

ERODED BY SOUND

MULTI-GENRÉ CONCERT HALL/ OUTDOOR VENUE DESERT, SOUTHERN OREGON

Collaboration with 2 people, year 3

Course Bachelor's Thesis

Examiner Morten Lund

Emphasis Context, Architecture and Engineering, Multidisciplinary collaboration

Tools/techniques Grasshopper, Rhino, Adobe Suite, Physical model making

BACKGROUND

In the suburb Åby of Gothenburg a fenced sports ground is currently consisting of nothing more than a couple of football fields and a spectator stand.

The program asks for an addition to the current buildings containing clubhouses with changing rooms for three football clubs, a youth recreation centre, a library wing, a café and a ticket office.

The objective was to better incorporate the site in the community of Åby, making it a valuable asset to the inhabitants and a vibrant meeting place.

CONCEPT

This project investigates the interaction between space and geometry, with an iterative appraoch.

The focus has been almost exclusively on creating a sense of overwhelming movement.

In order to acchieve that, geometries with four or more vertecies have been used to create perspecive distortion.

This illusion has been used both as a spatial quality but also as a way of directing the movement of poeple, e.g. the central plaza of the sports centre is an optical focal point, seeking to lure people in.



Left A Grand Entrance

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COMPETITION MATERIAL - OVERVIEW

Photographs and drawings were interpreted as sculptures by folding and cutting and then depicted as photographs and drawings yet again.

The cycle was iterated, and the qualities of the sculptures refined based on a discussion regarding spatial qualities such as sidedness, niches, porosity, depth and plane, design, posture and proportion.

Above is an excerpt from iteration 2 to the left, followed by an excerpt from iteration 3. The volumes and geometries from iteration 3 were then applied in an architectural context in Åby.

REFLECTIONS

INTERDISCIPLINARY COLLABORATION

The interdisciplinary collaboration has been a true pleasure and a great source of inspiration due to the creative input that (in this case) comes from acoustical prerequisites. These prerequisites create limitations that contribute to important design decisions in the continued work.

During the work process there was a close dialogue between the architects/engineers and the acoustician. One significant design decision with respect to acoustic properties was the addition of reflective/absorbing pans in the main (naturally acoustic) concert hall - while making the canyon walls more vertical. The previous idea had been to have the canyons extend out over the concert hall - creating a roof/ceiling. This, however, led to unsatisfactory acoustical results. Subsequently, the addition of the pans not only improved the acoustics immensely, but also the spatial qualities of the concert hall.

This kind of productive collaboration is achieved through close and regular (in our case daily) collaboration between the disciplines. (Please note that the project was conceived during the corona crises - however, due to the close and regular contact between all parts in the project the result was surprisingly satisfactory.

METHODOLOGY

This project has employed a methodology with a strong emphasis on the iterative process. In the first iteration three architectural suggestions were developed for three different architectural contexts - all with their distinct, respective, acoustic concepts. Through the different phases of the project the architectural and acoustic essence was extracted and refined, with spatial concepts, spatial design, integrated design and last but not least, competition narratives (with emphasis on communicating architecture, the Bachelor's thesis stemmed from a competition brief from Acoustics Society of America).

Are there any bad ideas? I strongly believe that the neglected ideas are also an essential part of a creative process. The iterative meth-odology allows for a multitude of ideas to be investigated. Some ideas eventually become viable, including those that did not seem promising at start. Moreover, even if the idea gets neglected, it has most likely given rise to thoughts that help lead the continued work forward.

However, an important skill to train, for all creative professions, I believe is the ability to recognise a viable idea early on. This provides more time to perfect a certain vision. But what are the criteria for this? In this project, one question was asked over and over again: "What would the concert experience be like?" A majestic, grand, and magical concert experience with a strong sense of origin was the aim. A concert hall where people gather around something, like one would around a fire. All decisions in terms of architectural and acoustical design have been made with that vision in mind.

ARCHITECTURAL AND ACOUSTICAL QUALITY

As previously mentioned, this project set out to create a magical concert experience with a strong sense of origin. Parking in the desert, walking into the canyon with the stars as the ceiling, gathering densely around the festival orchestra. It is grand, yet intimate. This is setting the tone for a magical evening.

For many genres of music, outdoor venues are considered far inferior to traditional (indoor) concert halls. The desired acoustic parameters such as reverberation time is very hard to achieve with exclusively natural acoustics, and noise will affect the concert experience (for better or for worse). This concert hall does not fight the fact that it is an outdoor venue - it embraces it. In truth, I would like to experience a concert hall like this. It is a complete take on the concert experience, from the moment you arrive until you leave.





Floorplan 1:500

Reflective/absorption pans

Reflective or absorbing elements with double curvature to diffuse the sound. Each pan respectively carried to any given position by a drone. This provides unparalleled flexibility in finetuning the acoustics.

The upper part of the pan, facing the drone, contains absorbers for the specified frequency of the drone. Additionally, the pans act as a roof over the concert hall.

Helmholz resonators

The curvature of the canyon walls implies different volumes for the Helmholz resonators, corresponding to absorption of a desired set of frequencies. Cast in massive concrete to store heat during the day and release it during the chill desert night.

Dug into the ground -Acoustically shielded from its surroundings

A concert hall, embedded 35 meters down in the desert floor - acoustically shielded from its surroundings. Thanks to the low positioning of the stage and audience as well as the long distance from the highway, the background noise levels are keep very low - in fact the environmental sound pressure average was calculated to be around 35 dB in the concert hall, in a crass estimate considering the highway traffic noise data provided.

