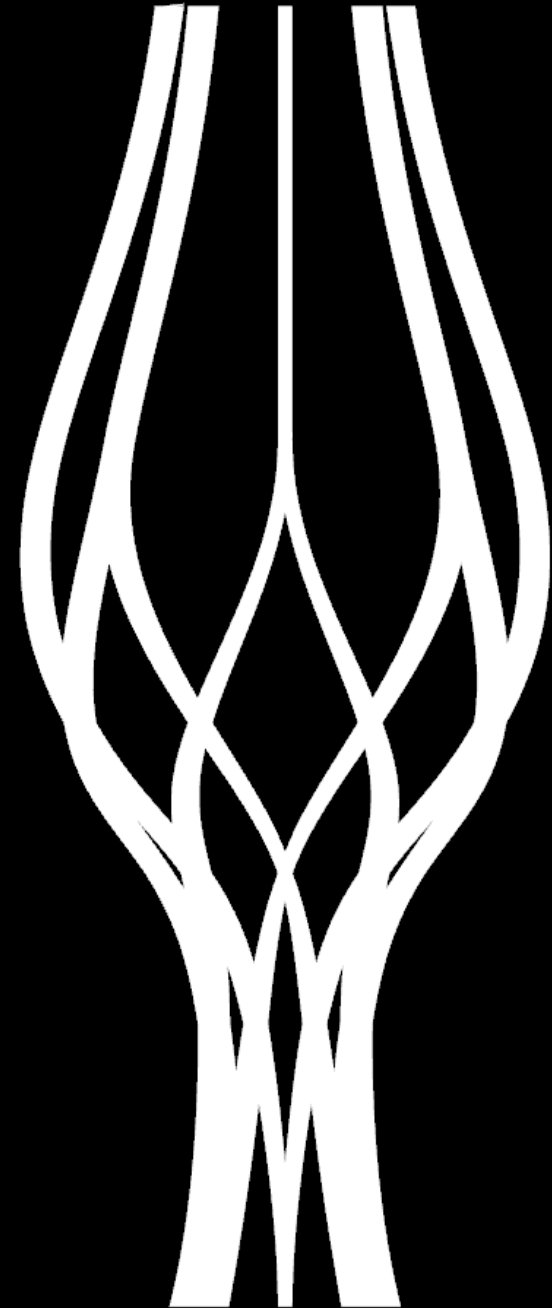


Operahus Utau Garasu

Kandidatprojekt Arkitektur och teknik 2024<
ACEX15 Calmers
Gustav Johansson
Emanuel Norrelgen

Denna presentation är gjord av
Gustav Johansson



Utgångspunkt

Kandidatarbetet i arkitektur och teknik behandlar arkitektur, akustik och byggnadskonst. Kursen kretsar kring en tävling som anordnas av Technical Committee on Architectural Acoustics, NSAF och Acoustical Society of America.

Tävlingskrav

Detta är en mycket sammanfattad version av tävlingsprogrammet:

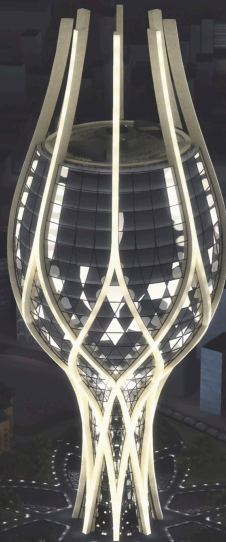
En musikhögskola med ett starkt opera- och vokalprogram planerar att bygga en ny, modern operahall med 1,200 sittplatser. Hallen ska huvudsakligen användas för opera men även för talade framträdanden av skolans president och inbjudna talare. Operateatern inkluderar en scen på 560 m² med ett djup på 18 m. Prosceniet är minst 15 m brett och 9 m högt, och scenhuset har en höjd från scenen till gridiron som är cirka tre gånger prosceniums höjd. Akustiken är variabel och inkluderar en portabel scenenhet samt variabel ljudabsorption för att anpassa sig efter olika typer av framträdanden.

Publikplatserna är totalt 1,200, varav 40% är fördelade på två till tre nivåer av balkonger. Orkesterdicket ska kunna rymma ensembler på 25 till 80 medlemmar. Repetitionsrummen är tillräckligt stora för att rymma 80 orkestermedlemmar. Övriga utrymmen inkluderar två körsångaromklädningsrum och åtta solistomklädningsrum, samt ett multifunktionellt Green Room på 46.5 m².

