Straight, No Chaser: Drawing A Parallel between Architecture and Music

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Submitted to the Department of Architecture on January 12, 1996 in partial fulfillment of the requirements for the degree of Master of Architecture.

ABSTRACT

Architecture and music share the same vocabularies: rhythm, proportion, harmony, repetition, contrast, etc. and contain similar structure in terms of composition and spatial characteristics. Given these parallels, how can music principles be used to create and inform architectural compositions?

The intent of this thesis is to investigate the relationship of these two art forms, seeking to establish a *methodology* through *repetition,* displacement, contrast, transition and other devices, which enables an understanding of the inherent nature of both. In order to generate the analogies of architecture and music, a *multi-use art center* will be the instrument through which the dynamics of architectural composition will be created. This new cultural facilities, containing the programmatic elements: art galleries, exposition space, and an auditorium will be located near the Dorchester Bay in New Squantum in North Quincy, Massachusetts.

As the outcome of this exploration, this multi-use art center will establish the consciousness of memory which provides people with a variety of spatial experiences while moving through a sequence of spaces.

Thesis Supervisor: Andrew Scott
Title: Associate Professor of Architecture

Acknowledgments

It seemed too long for a sailor to stay in the same port three and a half years. Somehow, the extraordinary experience at MIT made me believe that my change from a navigator to an architect was correct.

It has been a wonderful thesis semester with all of my fellow students, like Gwynne and Katie, who gave me tropical fish to get me inspired, shared mid-nite tea time with me, endured the music I created, and, along with Kyrre, proofread my *street-language-like* English. Moreover, Haldane's imaginative photographs have already recorded the sweetness and bitterness of our thesis life, especially the effort he made in our final review. And how can I forget the 40th birthday cake unexpectedly showing up in front of me right after our thesis final review.

I would like to thank the members of my thesis committee for the guidance and encouragement that they gave me. I owe a special thanks to my advisor, Andrew Scott, who patiently instructed me with a generous freedom and flexibility during the thesis semester. My readers, Bill Porter, for his warm informative musical input which kept me *sober*, and Len Morse-Fortier, for his *sound* supports for the structure of my designs. I also acknowledge the help from Ken Kao and Paul Donnelly, for their assistance in technology.

My thesis is dedicated to my parents. My father, who passed away years ago, would have been happy that we finally had something in common: We both switched our careers into art fields. He, once a businessman turned a Chinese calligrapher; I, a sailor turned an architect. My special thanks goes to my mother, who has been worrying about her youngest son (old enough though). Without her understanding and constant support, I would never have been able to complete this task. I cannot forget the members of my family for their unquantifiable concern and encouragement.

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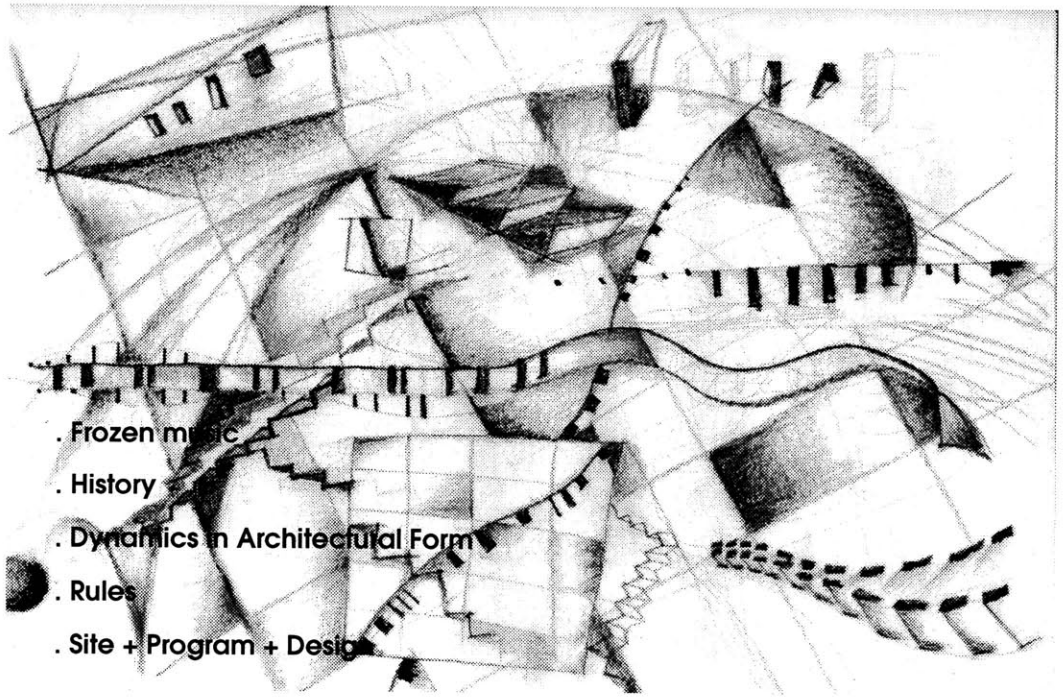
Introduction



Introduction

Frozen Music

I am writing now in the storming weather. If 'architecture is frozen music' as people say, then I am writing inside of a real frozen music.

When starting to investigate the relationship between architecture and music, one is at once confused with the perception of these two art forms, because architecture is the design of space, and music is the design of time. Therefore, the interface between architecture and music needs to be well defined in order to bridge these two art forms.

History

History has enough suggestions about the possibilities of interactive applications between architecture and music. Renaissance architects such as Alberti reflected on the fundamentals of musical composition by applying the musical ratios to systemize the proportions of building. They considered proportion, which informs beauty as a 'hidden cause', as something 'inherent'.

Unlike the majority of previous studies, like static perspectives, I am proposing a dynamic approach using musical principles to architectural compositions. What interests me is the parallel nature of architecture and music. When examining the structure of the compositions, architectural and musical, it has been found that they share the same components: rhythm, variation, harmony, theme, etc. I am not interested in literally translating from note to note, rather, I am looking at the inherent nature of these two art forms. It is also important that decoding from music to architecture should be intuitively correct. With this in mind, one begins to realize that mapping the organizational principles of a time-base onto those principles existing in a space-base, enables a transformation from musical form to architectural form.

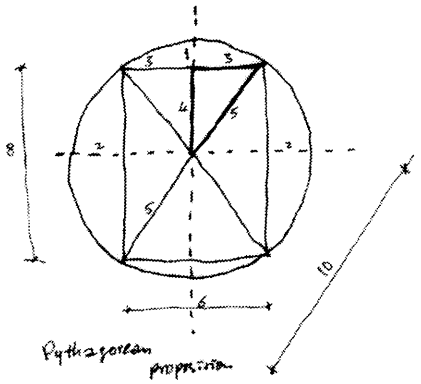


Figure 1: Pythagorean Proposition

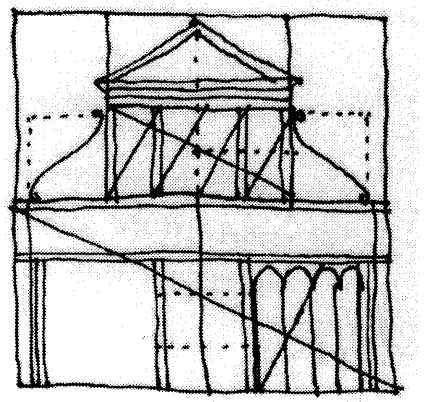


Figure 2: Alberti, Santa Maria Novella

Dynamics in Architectural Form

In a particular attempt to discover different spatial perception, this thesis seeks to establish a methodology and focuses on the issues of space- tension and relaxation; interactive circulation; conspicuous spatial organization- which make architecture more energetic in form. The question is: What kind of compositional devices will allow me to achieve dynamic architectural form? A series of explorations through diagrammatic modeling, based on musical principles were done to answer this question. I found four compositional devices, which exist in both art forms, to be suitable for this investigation. These elements are *repetition, displacement, contrast,* and *transition.*

For most of us, the notion of universal correspondence as the criteria in aesthetics now seems subjective and blurred. Proportion used to link everything together, but we probably need to reinterpret it so it has meaning in our contemporary environment. Deconstruction provides a good example for the different perception of proportion.

Art needs to be unfolded in order to be appreciated. We search for inherent structure to find the original meaning. I have no intention of establishing the 'real correspondence' between architecture and music, rather, the metaphoric conjectures of both. The point is to discover the essence of life: perception and the physicality of things. Therefore, through the exploration of this parallel between visual and audible patterning, the discourse of this relationship is given a new dimension.

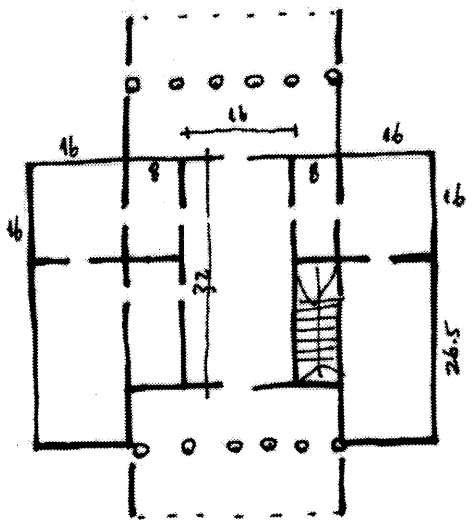


Figure 3: Andrea Palladio, Villa Badoer a Fratta Polesine

Rules

A series of diagrammatic models exploring the musical principles allowed me to investigate the relationship between architecture and music and to confirm the compositional devices of the *methodology*. Some explorations, based on different musical principles as themes, were carried out with 2-D or 3-D diagrammatic models: elementary form, rhythmic pattern, counterpoint, foreground/background, and motivic composition. The result of these explorations became the guidelines of my design. Combining intuition and discipline, the architectural form can be developed through the rules of composition.

Repetition

The activity of composition cannot be carried out without brining in this essential music element: repetition. Repetition is here an organizing device influencing the form of the resulting work, where as displacement is a device which generates the dynamic character of the composition. The repetition of a melodic figure on different levels is such a useful device because it simultaneously unifies while also providing sufficient contrast.

Displacement

Furthermore, the staggering of the same or similar melodic figures creates a diagonal situation in which the tension and relaxation of space and the dynamic architectural form occurs. Memory and recognition also play some part in the perception of such a unity.

Contrast

Contrast is always presented in the emphasis of space, structure, system, etc.

Transition

Transition is important in the point of differentiation of any two spaces or zones, such as water and land, the shift of two different instruments, or from key to key.

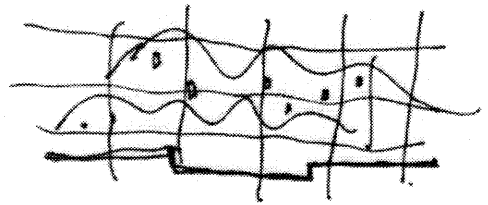


Figure 4: Sketch of Design Concept

"Music and architecture appeal to the human organism not only on the emotional level, but also on the intellectual level, based on our reasoning power (the power of association). Emotional response to a building (or symphony) acts upon the observer's (or listener's) powers of association". -J. Skinnider

Since this thesis can be approached from different angles, rules need to be established. In other words, my interpretation of the relationship between these two art forms and the approach I use, is based on the following ideas. Artists use their own language to communicate: poets use words; dancers use the movement of body; and architects use forms to convey ideas. Components in architecture and music are not fundamentally different: architects and musicians share the same compositional techniques; the architect composes space, the musician time.

Site + Program + Design

My position here is not to make a building which looks like a piece of music, rather, to apply musical principles to my design process.

This building features repetition, displacement, contrast, and transition which provide cohesion and dynamics. Melodic (curves) and rhythmic (structure) figures are so engaged with each other that they are two sides of one hand. Moreover, the dynamic assemblage and space manipulation add *flesh* to the idea of composition.

In order to generate the analogies of architecture and music, a multi-use art center will be the instrument through which the dynamics of architectural composition will be achieved.

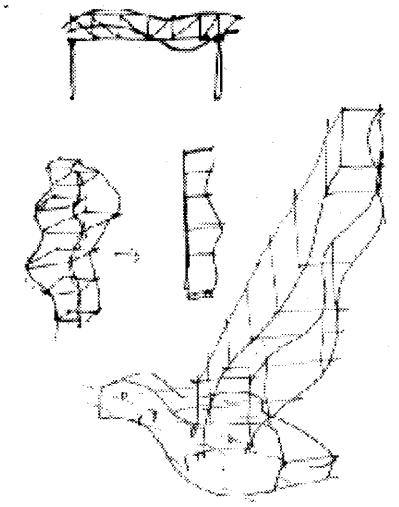


Figure 5: Sketch of Form Study

This new cultural facilities, containing the programmatic elements: art galleries, exposition space, and an auditorium will be located near the Dorchester Bay in New Squantum in North Quincy, Massachusetts. This art center should take part in offering the simultaneity of activities which is lacking in the vicinity.

As the outcome of this exploration, this multi-use art center will establish the consciousness of memory which provides people with a variety of spatial experiences while moving through a sequence of spaces.

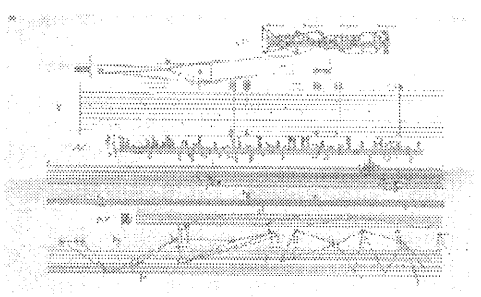


Figure 6: John Cage, Musical composition from *A John Cage Reader*

Harmony

Harmony is always felt in its relations to rhythmic structure. Thus, harmonic rhythm plays a role in controlling and stabilizing musical flow. This concept informs the theme of my design --that there are 'varied' spatial elements within a 'fixed' structure system.

Rhythm

Rhythm can be understood as a regular reoccurrence of visual forms and color in space or sounds in music.