Additionally, the set being acoustically isolated benefits the nearby housing area - with the canyons acting as absorbing buffer zone to minimize sound leakage during loud concerts.

NOICE & VIBRATION CONTROL

The acoustics have defined the form. The walls of the canyon are cladded with concrete elements with integrated Helmholz resonators. Furthermore, by tailoring the curvature of the walls, the volume of the Helmholz resonators is changed - meaning that the desired amount of each given frequency can be absorbed.

Logistics

Containing all the necessary functions for the operation of the facility, is the «island» located just behind the stage. People move through this logistical building using a entering the canyon. During the evening, the cylinder is staircase/elevator (additionally acts as a light shaft), while lit up by the descending sun as excited visitors enter the scenography and instruments is transported directly to the stage level by truck.

ACOUSTIC ELEMENTS

In terms of acoustical properties, the canyon is constant and never changing. Thanks to the distribution of Helmholz, corresponding to absorption of different frequencies, an even reverberation time is achieved across all frequencies in the concert hall.

Located in a NE SW axis the opening of the facility is facing the quiet corner of the plot reducing background noise underground complex.

Internally, the acoustically sensitive functions rehearsal room and orchestra pit have been placed on spring bed

to protect them from undesired vibrations. Furthermore,

the MER has been placed strategically on a generous

distance, surrounded by thick concrete.

Situation

As a measure to meet the different acoustical requirements for different genres of performances, flying pans reflect (frequencies from 100 Hz and up) or absorb (250 Hz and up). They swarm out from the cylinder in which they are being stored and position themselves appropriately. When the performance is over, the flying reflector/ absorber pans return to their home.



Detail pans 1:500/1:100

Detail Helmholz 1:50

M



State highway





THE CONCERT EXPERIENCE

Photographs and drawings were interpreted as sculptures by **folding and cutting** and then depicted as photographs and drawings yet again.

The **cycle was iterated**, and the qualities of the sculptures refined based on a discussion regarding **spatial qualities** such as sidedness, niches, porosity, depth and plane, design, posture and proportion.

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Man-made meets nature -A rich concert experience

Like water flows, the audience seeps into the arena. Starry sky, people parking in the endless dessert. Light protruding towards the sky. The pans swarm out, the cylinder lift off and the show begins. Setting the tone for a magical evening.

Tosca mode

The seating la

80% cove

90% abs. 10% ref

Pan configuration

Absorbing pa

Opera, ballet, theatre, chamber music and broadway

A contemporary take on opera. The dramatic plays will find a new home in this spectac-ular landscape and the popular appeal will reminisce that of Verona.

ity of the voice. Furthermore, practically all opera, theatre and ballet has been developed

with this directionality in mind.

5 000 acousti

2 000 electro

Gershwin mode Symphonic orchestra

Since ancient times, people have gathered in a circle around the fire to enjoy music. «Eroded by Sound» aims at creating the same sensation of intimacy, intensity and origin.



ional. The Orchestral sound is 3-dimens sound stage will vary depending on where you sit. In front, the most balanced stage will you such that, the most balanced stage with be provided. However, sitting on other locations does provide other qualities, such as seeing the conductor, with the added benefit of getting closer to the orchestra.



Pan configuration Reflective pans placed high - leads to higher RT. 80% of «ceiling» covered of which 100% reflecting pans.



125 250 500 1k 2k 4k Freq. [Hz]

C80

RT



STI

RT

Mean: 0.63

Strength Mean: -5.26 dB

ans placed low - leads to

decreased RT. 80% of «ceiling» covered of which 90% absorbing, 10% reflecting pans.



starry sky to enjoy a truly epic concert with Lady Gaga. A central stage makes it possible to be as close as possible to the performing star.





Pan configuration No pans - open air ve canyon acoustics.



«natural»

Range: 15 dB



Possible speaker mounting points nco for spoakors fa stage: 5-7 dB, delay 220 ms



magine, cro



Election accesses in provides the possibility to arrange for a 360b layout of the seating. Compared to e.g. opera or theatre the direc-tionality of the voice is no longer a limitation. People standing behind the stage will have the added benefit of being in the proximity of the performers.



 Direct sound - - - - Early reflections Late reflections

- Electro acoust

Electro acoustic seating

The geometry of the «islands» decouples the

electro acoustic seating from the naturally

acoustic zone. Multiple small loudspeak-

refinement.

ers allow for electro acoustic precision and

Sound plan 1:5000



Right An evening at the opera

Concert hall

Pans, literally flying above the hall, handle late reflections and absorption. The fact that each pan is completely independent from any other structure provides flexibility and therefore a possibility to fine-tune the acoustic properties to any given situation.



Section 1:1000

Canyon

The Helmholz resonators in the lower parts of the canyon walls have been optimized to absorb the higher frequencies created by the audience when conversing or walking. Additionally, the resonators of the upper section are calibrated to frequencies corresponding to background noise (the river, the road and the sky above).

Completely silent zone

PROCESS - Sound and Distance/Spatial Concepts





CONCEPT I - Urban Venue

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CONCEPT II - Zones

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IMPORTANT/CRUSIAL DESCISION





CONCEPT III - Gather around

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PROCESS - Spatial Design





SPATIAL INVESTIGATIONS

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4 VIBRANT AND DYNAMIC

PROCESS - Integrated Concepts





Above Integrating helmholz resonators

HELMHOLZ RESONATORS

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