Meandering Structures | A Theatrical Take on Sonorous Environments

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Meandering Structures
A Theatrical Take on Sonorous Environments
Meandering Structures
Atlanta, GA

Thesis Proposal is Presented to the
Faculty of the Department of Architecture
College of Architecture and Construction Management

By

Jamilah-Renay C. Bouges

In partial fulfillment of the requirements for the Degree
Bachelor of Architecture

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Marietta, Georgia

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Request for Approval of Project Book:
College of Architecture and Construction Management | School of Architecture
Kennesaw State University

Student’s Full Name: Jamilah-Renay C. Bouges
Project Title: Meandering Structures | A Theatrical Take on Sonorous Environments
Thesis Summary:

This project studies the distinct patterns of sound created by specific activities in our day to day lives. Ways in which these sounds travel and impact the receptor will directly influence how this project performs and reacts to a given source’s stimuli. Once this is understood, the environment of the final proposal will be more easily manipulated into a reflective and absorptive form which molds itself in order to provide more adequate clarity to an audience. This flexible form is applied as an interior skin for a travelling theater supplying a myriad of performing arts and musical acts as demanded by a client. All portions of this travelling theater shall be constructed as a kit of parts which can be assembled and disassembled on site in a given arrangement according to the intended acoustic program. Through configuring the supporting structure and interior skin, this proposal seeks to be adaptable to numerous sonorous environments from concerts, to lectures and even social functions.

Student Signature: ________________________________ Date________________

Approved by:

Internal Advisor 1 ________________________________ Date________________
   Professor Bronne Dytoc

Internal Advisor 2 ________________________________ Date________________
   Professor Marietta Monaghan

Thesis Coordinator 1 ________________________________ Date________________
   Professor Elizabeth Martin-Malikian
First and foremost, this is dedicated to my beautiful mother for all of her unending support and consistent reaffirmation. You know I am stubborn, but your words mean more to me than you’ll ever know.

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CHAPTER ONE.

DESIGN THEOREM
1.1 THESIS STATEMENT + DESIGN INTENT

Whether the time is spent alone, socializing, or with leisurely activities somewhere in between, the average American spends over 85% of their time indoors. The nature of architectural space, especially those developed for interior functions, should cater to most, if not all, of the necessary functions of the inhabitant, this includes their visual, auditory, tactile, olfactory and proprioceptive senses. Architects have traditionally catered primarily to proprioceptive and visual senses first and foremost with careful consideration to tactile materials next before finally considering sound as a lesser valued design concept. The delicate relationship between sound and receptor can be considered earlier on in the design process for certain architectural typologies in order to facilitate a healthier connection with the design constructs within which we typically work and play.

This project studies the distinct patterns of sound created by specific activities in our day to day lives. Ways in which these sounds travel and impact the receptor will directly influence how this project performs and reacts to a given source’s stimuli. Once this is understood, the environment of the final proposal will be more easily manipulated into a reflective and absorptive form which molds itself in order to provide more adequate clarity to an audience. This flexible form is applied as an interior skin for a travelling theater supplying a myriad of performing arts and musical acts as demanded by a client. All portions of this travelling theater shall be constructed as a kit of parts which can be assembled and disassembled on site in a given arrangement according to the intended acoustic program. Through configuring the supporting structure and interior skin, this proposal seeks to be adaptable to numerous sonorous environments from concerts, to lectures and even social functions.

Figure 1.1a
Transformative mesh as influenced by human form
1.2 PROPOSED CONTEXT + DESIGN RATIONALE

Figure 1.2a
Sketches referencing the alignment of human movement through traditionally composed spaces.
Figure 1.2b
Sketches of interior and exterior form and how they can be configured.
Figure 1.2c
Sound “rays” shown bouncing around an untreated interior space.

Figure 1.2d
Sound “rays” shown bouncing around an acoustically treated interior space.
1.3 UNDERLYING PRINCIPLES

+ DESIGN CLARIFICATION

Figure 1.3a
Studies of meandering forms inside and around a given structure.
Figure 1.3b
Diagram of sound absorptive coefficients and methodologies.

Figure 1.3c
Various materials and their inherent sound absorptive or reflective qualities.