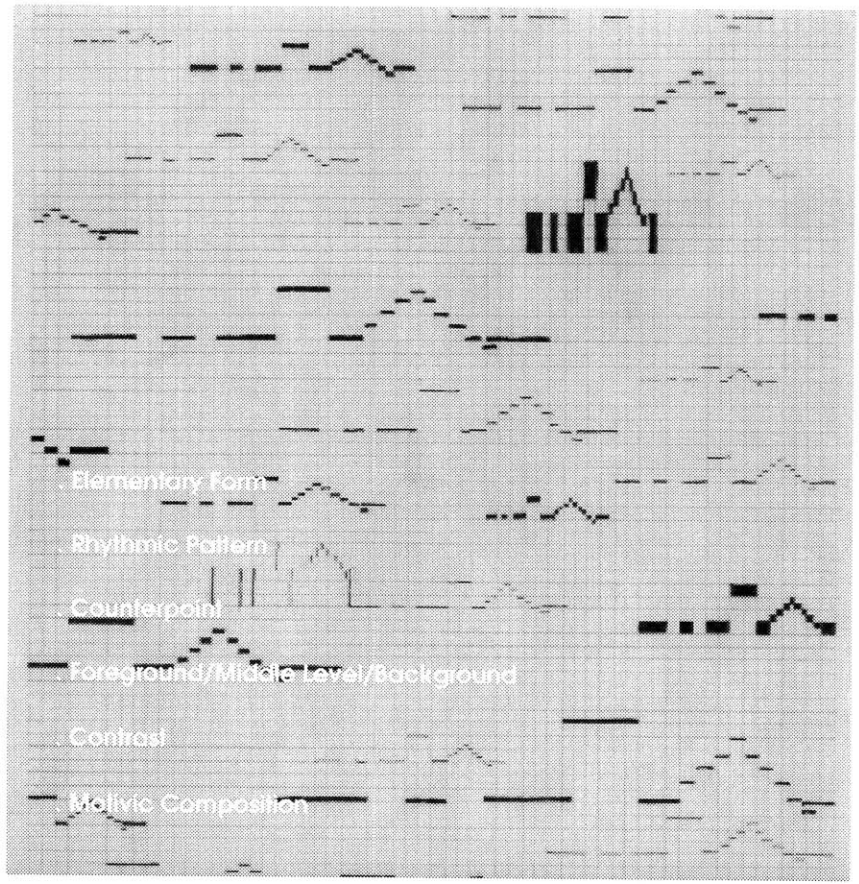
-from *The Structure of Music*

"... composition as an activity integrating the opposites, the rational and the irrational, bringing about, ideally, a free moving continuity within a strict division of parts, the sounds, their combination and succession being either logically related or arbitrarily chosen..."

- John Cage

Chapter 2

The Exploration



The Exploration

I do not read musical scores, but I play music, and I oftentimes play along with some pieces which I have never heard before. I do not imitate the melody and repeat it; I listen to the structure, sense the tonality, and pick up the pattern of the specific piece of music. Especially during improvisation, what the musicians need is the skeleton to which they can add flesh. They can forget about the notes on the score, because they cannot improvise while they are reading the notes. Therefore, when investigating the relationship between architecture and music, I am not interested in literally translating music from note to note, but to use the compositional principles of music as the vehicle to generate architectural compositions.

Half-way through my thesis, my advisor professor Andrew Scott and I had a discussion about the strategy of my thesis: Will it be a highly deterministic process of explorations all the way to the end? Or, up to some point, take a pause, evaluate the process, then according to whatever the result, set up the criteria for the next step and find the direction toward the destination -- design. The latter seemed more reasonable to me, for the belief in the theories of my thesis should be tested out by physical construction.

A series of diagrammatic models exploring the musical principles allowed me to see the relationship between architecture and music and confirmed the devices I selected.

Some explorations based on musical principles of different themes were carried out with 3-D diagrammatic models: form, rhythmic pattern, counterpoint, fore/middle/back grounds, and motivic composition. They later became the guidelines of my design. I realized that my architectural proposition dealt with the interaction of two systems.

D1 - Elementary Form

As a warm-up exercise, this A-B-A form simply suggested to me that transforming music into 3-D architectural representation is by no means an easy task.

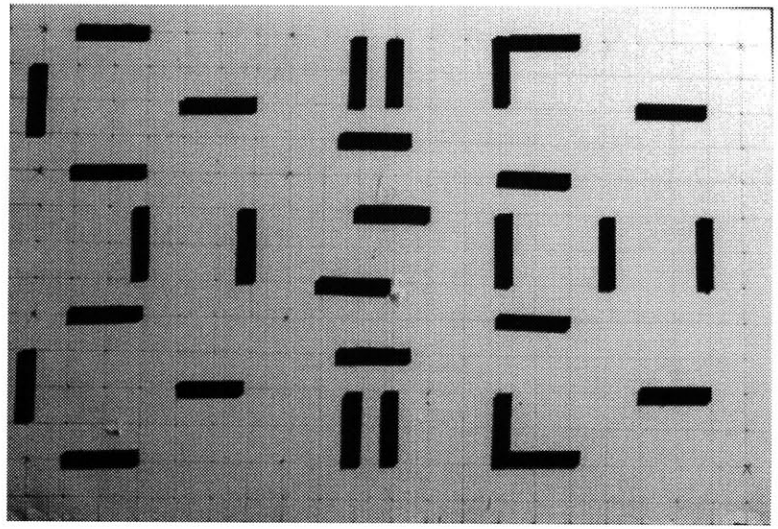


Figure 7: A-B-A Form

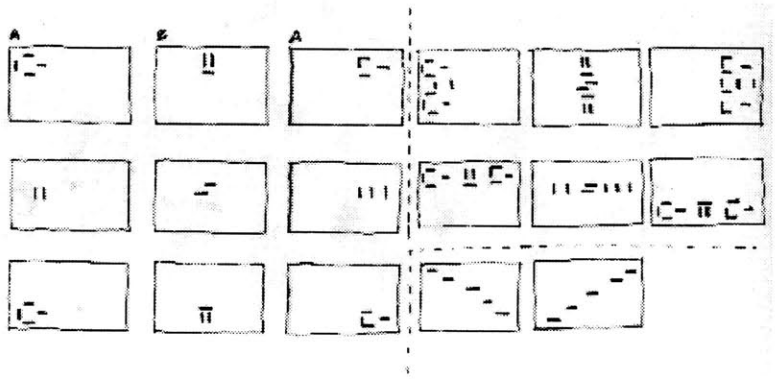


Figure 8: Analytic diagram showing the combinations

D2 - Rhythmic Pattern

Shifting rhythmic patterns can provide an interesting way to further develop a melody. When the melody deviates from the chordal progression, the melody and chords are on the diagonal and generate tension and dynamics.

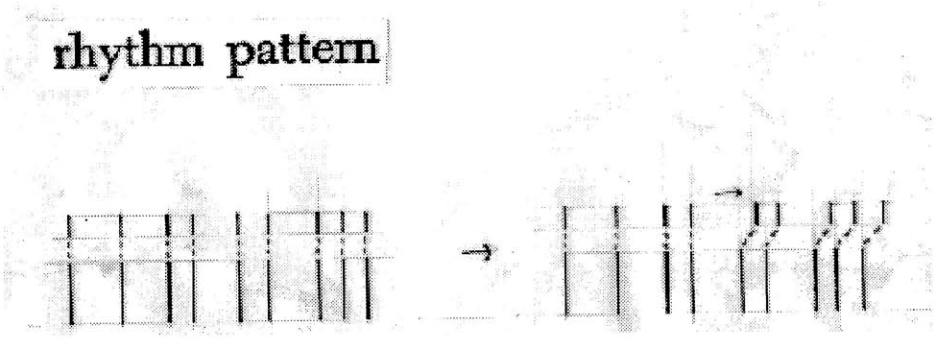


Figure 9: the shift of rhythmic pattern

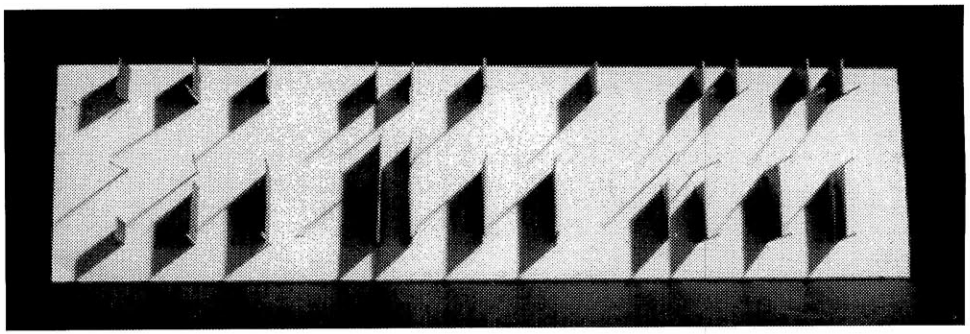


Figure 10: Combination of rhythmic and melodic progression

D3 - Counterpoint

The purpose of this exercise is to show how the tension and relaxation of spaces is generated by staggering three identical but different timbres (materials) melodic figures. Before displacing the melodic figures, all of the vertical intervals are the same. By a simple move, the spatial relations among them are totally changed. Some spaces become looser, some more collective. Short columns on the top as the datum and some strings make the spatial organization more defined. This becomes the most important exercise, simply because it allows me to see, again, the tension and relaxation in space, and the interaction between two systems (fixed and varied). Many study models as well as the driving idea of my design were actually derived from this exercise. Later on, displacement, as a compositional device, became the creator of the dynamic architectural form in my design.

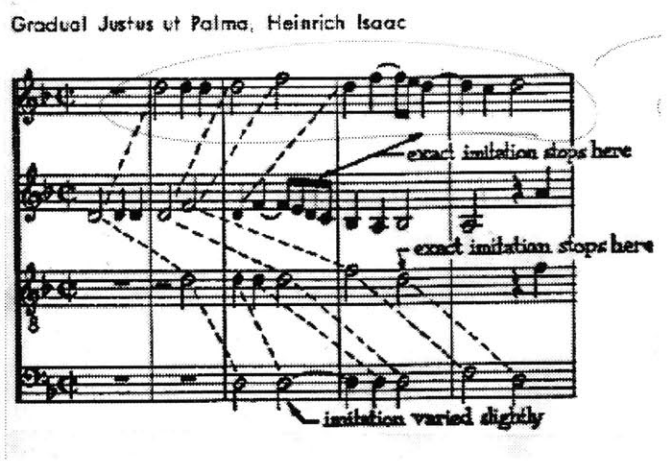


Figure 11: Heinrich Isaac, Gradual Justus ut Palma
from *The Structure of Music*

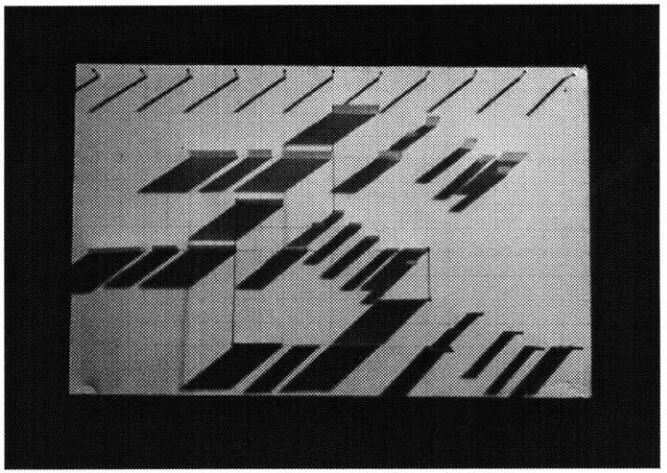


Figure 12: Imitation of melodic figures of different materials

D4 - foreground/middle level/background

The representation of foreground/middle level/background resulted in a form enclosure suggesting a roof. Notes in different sections are extruded to the same pitches as shown on the ground. Then the related notes were connected with strings to shape the unusual transparent pitched roof.

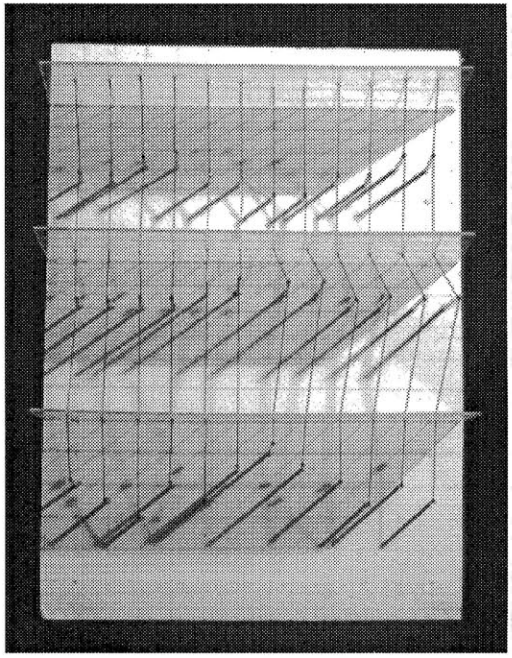


Figure 13: Spatial components

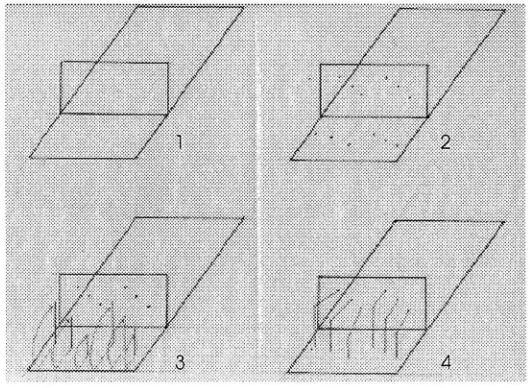


Figure 14: The procedure of extrusion

D5 - Contrast

White cubes forming the curves within a rhythmic structure pattern revealed the interaction between two systems, showing different spatial compartments. With this diagram, I was able to confirm the idea of the *varied* within the *fixed* that would be the theme of my thesis design.