Tävlingsbidrag

歌うガラス

"Utou Garasu" - The Singing Glass



In the heart of Shibuya, one of Tokyo's most vibrant and culturally important districts, Utou Garasu emerges as a beacon of music, standing over 150 meters tall. In collaboration with the newly founded music program at the neighboring Aoyama Gakuin University, Utou Garasu offers a modern and redefined version of opera, enriching the already prominent cultural scene of Shibuya while simultaneously elevating the rich operatic tradition of Japan to new heights.

The close proximity to both Shibuya Station and the Aoyama Gakuin University will provide the opera house with a young and diverse audience, incorporating opera into the existing nightlife culture in the area, as well as bridging the gap between tradition and modernity.

In Utou Garasu, the opera hall has been elevated high above ground, moving it further away from the loud and sporadic street soundscape. The city noise at that level is more even, and therefore easier to handle. Furthermore, its visitors are offered a splendid view of Tokyo from above, as well as a distinct transition between the busy streets and the main opera hall, allowing the visitors to ascend to a realm of music, detached from the world below.

Emanuel Norrelgen, Gustav Johansson, Märten Muregård

Wall Construction and Noise Criteria

The glass facade comprises of a double-leaf glass panel - two layers of glass, 9 cm and 7 cm thick, separated by a 15 cm air gap. This configuration significantly reduces sound pollution from the outside, sufficiently to meet demands of NC25 throughout the building.

To achieve NC25 in the opera hall, a double-leaf wall construction is utilized, consisting of two layers of 25 cm thick concrete, with a 10 cm thick layer of absorption material between them. The inner concrete layer rests on springs to minimize vibrations.

Rehearsal Rooms Explained

The rehearsal rooms are located on either side of the main opera hall. They feature large glass sections allowing natural light to enter. Two layers of the glass facade panels help maintain a noise level of NC25. The walls are constructed from poured concrete and are covered with velour carpets. The acoustics can be adjusted using carpet rolls that can be lowered as needed. Clarity ranges from 5 - 7 dB, with strength varying from 7 - 4 dB at 1 kHz.

Floating Floors in MER-MEPPIT Rooms

The rooms designated for MER and MEPPIT are equipped with floating floors to reduce impact noise. The machinery is placed on spring systems.

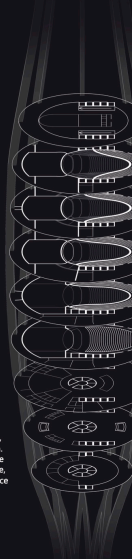
Acoustic Configuration in the Opera Hall

The opera hall also features a speech configuration, which can be utilized with electro-acoustic amplification. This system includes speakers positioned above the stage, with all panels flipped to their fibreglass side, covering 70% of the wall area. This setup helps reduce the reverberation time.

Communication and elevator systems

The height of the building results in a highly vertical layout, relying on three elevator systems. A central elevator system transports opera attendees from ground level to the lobby, while the other two connect the lobby to the upper floors of the building. Thus, the lobby serves as a social midpoint of the building.

The floor between the lobby and the parquet serves as a staff level, including dressing rooms, individual practice rooms, a green room, as well as the scene shop. To transport materials to the scene shop, as well as to the stage, an exterior cargo elevator runs along rails on the building facade.



Restaurant

Top floor with view over Tokyo

Balcony, level 4

Orchestra balcony (150 seats), MER and MEPPIT

Balcony, level 3

Seating (165), restrooms

Balcony, level 2

Seating (200), rehearsal halls, restrooms, follow spot booth

Balcony, level 1

Seating (220), lighting control room, restrooms

Parquet

Stage (800 m²), loading dock, orchestra pit (80 members), seating (800 seats), audio mix booth

Green Room

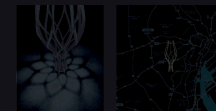
Dressing room, practice rooms, scene shop, loading dock, storage

Lobby

Elevator hub, reception, wine bar, wardrobes, restrooms

Staff level

Offices, administration, staff restaurant



The shadow of the building structure, serving as inspiration for the park below

The location of the building in Tokyo

Alternative Orchestra Configuration

The grandeur of Utou Garasu, towering above nearby structures, is echoed within the opera hall, where the orchestra may be seated on the top balcony, allowing the audience to be enveloped by the music. The conductor would then be stationed on a separate balcony above the stage.

The hall offers a reverberation time of 3 seconds, surpassing that of contemporary opera houses. This is achieved by opening the insulated walls to the adjacent rehearsal halls, thus transforming them into echo chambers. This design choice opens new avenues for modern composers to create operas for spaces that can sustain longer sound, a possibility not found in other opera halls.