TRANSMISSION

ABSORPTION

REFLECTION

DIFFUSION

0.35 > α > 0.95
0.1 > α > 0.2
0.02 > α > 0.04
0.45 > α > 0.75
Figure 1.3d
Graphs depicting differences in effective methods of soundproofing and rooms left untreated.

Figure 1.3e
Graphs showing how a set of typical Americans spend their time during the day.
Figure 1.3f
Plans and sections of “source” and “receptor”. All images assume a 6’ tall human in a 100 sf space.
Plans and sections of "source" and "receptor". All images assume a 6' tall human in a 100 sf space.
Axonometric model showing the decibel levels and associated zones within a school theatre room.

Figure 1.4a
A miniature concert hall with a maximum capacity of 6 people can be found travelling through London and areas beyond with only a truck and a crew to pull off a show on any coast one could imagine. Made of MDF and sheet metal, the exterior of the theater stands out and calls for your visual attention first, before any sound can even be heard as projected from its front “microphone”.

Designed by London studio Aberrant Architecture, the Tiny Travelling Theatre was inspired by contemporary accounts of the music club started by Clerkenwell resident and coal salesman Thomas Britton in 1678, which took place inside the miniature concert hall that he built above his coal-shed home.

Circular skylights were concealed within each of the theatre’s chimneys, while a huge funnel on one side channelled out sound from the performances taking place inside. A door with a large circular handle led visitors inside the small venue, where they could sit down in one of three recessed booths in the chunky chip-board walls. The form is almost cartoon-esque on purpose, in coincidence with the frivolity of performance. Pulling from the ease of constructibility with this project, we can see how simple it would be for several theaters to be constructed and essentially go on their own tour together.

Tiny Travelling Theater,
Aberrant Architecture
Leitner’s Le Cylindre Sonore is an installation in the Parc de la Villette in Paris. This project is an aurally kinetic composition that draws connections between defined physical space and undefined phenomenal space. Situated in a forest of bamboo, this structure is hidden away by design; only two pathways lead in and out of the space but the sound resonating from within the cylinder is what actually draws you inside. In fact, Parc de la Villette is the same park that housed Bernard Tschumi’s red follies but Leitner’s project demands much less visual attention. For Leitner, this project is one that allows the inhabitant to exist within a space that highlights the relationship of their body with nature and frames this connection between the two with sound.

Inside the 16 ft. high concrete arcs that form one circle offset from the other, eight speaker columns line the immediate facade. These walls form a resonating body that consolidates the sound through the weight and tension of the curved surfaces. Those who pass by are invited into the static space by the natural contrast provided inside. The mechanical, high-pitched tones steadily pumping through 24 speakers would typically sound dissonant, but the sound of nature - running water, birds chirping, the predictable pattern of breathing - balances the environment and promotes a heightened sense of awareness in the inhabitant. This is a space to pause and reflect, to focus on nature and reconnect with oneself as evident in the texture and quality of the space itself. The architecture, paired with the careful balance of man-made and natural sound, facilitates a contemplative environment. Even the descent into the space serves as a symbolic separation from typical everyday life; the placement of the project at a low point in the existing topography further highlights a relationship between nature, man and architecture. Leitner’s intent is solidified upon exiting.

Le Cylindre Sonore,
Bernard Leitner
The topography further highlights a relationship between nature, man and architecture. Leitner’s intent is solidified upon exiting the structure and looking back to only see trees, but the sounds resonating through nature still persist almost as if they are calling the visitor back.

The potential of harmonics in architecture can be further understood through this project. Although Leitner was not using this term specifically, he was still drawing careful connections between the human body and its receptiveness to sound and nature. The experience of the space was designed such that the visitor left with a more holistic contextual awareness that, hopefully, lasted throughout their day. This project is one that successfully bridges the phenomenal gap between the visual and auditory realms while continuing to have its own significant architectural presence.
Its shape is derived from the song “Spiegel im Spiegel”, consolidating the main sequence spectrogram of the song into the curves of a roof. This cloud of sound forms an introverted space within where the music is played and listened to and a space underneath that becomes the work and meeting place for the people interested in the legacy of the composer. The cloud only touches the ground where it is thickened to house the performance space, and otherwise hovers between the trees, like the tree house of the observation platform, suspended in the natural environment of the forest.