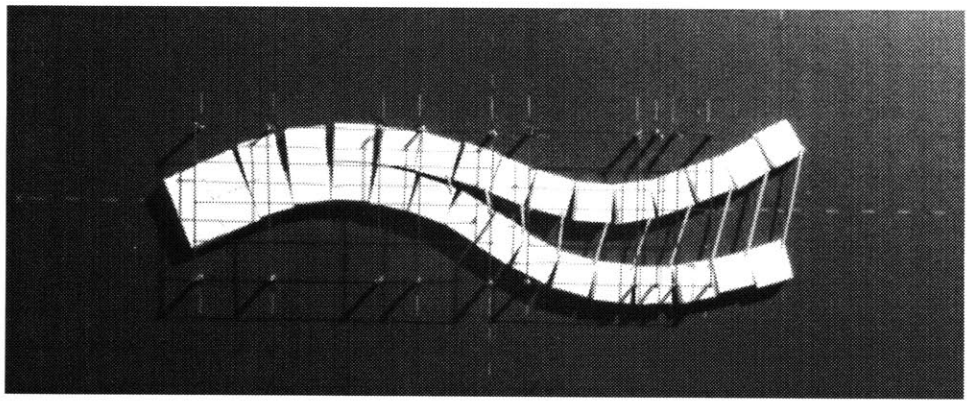


Figure 15: The 'varied' within the 'fixed'

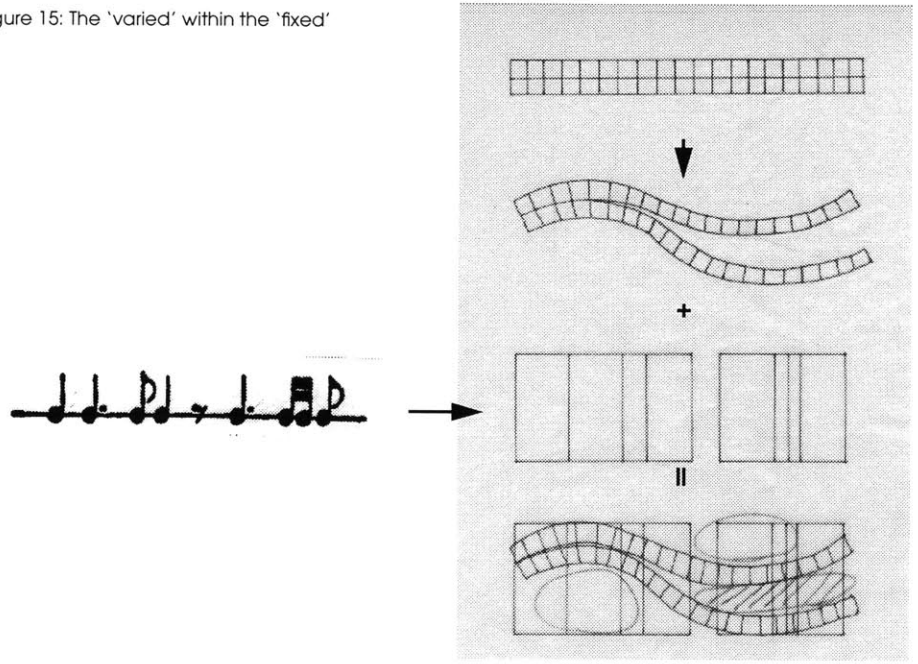


Figure 16: The interaction between two systems

D6 - Motivic Composition

This is an abstraction from Henry Purcell's work. All the motivic elements were 'plugged- in" so that spatial elements could be freed up from the conventional perception of stacking the floors to create volume.

The sculptural composition suggested that all the floating spatial elements are linked by an interactive circulation system within the framework.

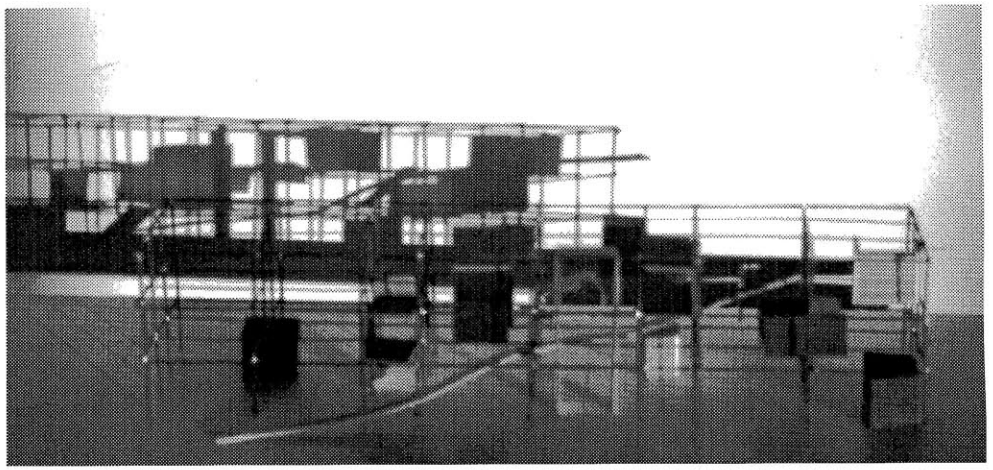


Figure 17: Model showing the 'plugged-in' spatial elements

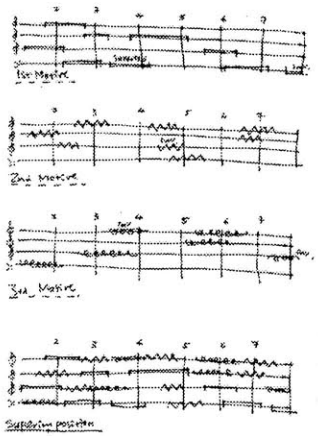


Figure 18: Motivic composition

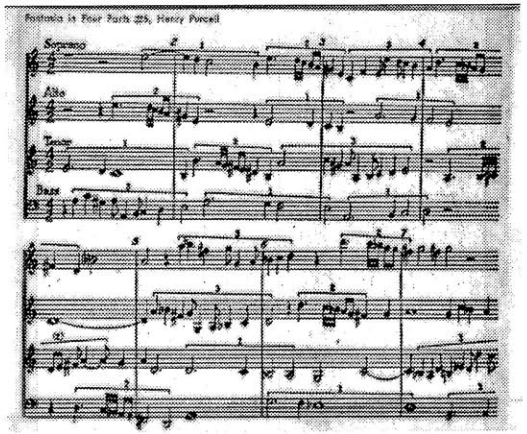


Figure 19: Henry Purcell, Fantacia in Four Parts #6 from *The Structure of Music*

Chapter 3

Point of Departure

Point Of Departure

Choosing Thelonious Monk's "*Straight, No Chaser*" as the point of departure, I translated the first twelve bars into a 2-D graphical representation of notes revealing the pattern of motive which interacted the repetition of motives that generated the dynamic character of this particular piece of music. It also presented the importance of repetition that creates the awareness of memory in order to sense the variations of motive. Through the variations of motive, combining expansion, truncation, and syncopation, the first bars create unbelievably intense and dynamic musical expression, which set the stage for the next 12-bar cycle. Without applying the device of repetition, one can hardly perceive the notion of truncation in this piece of work.

Each single note actually produces nothing musical without reacting to the other notes. Through composition, the interaction between notes, vertically and horizontally,

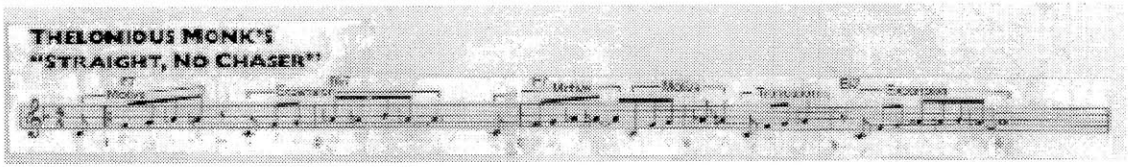


Figure 20: Thelonious Monk, *'Straight, No Chaser'* from *Jazz: Theory and Practice*

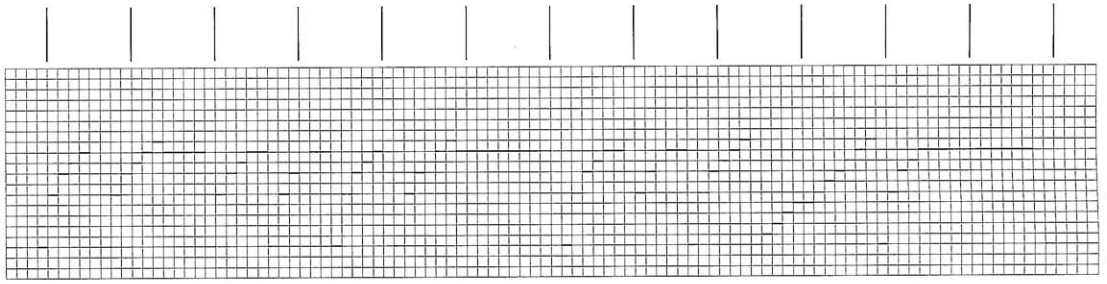
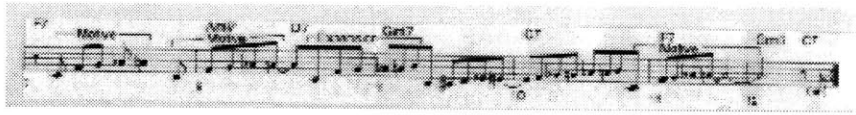


Figure 21: Graphical representation of *'Straight, No Chaser'*

establishes the harmonic relations and progression. Similarly in architecture, a space cannot be formed by a single element unless all of the related elements are correctly assembled.



D8 -Straight, No Chaser

With this in mind, I 'borrowed' the musical structure of Monk's *Straight, No Chaser* as the framework in which the spatial organization was generated by the variations of simple architectural motive.

More importantly, this exercise stated my architectural proposition: From the interaction between two systems, spatial or structural, one begins to see the boundaries, the different zones, the spatial containment, and the possibilities of movement. For instance, a curve is just a curve, a grid is just a grid. When a curve sits in a grid, one can see the interrelations of systems, and of spaces, since the whole configuration is more defined.

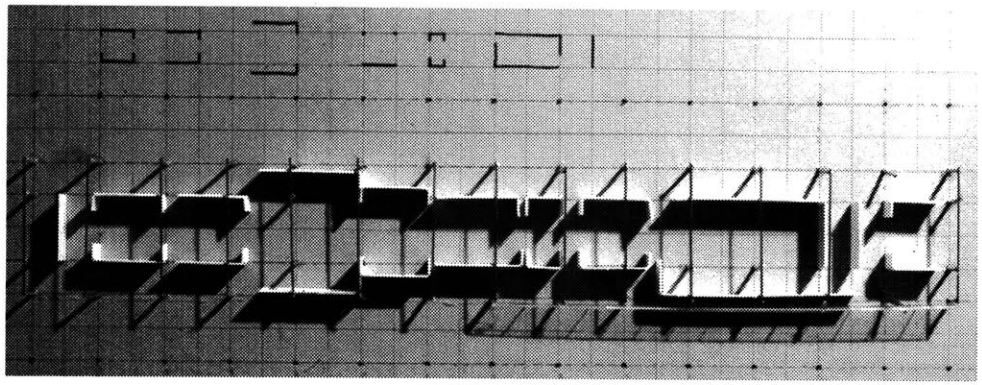


Figure 22: Spatial Organization of the variations of spatial motive

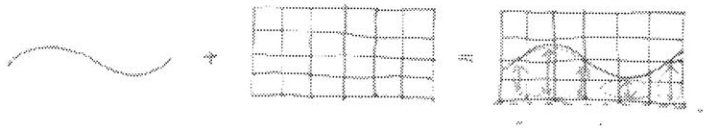


Figure 23: Interrelations of system revealing the territorial definitions of space

D9 - Pattern Shifting

Turning from plan to elevation, and equating window openings with pauses, which are like rests in music, I began to design a building facade. I repeated the pattern, stacking up the floors and sliding them to either side, and generated a dynamic facade with different heights of spaces at both ends as transitional areas.
This diagrammatic model showed all four of the compositional devices, but the question is: Can this diagram become a building? Is the linearization of architecture as important as that of music? One can stop, stay, and turn-around in space, but not in time.

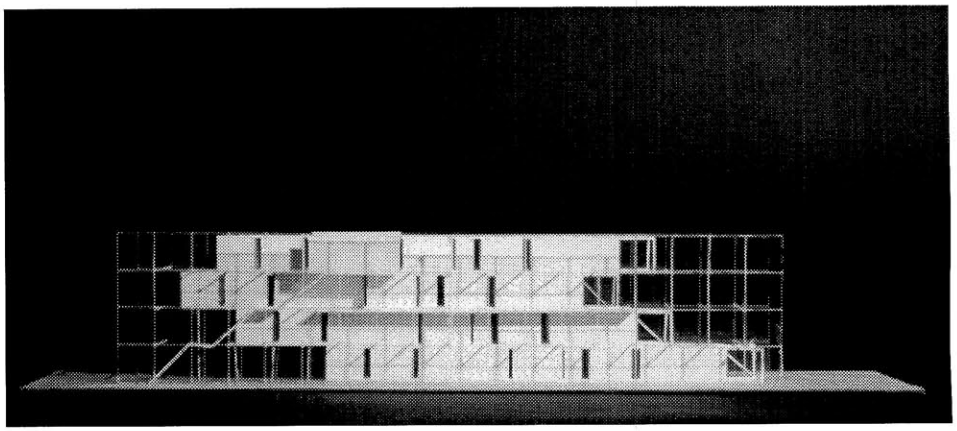


Figure 24: Shifting of window patterns and transitional spaces

D10 - Circulation as a Loop

In order to break up the linearity, the previous model was duplicated in a conceptual size and was arranged in such a way that the circulation system can form a loop as well as the transitional zones

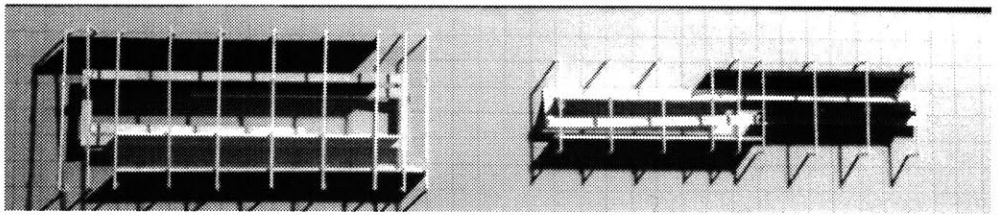


Figure 25: Interactive loop

D11- Void/Solid

This was an unsuccessful jump from diagrammatic explorations to architectural design.

