood, there is a profile of the theatre in the park of the undulating landscape and perpendicular view of the Urban Organ.

**CHAPTER FIVE**

**WEST ELEVATION DIAGRAM**

Like the West view of the site, the Eastern side invites people into the landscape through curved paths and structures with dynamic sounds emanating from the site.
The northern view of the site uses landscape to create intriguing views and dynamic environments for the Consonant Sound Garden. The site would be seen from Atlantic Station as part of the skyline of Atlanta, creating an image for the city and gateway to the downtown neighborhoods.

From the southern exposure, there is a view of the Urban Organ and theatre behind with the obscured landscape surrounding.
Wind turbines on the underside of the bridge generate energy from the wind tunnel of the Connector for powering dynamic lighting at night and other amenities. The Consonant Sound Garden pulls sound through resonators to create a playful sound scape to microclimate the park-like surroundings. The highway noise should be completely deadened with occasional anomalies of vibrations traveling through the mass of the structure. Two co-dependent structural systems reflect highway sounds back down towards the highway while capturing sound waves in cavities between and within the structures to reduce the overall noise of traffic.

CHAPTER FIVE

SITE SECTIONS

Vegetation creates sound barriers to disrupt sounds from traveling through them and into other spaces. They are also being utilized as shading and a means to reduce heat island effect of that area of highway. The theatre shell hangs the orchestra and stage from within to separate the theatre from the vibrations of the highway and reduce sonic interference even further. The Urban Organ is a three piece sounding machine utilizing the movement of the highway, pedestrian-controlled cylindrical pipe resonators activated by wind currents, and the balancing of amplifiers by pedestrians. This system creates a socially activated orchestra of sound possibilities experienced along two paths culminating at the plazas where you enter the site and can hear the combination of the sounds through amplifying geometry.
CHAPTER FIVE
EXPERIENCE VIGNETTES
The site is comprised of several layers to reduce the sound of the highway at the source through architecture. This enables positive sounds of people and nature in a social setting while being enhanced by sounding devices. At the Interstate Connector level, there is noise of traffic, the structure and landscape above create a conducive environment for socially activated space. At the pedestrian level, sounding vessels of the Urban Organ and Consonant Sound Garden provide playful sounds to enhance the pedestrian experience. The theatre on site would be a source of sound while in use for concerts and various other activities.
CHAPTER FIVE
EXPERIENCE VIGNETTE
This thesis of CODA, sound urbanism, is the beginning of the discussion for the City of Atlanta to address sound in their undertaking to transform the highway corridor. The plan of the highway is an opportunity for the city to create a unique image for the city not only visually but sonically. Highway noise pollutes the atmosphere of all the neighboring communities from the 285-400 Connector. The Connector is crucial for the city to move people both North and South out of the city, however, creates a major barrier. The lack of public transportation in rail systems ensures the highway's necessity while people have to find efficient ways to move around the city. Access to the public transit station is crucial if the City of Atlanta expects to expand their system. As addressed by precedent proposal projects, more pedestrian-friendly modes of crossing the highway barrier need to be addressed so that people can walk to transit stations in an overall pedestrian-friendly city. Other cities which have undertaken projects to repair the highway barrier have also created space for pedestrian-friendly environments. The city of Boston created a cap project of 1.5 miles long with a $2.6 billion dollar cost to create a holistic pedestrian-friendly environment. With the example of CODA for Atlanta, the entire Connector could not only repair the connection from one neighborhood to the next in a positive sonorous environment, but provide an economic infrastructure to the city to pay for the project and potentially profit from its construction. This thesis explores sound of the environment being explored in options for future development of the city. Sound seems to be an ignored sensory experience in the transformation of the Connector, but could serve an integral part of what makes places and spaces enjoyable to inhabit. The CODA project would be repairing the pedestrian environment connecting Home Park and Midtown, while still providing exposure of the natural elements to the highway rather than providing a complete cap to the highway. As precedent to the rest of the Connector, there is potential to connect neighborhoods throughout the highway barrier with these amenities. By leaving areas of the highway open to the elements, the project utilizes the highway in the production of sound above through the use of resonators. Resonators turn the project into an urban organ to combat noise and create an interactive environment. Sound from the resonators could also assist in navigating the distancing from the one side to the other. Urban forestry, an important design move for the city, is heavily incorporated into this proposal to reduce noise from the highway permeating into the surrounding environment. By incorporating dynamic landscaping, the man-made environment will be aesthetically pleasing as a park environment, absorb sounds, reduce heat island effect from the highway, combat CO2 emissions, and provide a much-needed park amenity in the heavily concreted plan Connector.

The research of this thesis addresses connectivity, mobility, and identity through dynamic physical and auditory landscapes, challenging the contemporary approach to the present typical urban design of these mobility and affects aesthetics.
This thesis had many developments throughout its creation. It began as an architectural installation, then quickly grew to a potential 2-mile urban intervention, and eventually came down to the size of an enlarged bridge taking up an entire city block to bridge 16 lanes of highway. If there were more time to advance the proposal, this project would have become a master plan for the entire corridor to address the sound of the highway as a whole and provide economic amenities for the city. The structure of the project became an unexpected surprise for design intervention of the bridge and while it attempts to reduce sound pollution by absorbing vibrations into its structure, there is more opportunity to develop ideas of the reduction of noise in the highway environment and with a more efficient use of materials.

This project was an enjoyable experience within the thesis and could have had a number of outcomes to explore if one only had a lifetime to research these avenues.


Berg describes the relationship between the sounds produced from highways and the genetic population of a city. Health conditions become less common among periods of time. The study was done in the United States of America and contains results in Atlanta. This edition is in accordance with Berg, J. (2016) Study of traffic and sound.


SWA Group is the leading design group on the Atlanta Connector Project which transforms the highway connector in Atlanta into a gateway icon for the city and a multiple-use public zone with gathering space activated by art.


Educational resource to better understand resonance, Helmholtz resonators, and how to calculate the size of them.
CHAPTER SEVEN

IMAGE INDEX

Figure 1.1

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human brain anatomy vintage illustration, https://s-media-cache-ak0.pinimg.com/564x/9fbe/14/9fbe14f106a13b529c44fab076b15e47.jpg

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Roland Reipper. 1964-1955. Photograph of a student providing example of laboratory, https://media-cache-ak0.pinimg.com/460x5e0f56fa/9fcb/da435f82bb24f4b65f26b6242e524068.jpg; http://science.howtobuildalaboratory.com

Figure 1.19