The complex rooms of the program are organized in their functional groups and combined into a box building that is placed underneath the roof. Underneath the roof and in the center of the overall courtyard shape a poetic space is created within nature, where the memory of Arvo Pärt can reside.

A sound study analysis of the different “zones” in this theatre reveal the systematic study of spatial division in order to further strengthen the design concept. Almost partitioned like movements in a symphony, the building’s various functions are separated such that one does not necessarily disturb the other, but does not altogether ignore its existence either. The amphitheatre is connected to auxiliary spaces whose functions depend heavily on when a particular concert is beginning or ending. The guests can easily be signalled of the intermission’s end not only by visual cues, but auditory ones as well.

Arvo Pärt Sound Cloud,
Coop Himmelblau
Through the use of three-dimensional panels in pyramid and prism shapes, the walls and ceilings of the station act as acoustic and sound absorbing elements, preventing sound waves from bouncing and creating echoes. Made from fire-safe porous ceramic, the panels not only absorb noise, but also compose a pattern of arrows to aid passenger navigation, pointing in the direction of platforms, exits, and train directions.

The entrance pavilions, as well as the space between the pavilions, follow the same design principles, with simplicity and sound-absorbing elements, including groomed bushes capable of absorbing 40 decibels of noise from nearby roads.

In line with the idea of simplicity, the station would be maintained using a car wash-inspired method, cleaning the walls of the platforms with incorporated brushes that remove train grease.

Unfortunately, the sound analysis study proves a slightly different concept wherein the material of the transit center’s walls may be harming the inherent function of the space.

Moscow Metro Proposal, Variant Studio
When navigating a transit station, sound is imperative as it can direct someone more easily towards their destination thus potentially keeping them on time for work. Similar to most sound study schemes, this project divides itself into zones which also works to contain the sound in a more isolated fashion. The quietness of the station can be proved by the various soundproofing techniques, however this building typology is one that requires more sound transmission than this technique allows. A better solution would be to carefully distribute sound in a very intentional manner such that certain zones of the building are quiet, but only when they need to be.
COMMUNITY

CELEBRATION

CONNECTION

COLLABORATION

CULTURE

Figure 2.0a
Collage of sculptures and artwork on the Atlanta BeltLine.
SITE SELECTION CRITERIA

COMMUNITY  CELEBRATION

CONNECTION  COLLABORATION  CULTURE

For a site to be suitable, it must adhere to these criteria:
SAMPLE SITE:
OLD FOURTH WARD | VACANT LOT
ATLANTA, GA

Figure 2.2a
Collage of chosen sample site of Old Fourth Ward vacant lot in Atlanta, GA. All images sourced from Atlanta Beltline’s primary website.
Figure 2.2b
Correlations between 6 main influencers in a city's resident-scape and a chosen set of criteria that may draw or divert their attention to a particular site or event.
Site analysis for various outside influences on the chosen site. Studies on how fruitful an event might be.
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Figure 2.3b  Site sketch model with an initial layout for strips of activity with breaks for green space and audience meandering.
Figure 2.3c
Site sketch model with an initial layout for enumerated interior spaces for collaboration and community.

Figure 2.3d
Site sketch model with an initial amphitheatre configuration as determined by earlier site analysis.
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Sketches for layout of an amphitheatre, green space and individual workshops and smaller performance spaces.
Figure 2.4b
Sketches for interior form of an amphitheatre whose structure absorbs and reflects sound and provides clarity to every audience member.
Figures 2.4c: Sketches for interior form of an amphitheatre whose structure absorbs and reflects sound and provides clarity to every audience member.
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Sketches for layout of an amphitheatre, green space and individual workshops and smaller performance spaces.
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Collage of form ideas for a transportable performance theater.
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The decibel levels of a theatrical event in an untreated 100 sf space with a sound absorption coefficient of 0.00

Figure 3.1b
The decibel levels of a theatrical event in a treated 100 sf space with a sound absorption coefficient of 0.10

Figure 3.1c
The decibel levels of a theatrical event in a treated 100 sf space with a sound absorption coefficient of 0.30