The making of this model was stopped in the middle of the way, just because the literal transformation led to the lack of subtlety. But, it was the first time that I saw the curves for my design emerging from the placement of rectangles which formed the volume of the auditorium. I also sensed that I should be more energetic in my thinking.

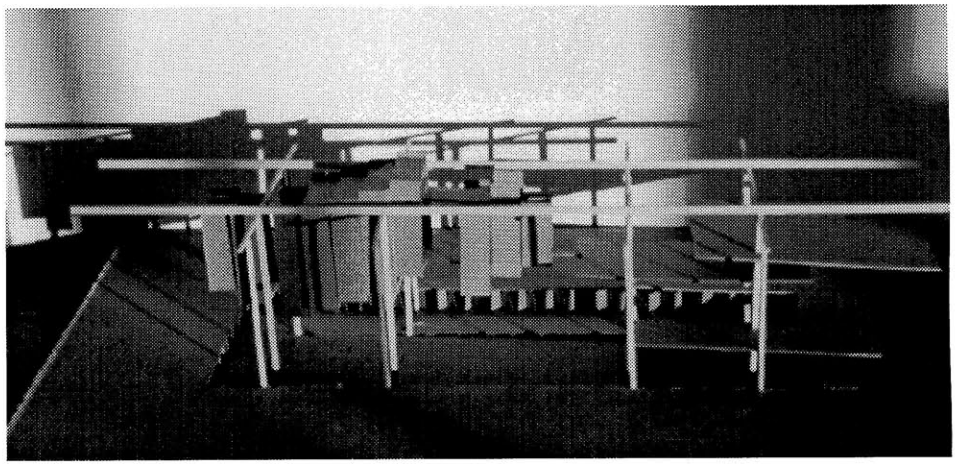


Figure 26: Contrast of vertical and horizontal spatial elements

D12- Dynamic Form

Then the real jump happened. The previous model suggested that freeing up the spatial elements inside of the framework was a must. Motivic elements therefore were thrown into to the air, mingling, interacting, and sometimes interlocking with each other. When looking carefully, the spatial ordering based on function could be found in the composition.

Were these motivic elements really free in the cage? Not really. The ambiguity of the independence of components within the framework was there because of the unclear differentiation between structural and spatial elements.

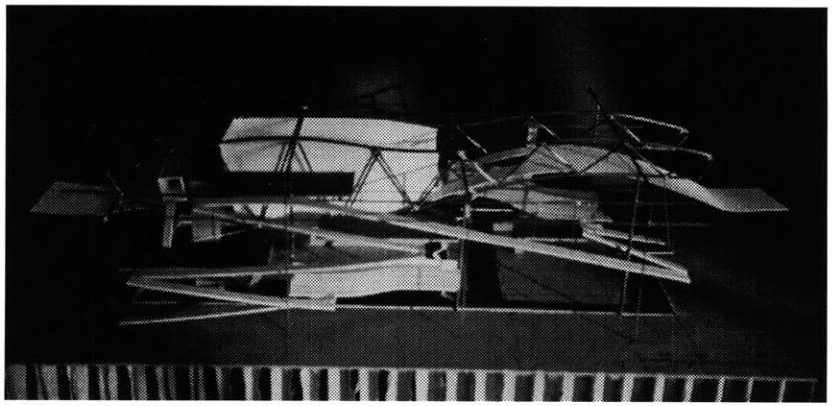


Figure 27: The fluttering object

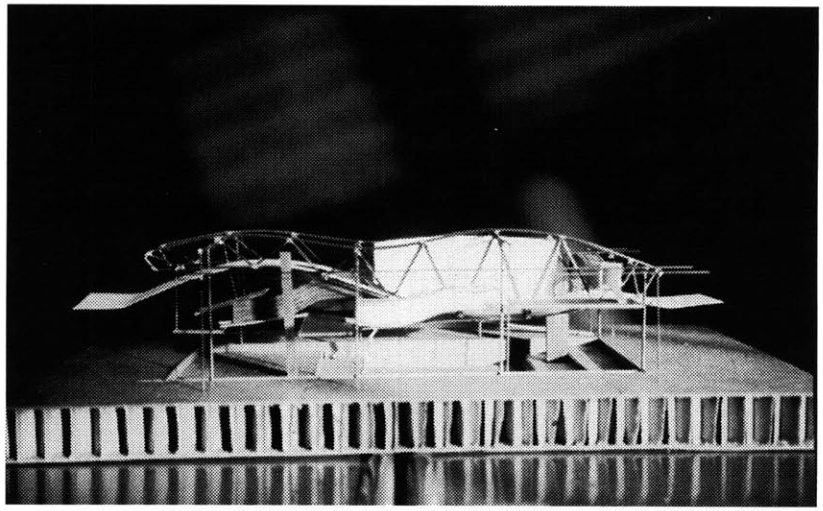


Figure 28: same as above

D13- The Curvy Bridge

For clarity's sake, the structure for these two curves was detached from the framework. A bridge-like truss structure held up the volume between the two curves and sat on the forks at both ends. That brought up the opposite argument: The nature of curves tends to be free, so why bother to suspend them in a huge structure which detracts from their elegance? Furthermore, the 'bridge' seemed too narrow to accommodate an auditorium. It needed a change: The suspension. . . .

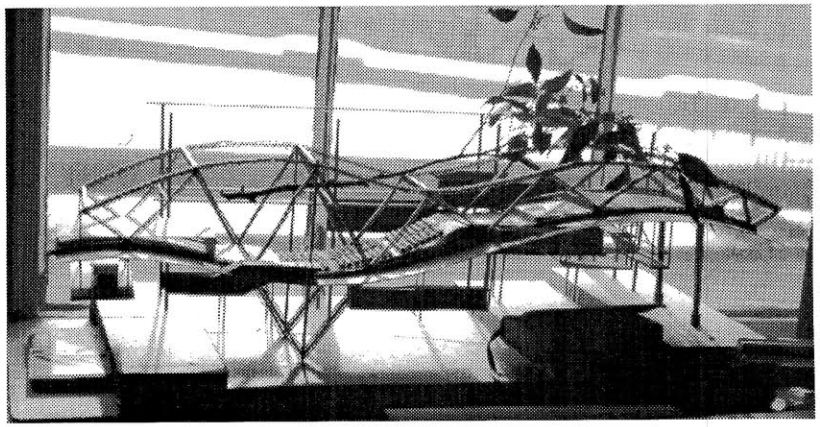


Figure 29: The curvy bridge

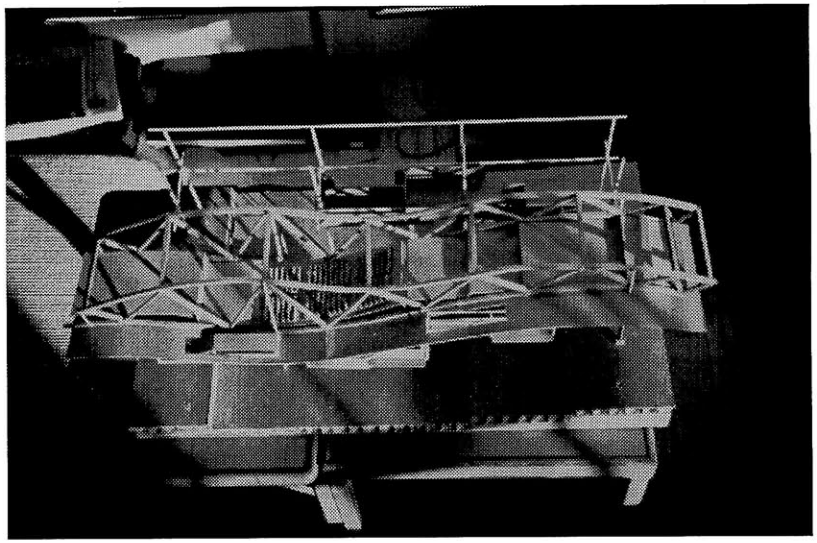


Figure 30: Looking down from above

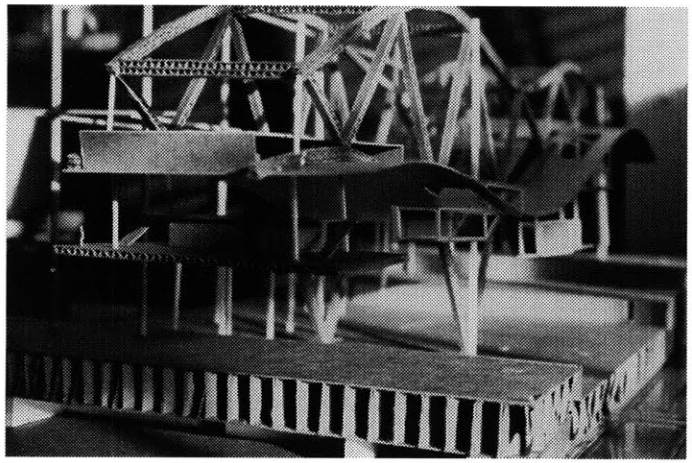


Figure 31: Showing the wavy access on the side

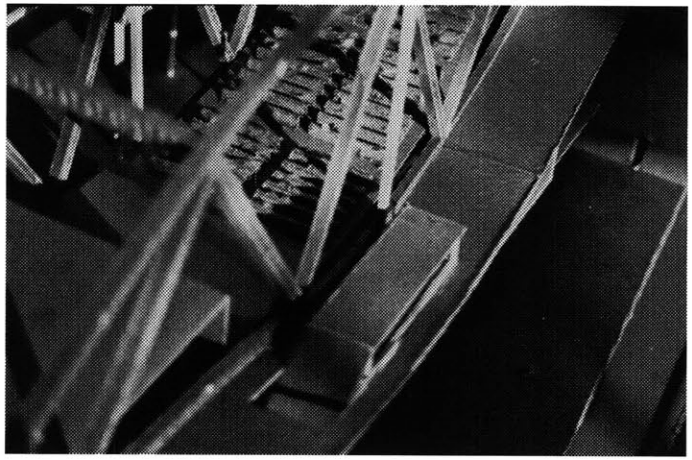
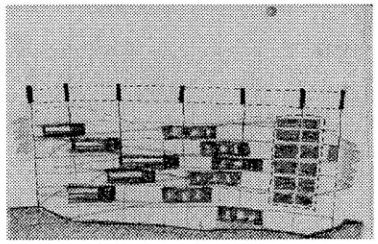
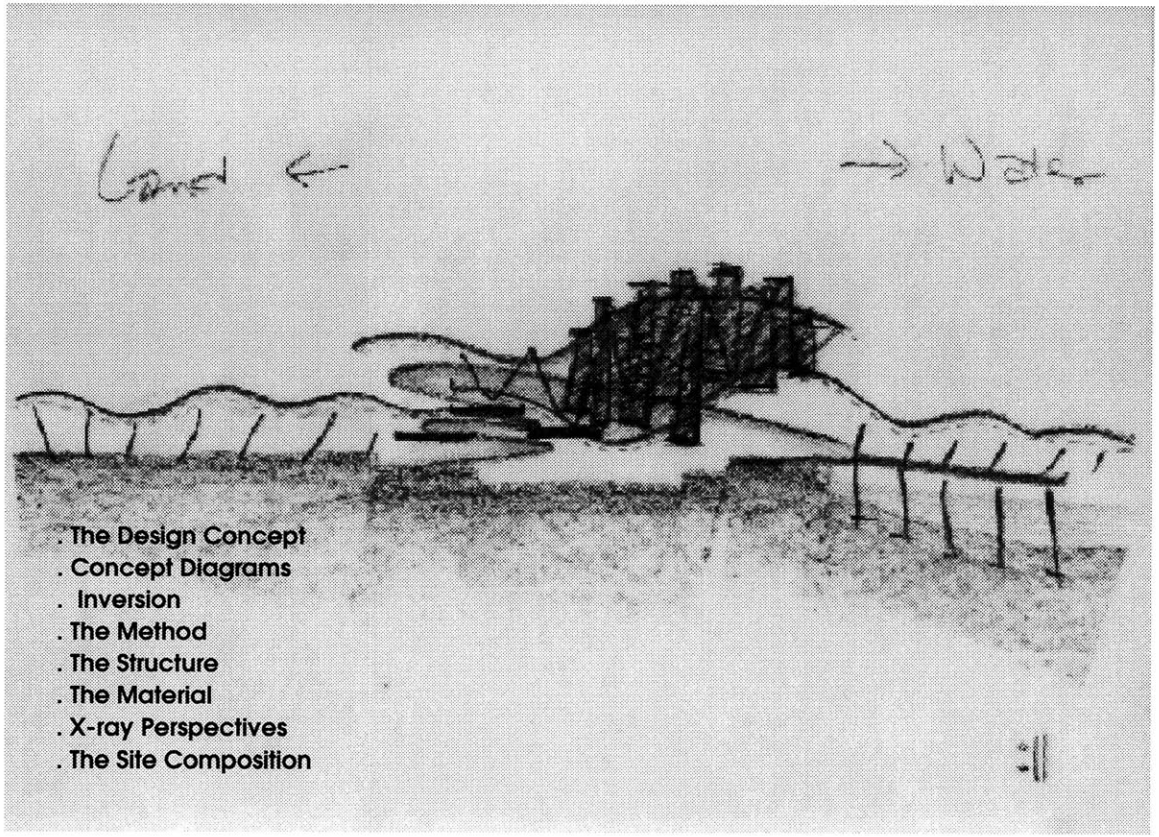


Figure 32: The seating of the auditorium



Chapter 4

The Design



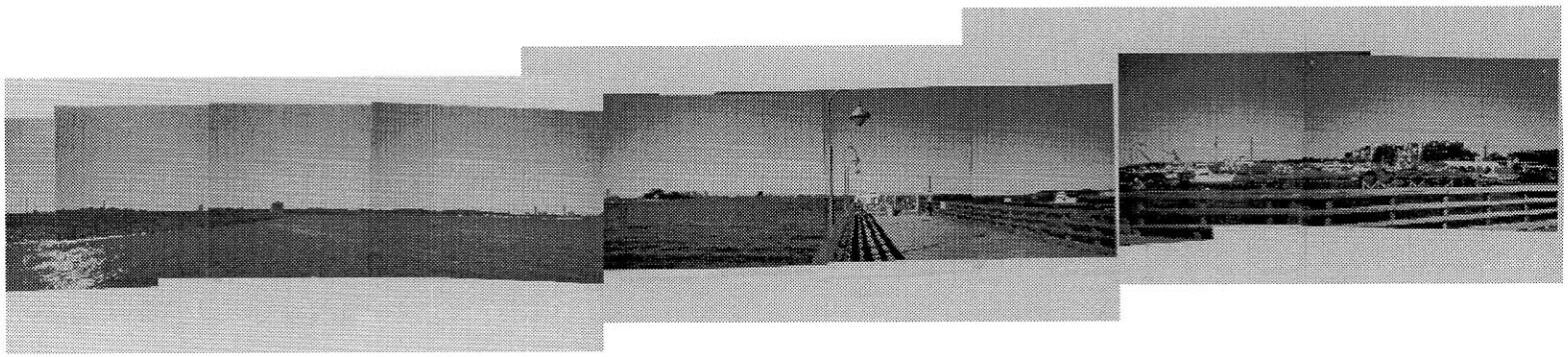


Figure 33: Panoramic view of the site **from the pier**

The Design Concept

This project strikes a balance between the elements of variety and expectation through repetition and other devices. The scheme synthesizes the concept: varied system (sculpture-fish) within fixed sytem(frame-cage). An interactive circulation system is provided to link up these two systems and to create a more vital spatial experience.

This multi-use art center combines daytime activities- meetings, symposiums, exhibitions- and nighttime events- concerts, art performances- creating its own culture on the site. The visual impact of the building from a distance reveals the composition as a whole. When approaching, a micro-perspective occurs. Some important spatial experiences, which occur while moving through the building are tension/relaxation, dark/light, and closed/open. All these spatial phenomena will be experienced within this built form.

Different from the conventional setting, all of the programmatic elements are conspicuous to the visitors. Issues of public/private areas, and indoor/outdoor activities are clearly connected and defined. A variety of alternative accesses intensifies the walk-through experience by weaving together the number of events which are encountered.

An outreaching cafe at the mouth of the suspended auditorium allows for panoramic views to the city and the bay, while also defining the transitional zone between water and land. At night, from a distance, the building shows up as if the elements of the building are a urban lantern, raised up in the air.
The pier acts as a connector /turn-around, and mediates an *arrival sequence* from water.

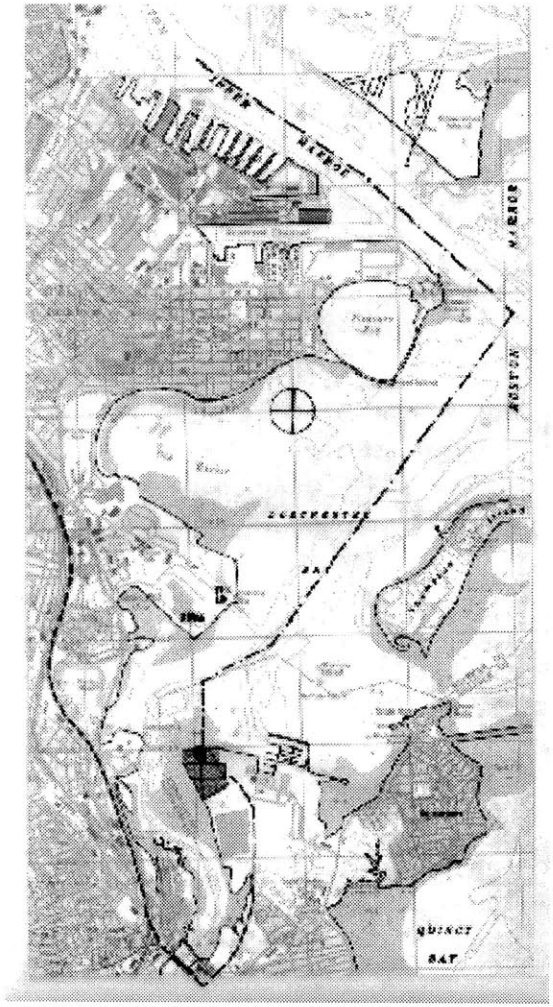
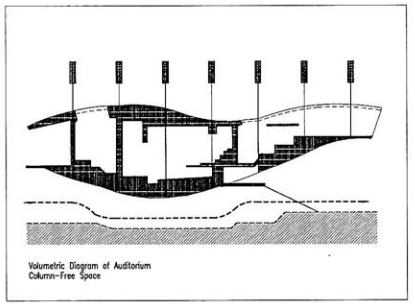


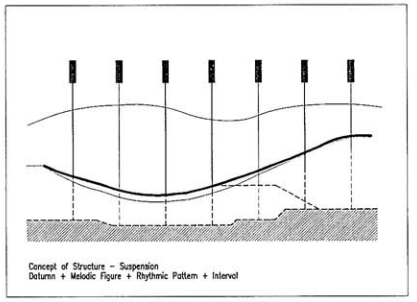
Figure 34: The orientation of the site

Concept Diagrams

How to establish the dialogue between two curves running on different levels in different contours (shapes)? From the counterpoint point of view, I used short identical pieces of segments inherently existing in these two curves, and twisted them. Thus, the repetition of the short segments was staggered on the diagonal, situating the ordering of double melodic figures into a clear harmonic and rhythmic relationship.

Within the cage, spaces with different heights (intervals) in the open and closed area generate tension and relaxation in space.





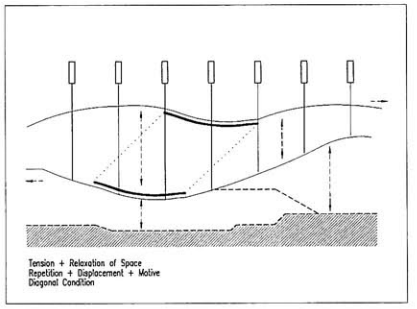
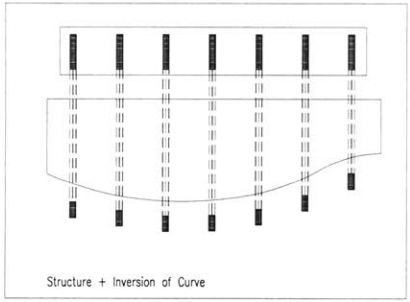


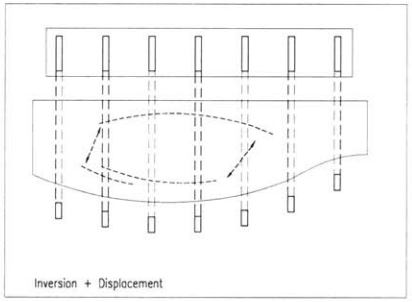
Figure 35: Diagrams of design concept

Inversion

When intervals are inverted, their consonant quality changes, because the spacing and register have been altered. Inversion in space, in my interpretation, is not simply turning things upside down as musical notes, but changing the situation from vertical to horizontal or vice versa.

The diagrams show the inversion of curves from section to plan, and the idea of suspension creates the column-free space for larger expositions.
They also show the contrast between two systems, and void/solid spaces.
In terms of programmatic organization, the long bar, accommodates three zones: public art galleries, semi-public conference rooms and studios, and private administration areas. Also, the bar acts as a supporting element, serving the auditorium and exposition space.





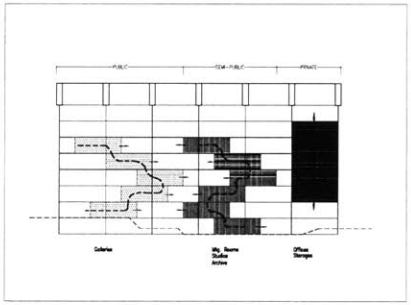


Figure 36: Diagram of design concept

The Method (of construction)

This study model, a useful vehicle, gave me the sense of space, form, and the method of construction.

With the understanding of a construction method for this project, I made this model in reverse order. A negative base was constructed for the girders, beams, and joists on which to lie. Having done this, the exterior and interior walls, floor, and seating of the auditorium were fixed into positions to stabilize the fish.

The framework, a series of bents as for single story, was built separately on the site to define the territory of this building. Next, the fish was moved into the cage, and was correctly hung by cables.

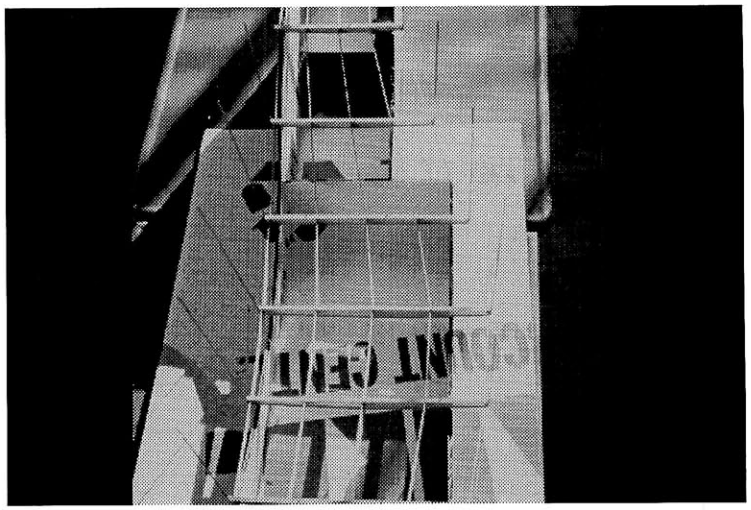


Figure 37: The base

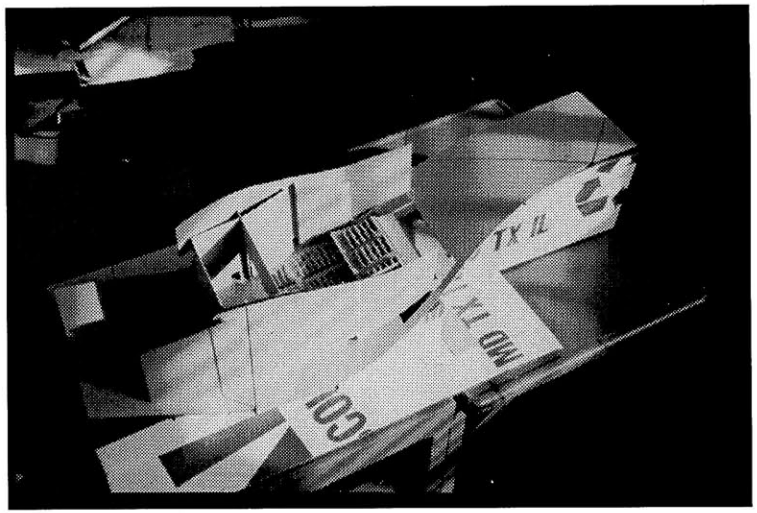


Figure 38: The enclosure and seating of the auditorium

During my content review, professor Scott called it a *'jumbo 747'*; professor Porter a *'mobile crane'*; professor Morse-Fortier a *'whale'*. I call it the *'fish'* in this book.

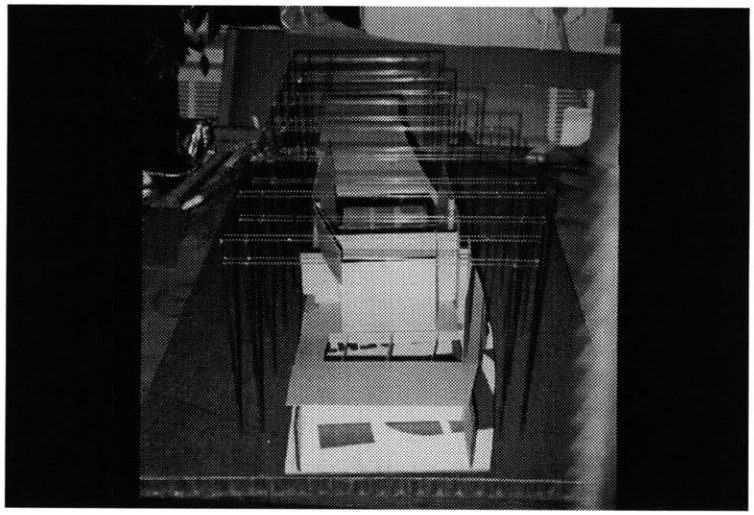


Figure 39: The 'fish' fitted underneath the framework

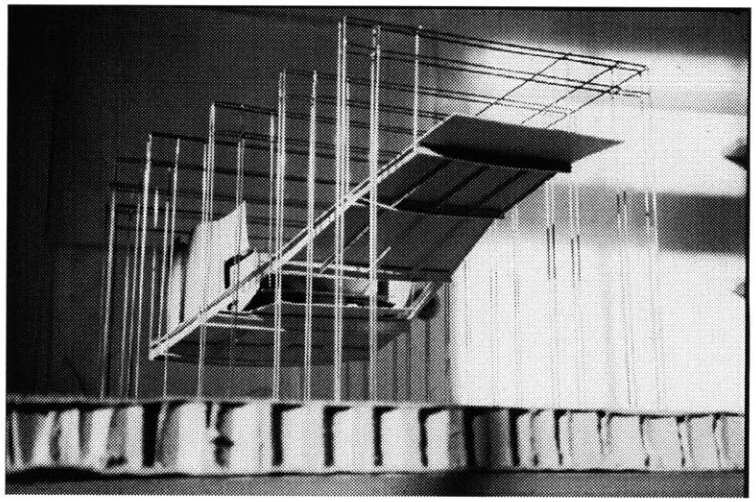


Figure 40: The fish hung in the 'cage'

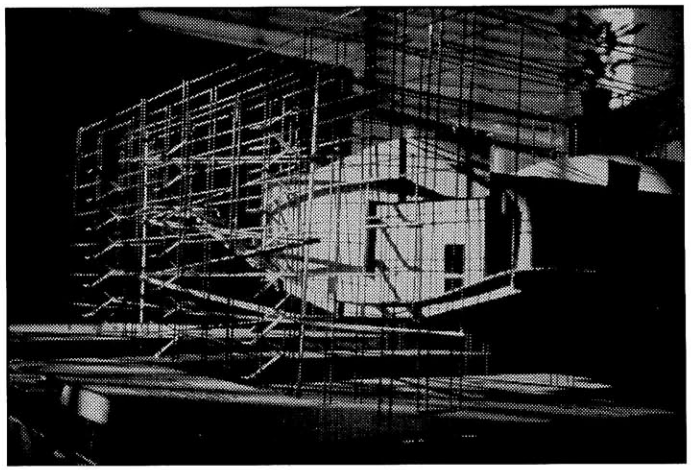


Figure 41: View from the side

Figure 42: View from the top

The Structure

As soon as I learned that the auditorium space should be wider than the phase 1 model showed, I decided to expand the width by 'dragging' out the edge. With the concept of catenary: the wider, the deeper, the shape of the fish belly was then determined.