Figure 3.1d
The decibel levels of a theatrical event in an treated 100 sf space with a sound absorption coefficient of 0.90

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THEATRICAL EVENTS

PLAYS
PERFORMING ARTS
SPOKEN WORD

EXPOSED DEPLOYABLE FRAME

STATIC TESSELATION PANELS

KINETIC TESSELATION PANELS

The proposed structural frame configuration with exterior and interior skins for a schematic understanding.
Figure 3.2a  The decibel levels of a musical event in an untreated 100 sf space with a sound absorption coefficient of 0.00

Figure 3.2b  The decibel levels of a musical event in a treated 100 sf space with a sound absorption coefficient of 0.10

Figure 3.2c  The decibel levels of a musical event in a treated 100 sf space with a sound absorption coefficient of 0.30

Figure 3.2d  The decibel levels of a musical event in a treated 100 sf space with a sound absorption coefficient of 0.90

Figure 3.2e  The proposed structural frame configuration with exterior and interior skins for a schematic understanding.
S O C I A L  G A T H E R I N G S

S T A T I C  T E S S E L A T I O N  P A N E L S
K I N G T I C  T E S S E L A T I O N  P A N E L S

S T R U C T U R A L  F R A M E  C O N F I G U R A T I O N

F i g u r e  3.3a
The decibel levels of a social event in an untreated 100 sf space with a sound absorption coefficient of 0.00.

F i g u r e  3.3b
The decibel levels of a social event in an treated 100 sf space with a sound absorption coefficient of 0.10.

F i g u r e  3.3c
The decibel levels of a social event in an treated 100 sf space with a sound absorption coefficient of 0.30.

F i g u r e  3.3d
The decibel levels of a social event in an treated 100 sf space with a sound absorption coefficient of 0.90.

F i g u r e  3.3e
The proposed structural frame configuration with exterior and interior skins for a schematic understanding.
Figure 4.0a
Skin formation from a transportable planar figure to a tessellated interactive shape catering to the acoustic environment.
LEGEND

1. STAGE AREA
2. AUDITORIUM SEATING
3. MERCH TABLES
4. GENERAL SEATING
5. TICKET LOBBY
6. MAIN ENTRY
CHAPTER FIVE.
CRITICAL RESPONSE TO DESIGN THEOREM
In summation, this project aims to provide culture, collaboration, connection, and community in celebration of music, spoken word and all performing arts with respect to the intelligibility of all sounds associated with each performance. By studying acoustical data in a given interior volume, a set of rules and criteria have been developed in order to allow clarity within a particular acoustic zone. By using reflective and absorptive panels integrated with lighting, ventilation and aesthetically pleasing materials, the interior skin is allowed to cloak the event with architectural interest while still remaining performative in nature. The ease of constructing and deconstructing the supporting frame pulls the event’s various zones together and provides flexibility in arrangement and program on site. Rounding out the project is the transportable nature of the end result which allows a 2-10 person team to erect a full assembly for approximately 50-100 people within hours. Being able to plug in to larger productions as needed or to stand alone mimics the richness of architecture as it relates to the inherently transformative nature of human interaction and exploration.

In the pursuance of acoustic clarity – first and foremost – in addition to kinetic and manufacturable structures accompanied by all variables associated therein, the initial proposal suffered a loss of its own precision and alignment with the main goal of creating a captivating sonorous interior environment. With that being said, simplifying the structure to one typology both enhances the strength of form and the flexibility of the end program. Once one “dome” is deployed, the nature of the construction method lends to a more controlled enumeration of acoustic zones. Treating each zone with the predetermined skinning method allows for stronger clarity during separate event moments. The site selection criteria can expand and contract due to the client’s vision without compromising schedule and transportation. Finally, disassembling and transporting the theater from city to city for a major festival is as inherently simple as a one-man band seeking to entertain a niche audience. Expanding further, this concept could easily be adapted to other types of environments not discussed in this thesis, such as public transit terminals, restaurants or open office spaces with an understanding of the necessary software to manipulate and configure the interior acoustic cloak.

Figure 5.1a
Collage of sound raytraces inside and around a spherical object.
BIBLIOGRAPHY