From a structural point of view, this is another way to understand where the form of the auditorium was derived. One can also interpret the structural system in a musical way: The framework sets up the datum as a *bass line*, serving as the foundation for percussion, controlling and stabilizing the melodic progression. The strings (cables), in different pitches, then performed the melodic progression. Compared to the Counterpoint diagram (see p.19), there is actually nothing different.

That is why the suspension system was selected.

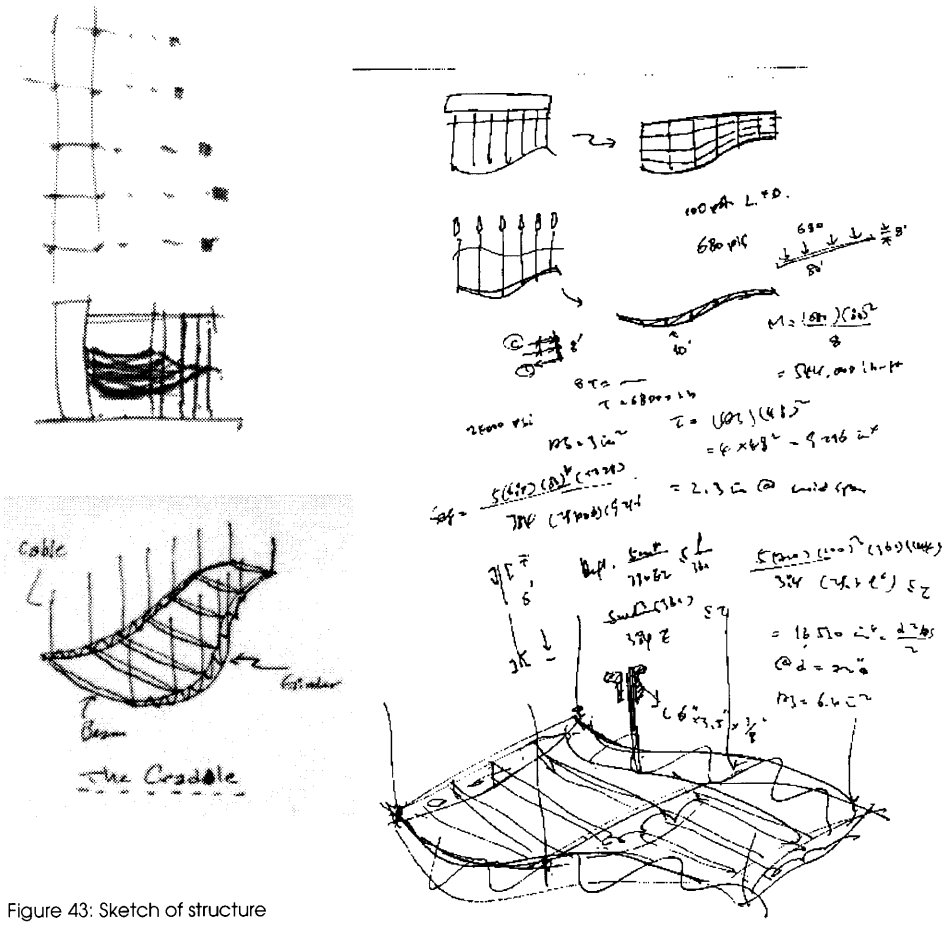


Figure 43: Sketch of structure

The Material

Whatever the style of music, it is important to recognize first those musical elements and materials that belong to that style. In terms of materiality, steel and glass play the major roles by their behaviors and properties. The choice of building material in architecture corresponds to the instrument chosen in music. (Simoncsics, p.163)

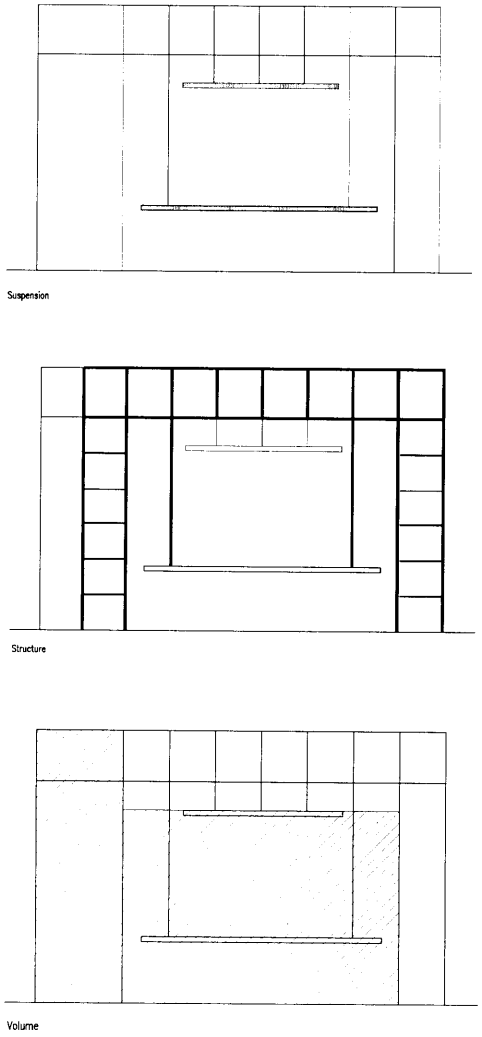
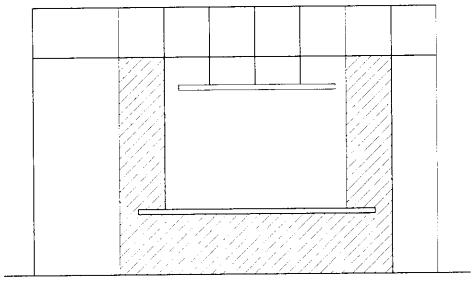
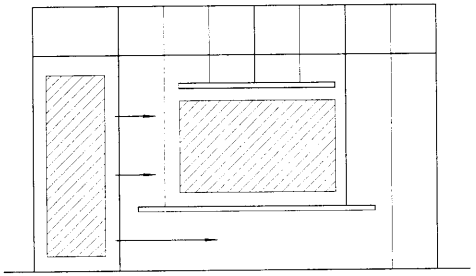


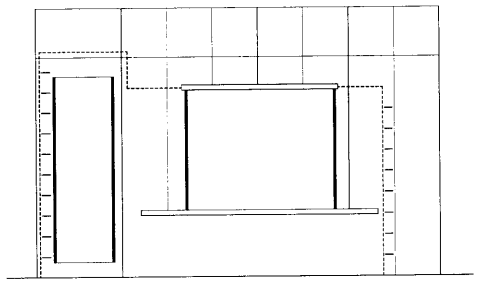
Figure 44: Diagrams of suspension/structure/volume



Transitional Space



Service



Layering of Vertical Enclosure

Figure 45: Diagrams of transitional space/service/enclosure

X-ray perspectives

Oftentimes, I thought about the issues of representing and revealing the notion as well as the perception of space. To find a new mode of representation, the abstract is always important. In this manner, wire-frame computer drawings allowed me to examine the space by seeing through it objectively from any angle.

Another level of representation is collage: by doing that the designer's personal expression can then be presented subjectively (see p.56). Furthermore, when comparing to physical models, the x-ray perspectives supplement and highlight the perception of space.

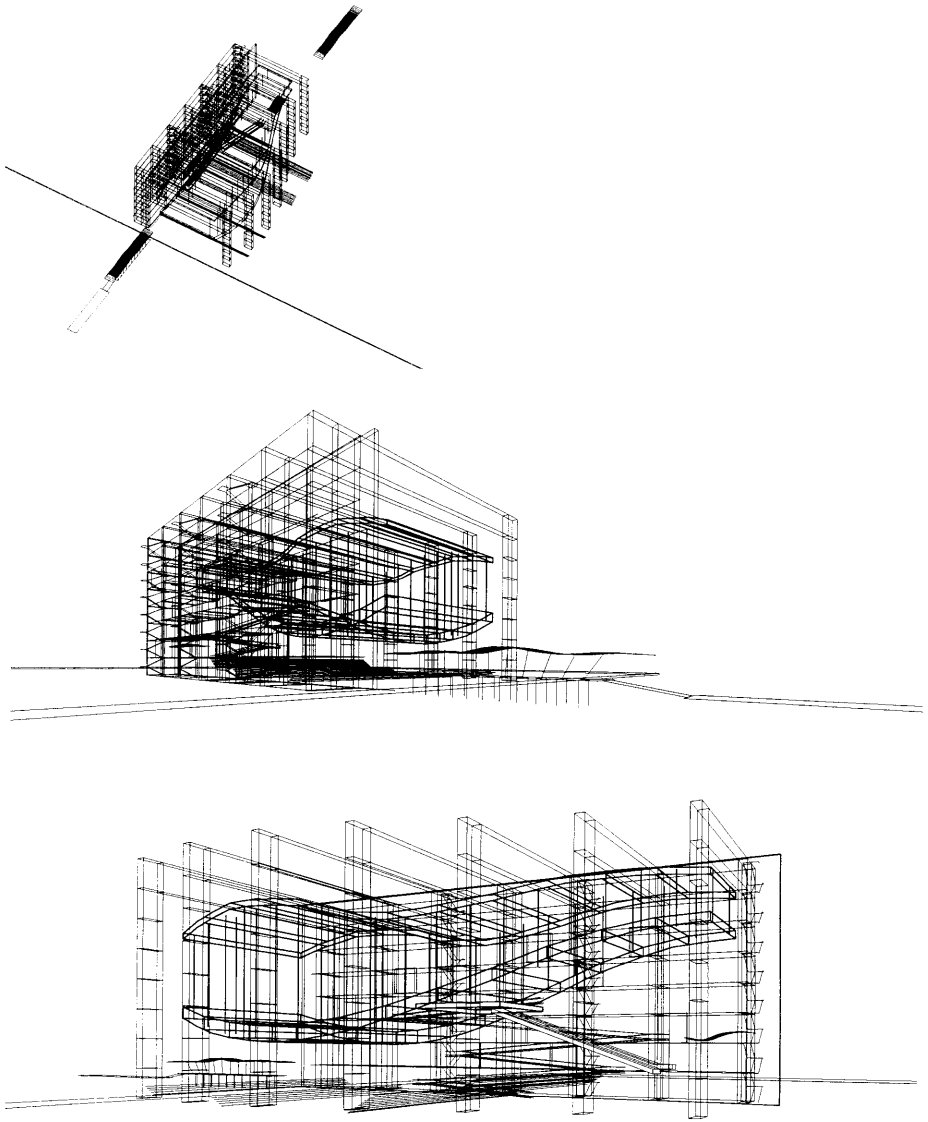
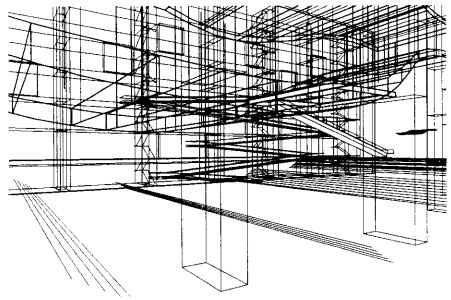
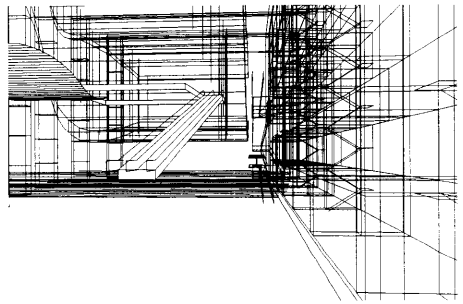


Figure 46: Exterior x-ray perspectives





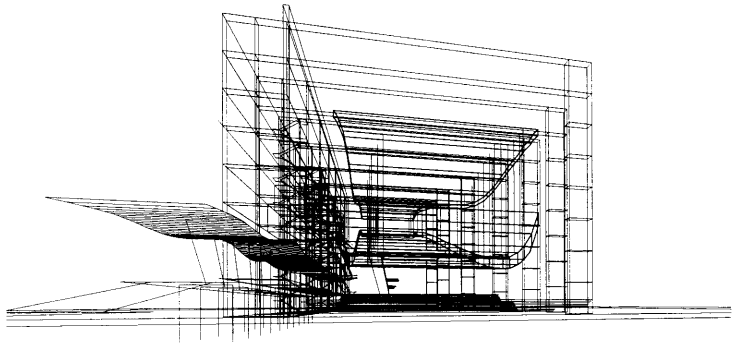


Figure 47: Interior x-ray perspectives

The Final Model

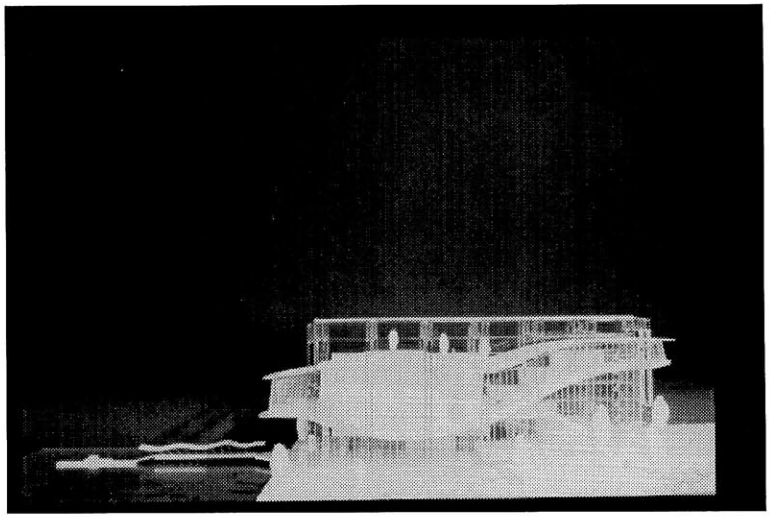


Figure 48: Longitudinal view from West

A generous and welcoming lobby is shaped by the 'tilt-up' tail, addressing the *arrival* from land.

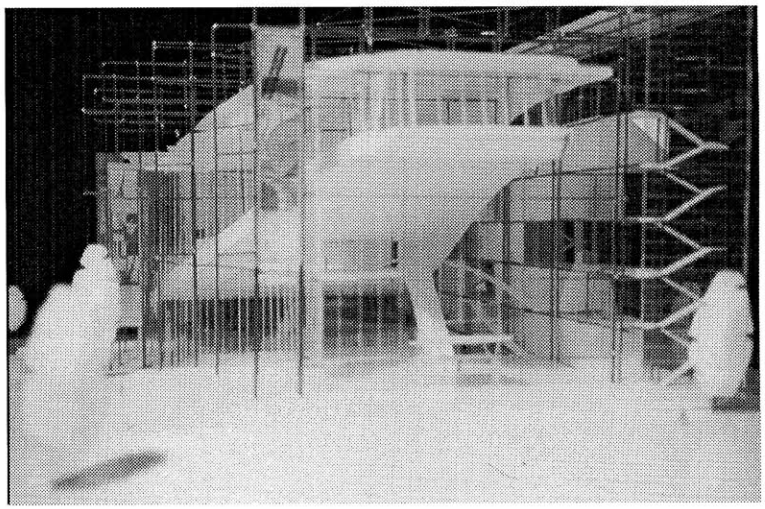


Figure 49: The main entrance

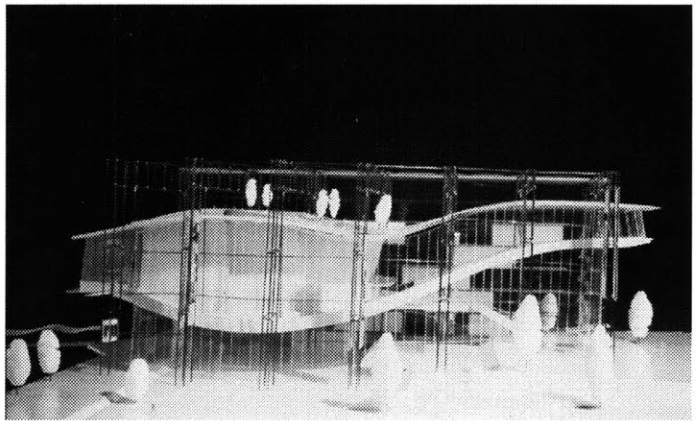


Figure 50: View from West

One surprise on the roof provides people another level of *landscape* and panoramic view. The combination of *steel forest* and real trees gives visitors some kind of metaphoric atmosphere.

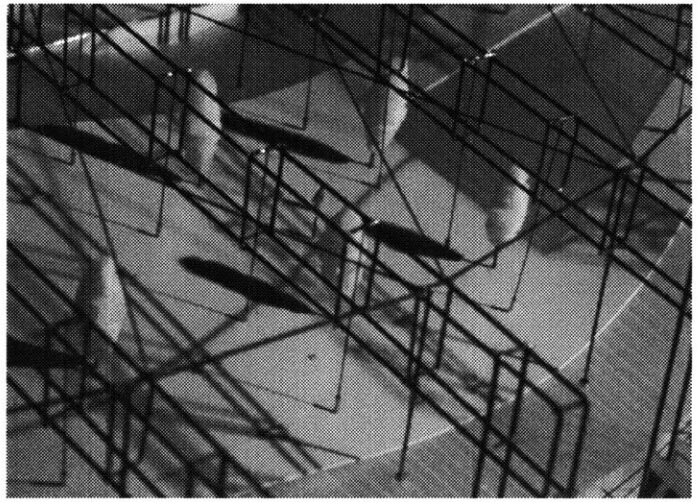


Figure 51: The roof garden

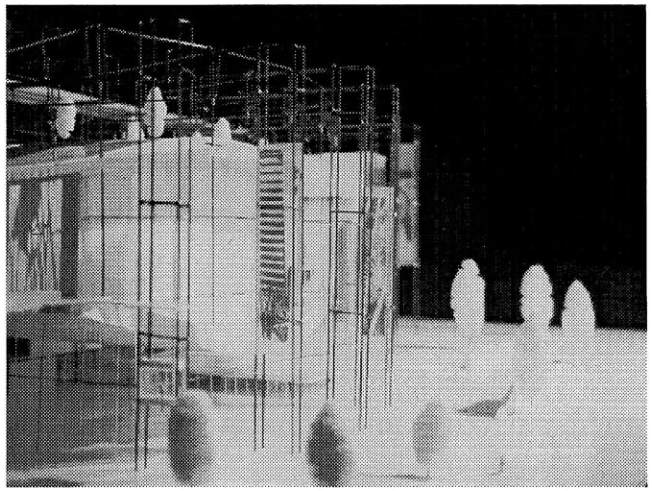


Figure 52: Billboardsused to stabilize structure

The rectangular bar on the east side of the fish on one hand acts as a supporting role to the fish, on the other hand, plays its own role as a contrast element to the fish.

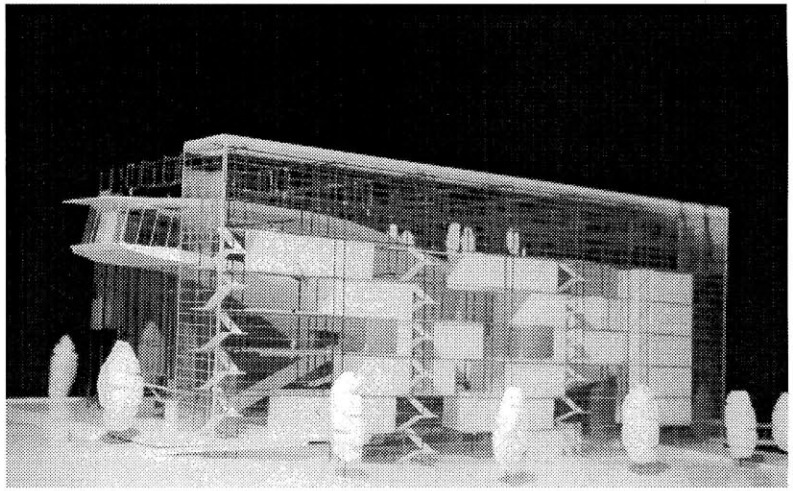


Figure 53: View from East

Using the idea of D3 (see p.19), the staggering of these conspicuous spatial elements actually differentiates the public/private areas, combining the indoor/outdoor activities.

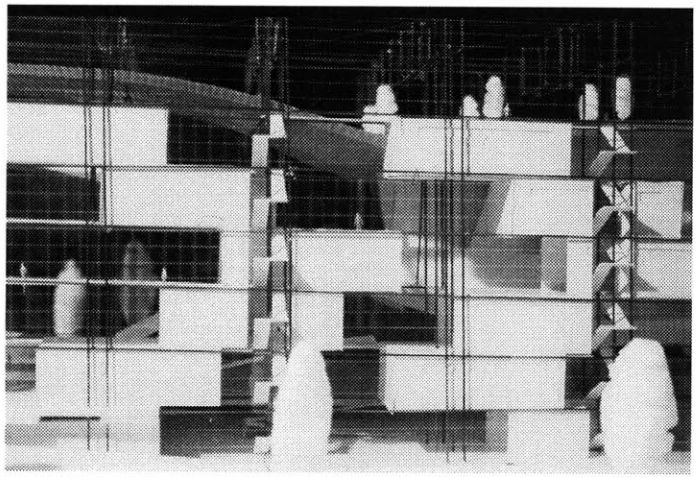


Figure 54: Void/solid spaces, indoor/outdoor activities

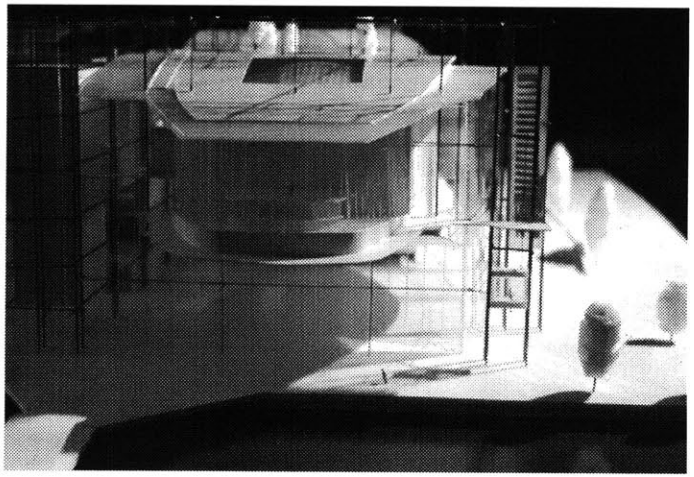


Figure 55:The cafe as a transitional element

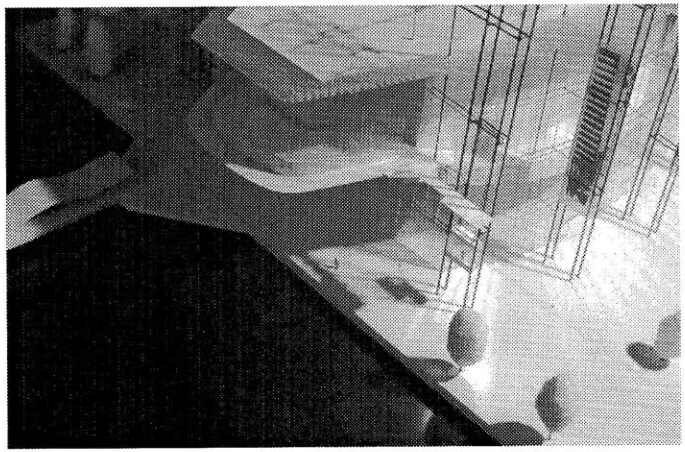


Figure 56: Water/land relation

The pier, in musical terms, is the passage from the restatement to the development, and gets people out of the *key* (move) into another, like an *episode*, to be very narrow and restricted.

The pier as a piece of episode from the building, mediates between A and B, but from C.

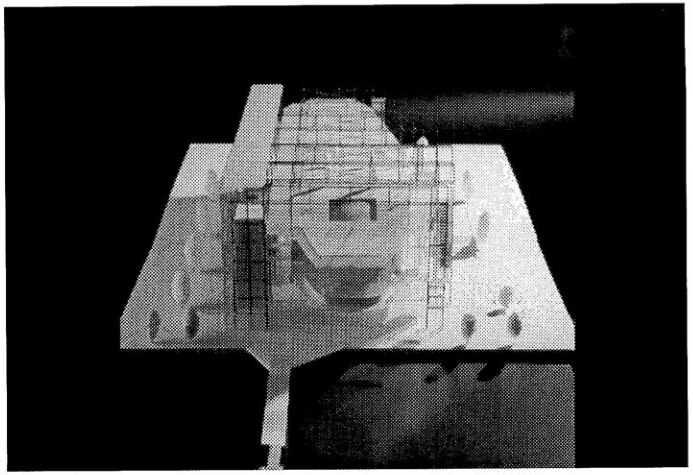


Figure 57: Aerial view of the building

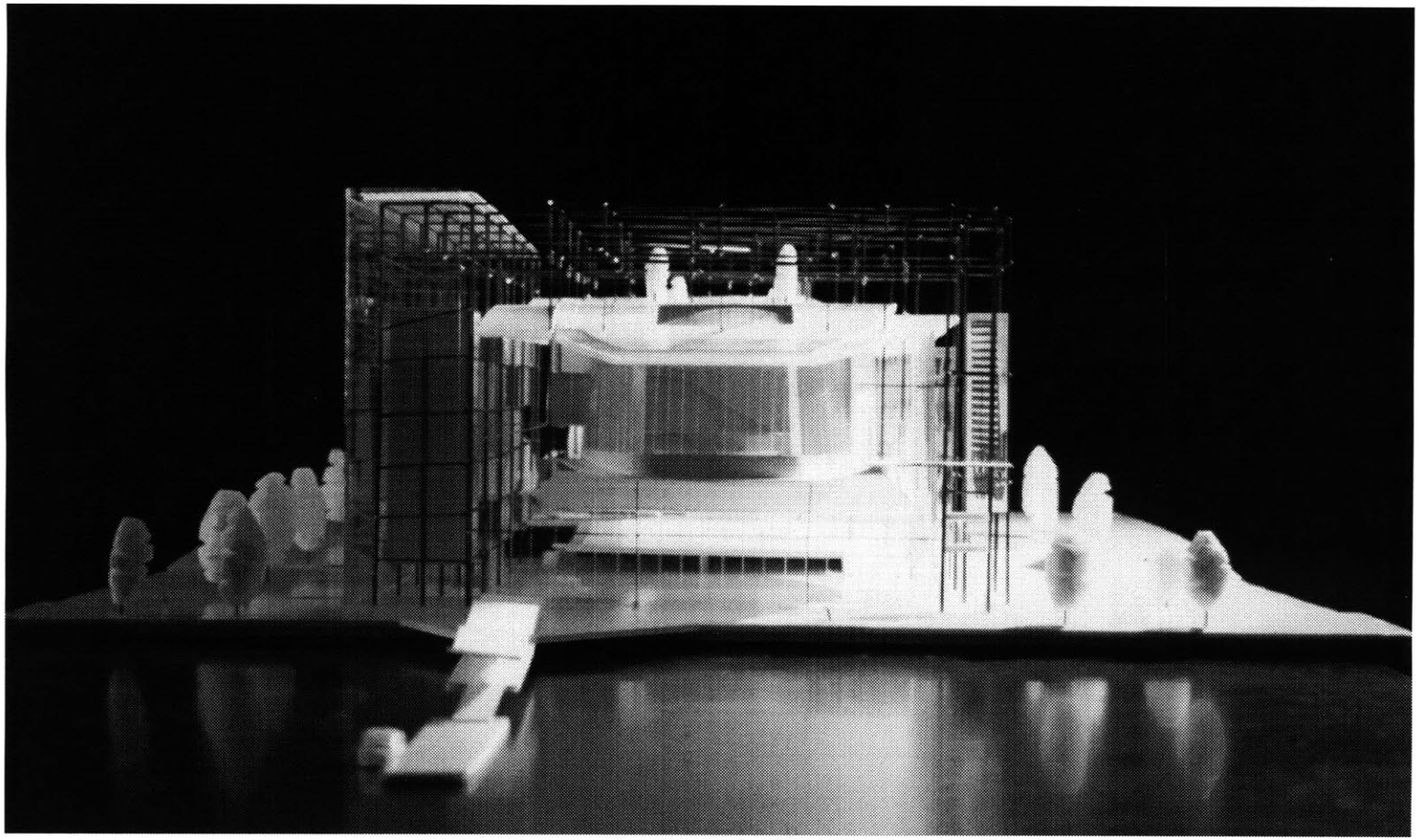


figure 58: View from water

The Site

The site (refer to page 35) reassembles the elements of the building. The matrix, as a datum, organizes the site and allows the elements to shape its composition. The ingredients of the building are scattered on the site to establish the tonality of the composition. By duplicating and displacing the composition of the site, new site compositions occur. An offset of this arouses people's awareness upon arrival and prepares them for the journey. The *memory* of the building elements therefore will begin while approaching the building. The experience of the site foreshadows those experiences to be encountered in the building.

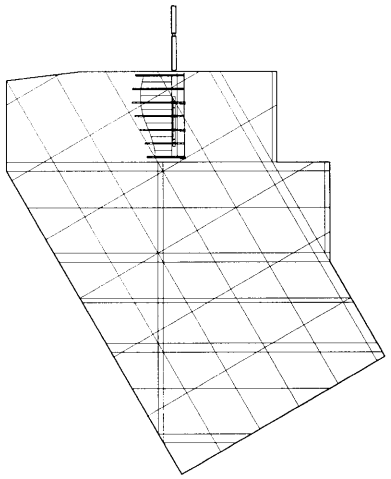


Figure 59: The matrix

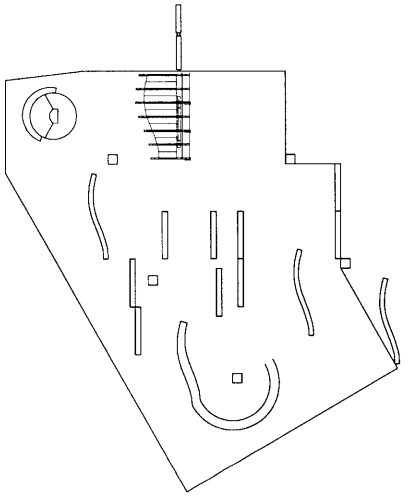


Figure 60: The elements

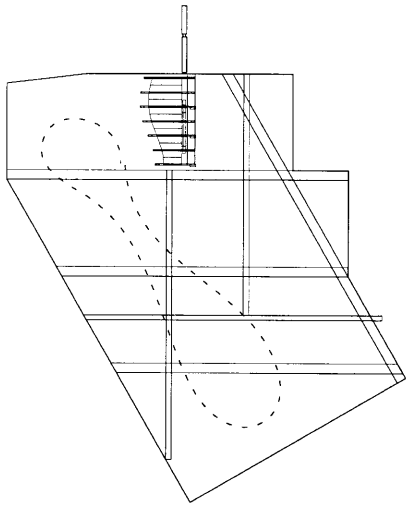


Figure 61: The circulation

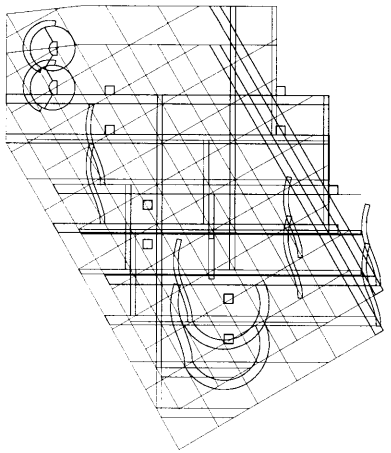
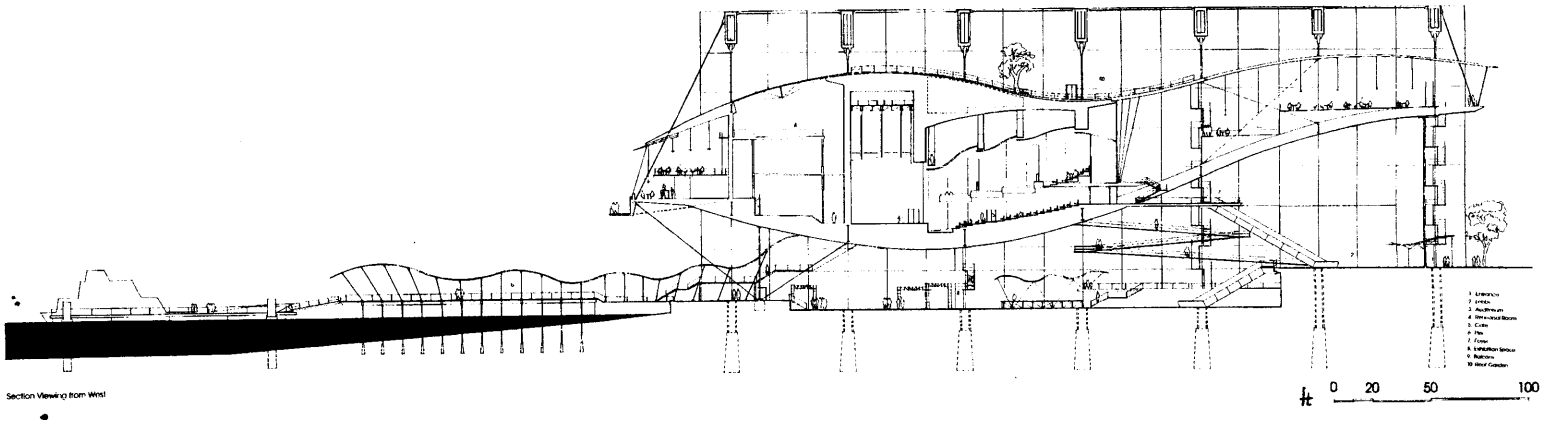
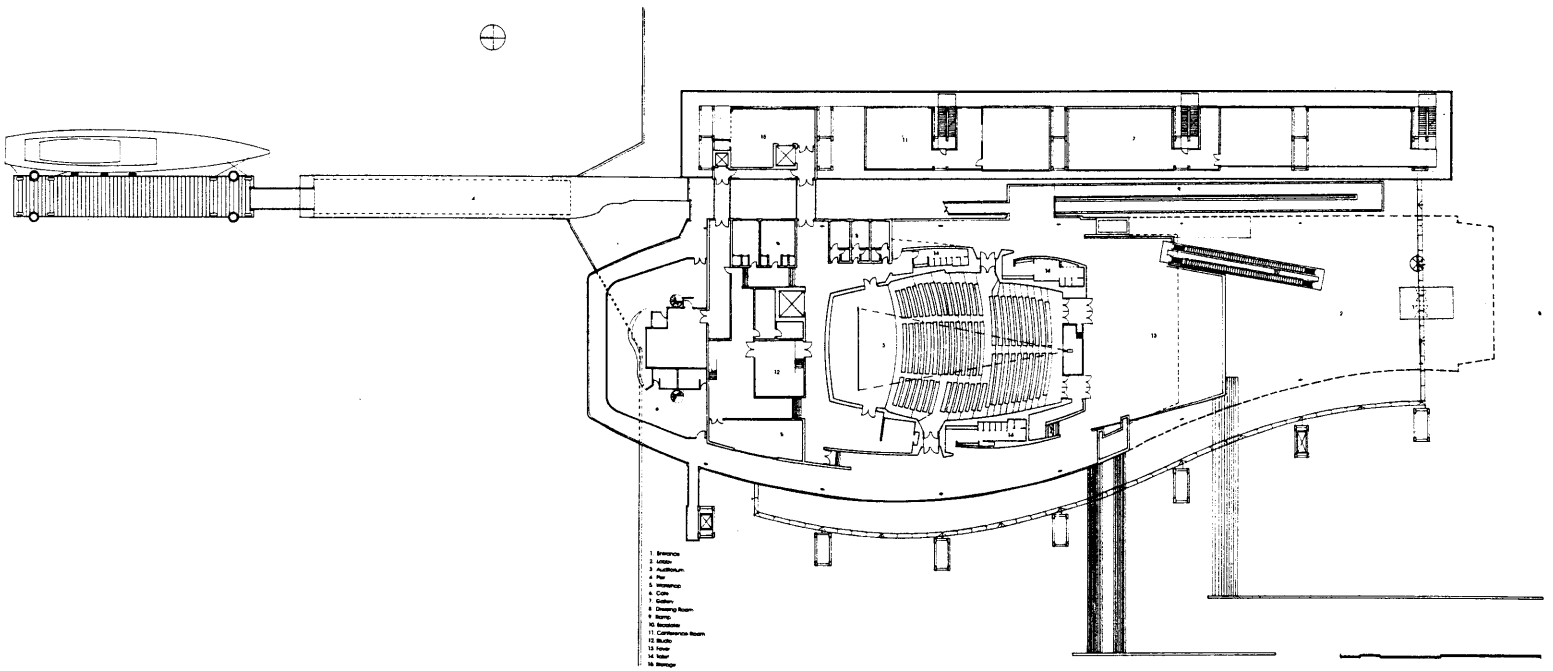
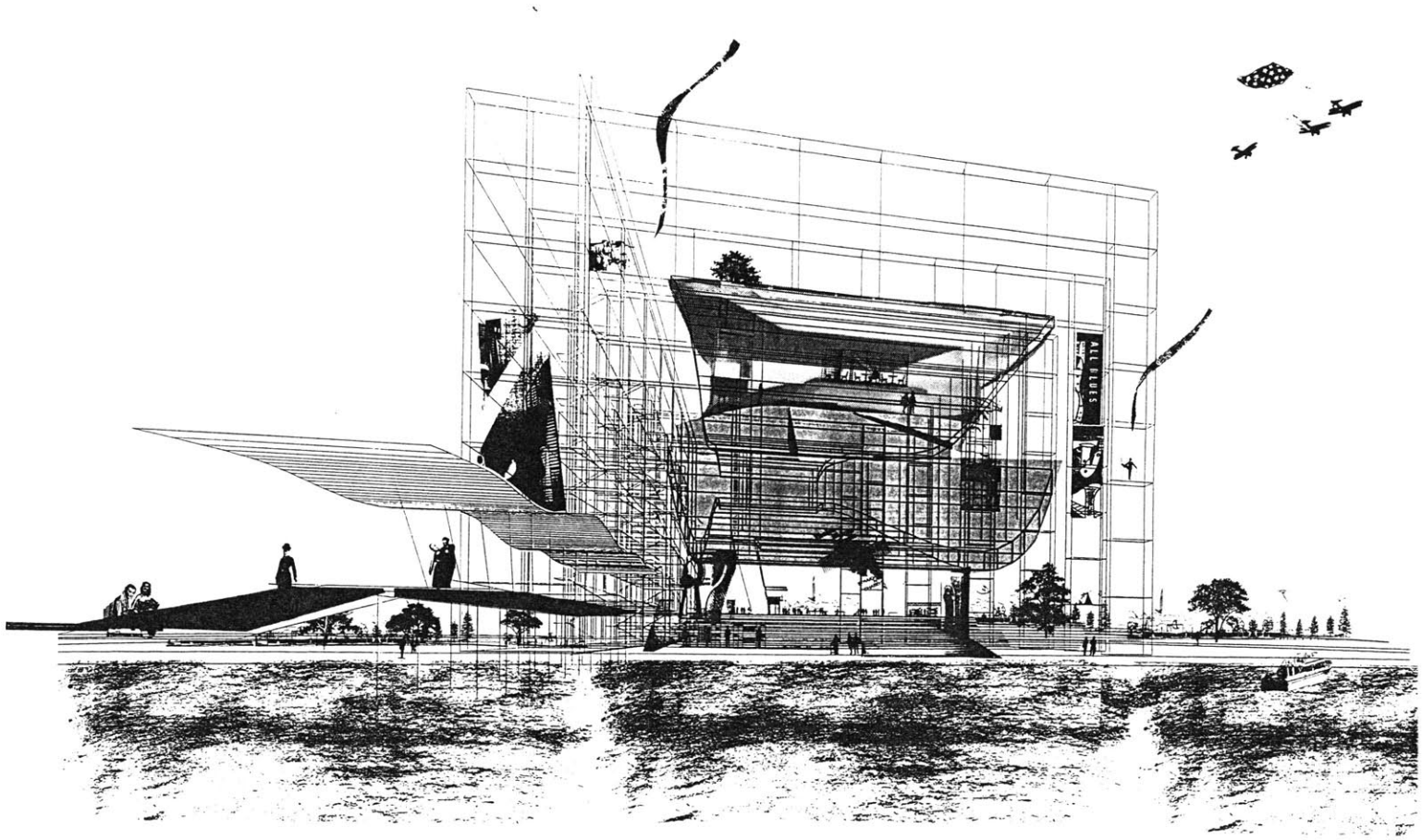


Figure 62: The displacement


Section Viewing from West
0
20
50
100




ALL BLUES

Conclusion

Exploring music can be a valuable means for inspirations in architectural design. But it needs an interface to make these two art forms compatible to each other. Directly translating ideas between architecture and music does not work, because no real communication can be established. Therefore, when dealing with the transformation of architecture and music, the inherent natures of them should be investigated. In terms of the inspiration from music, it is not important if the building looks jazzy or classical, but the important thing is the way it is composed. This thesis was an extraordinary opportunity for me tofind a methodology to explore the relationship between architecture and music.

The methodology, featuring repetition, displacement, contrast, and transition, not only revealed the thinking process of exploration, but also led me to the destination of my thesis design. Furthermore, I now have another way to approach architecture. The exploration between architecture and music allows me to see architecture in different perspectives, and to apply wider spatial definitions and dynamic architectural forms to my future designs.

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