Flexible Acoustics

The opera hall is however designed with versatility in mind, also allowing a more traditional setup, with the orchestra seated in the pit and a reverberation time of 1.6 seconds.

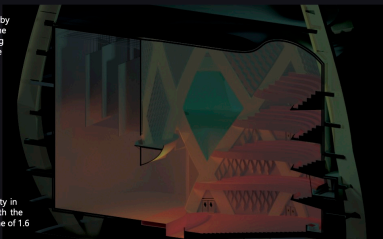
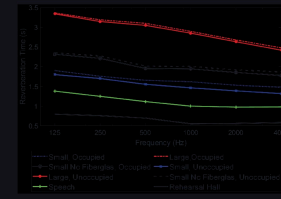
The orchestra pit boasts a lifting mechanism that allows for three different configurations: lowered to a standard pit, mid-height to expand the parquet seating, and raised to stage level to extend the performance space.

Inside the hall are large panels that can rotate both horizontally and vertically. These panels have poured concrete on one side and fiber glass panel on the other, permitting precise acoustic adjustments. Additionally, the slanted beams within the hall have a diffusing surface texture, further refining the sound quality across the venue.

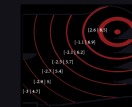
To control the lower frequencies, 400 Helmholtz absorbers are placed around the balconies in the opera hall, which can be opened and closed.



Adjustable panels, concrete/fiberglass | Diffusing wood surface

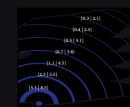


Large configuration



Clarity | Gain

Small configuration

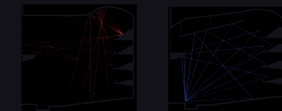


Clarity | Gain



ITDG, 25-170 ms

ITDG, 25-50 ms



40-90 ms

35-90 ms

Texter på affischer

Affisch 1

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Affisch 2

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Affisch 3

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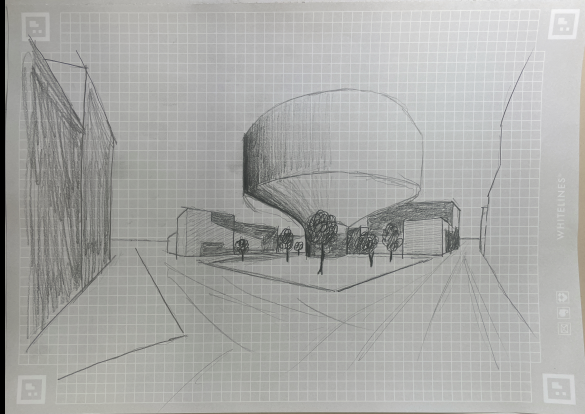
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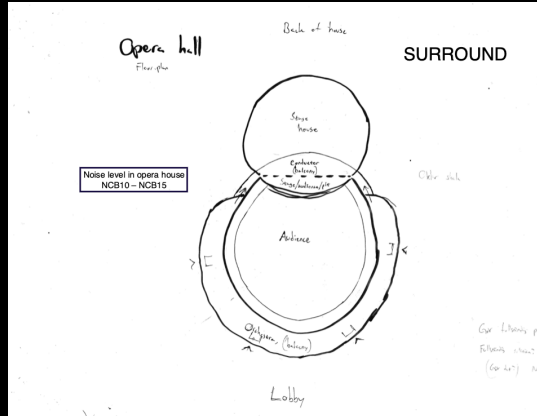
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Process

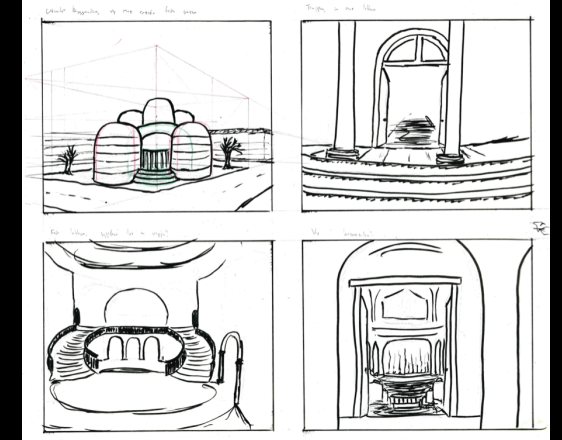
Första skisser och idéer:



En vilja att lyfta upp operahuset över kvarteret.



En vilja att kunna placera orkestern runt publiken.



En formidé som inte blev av.

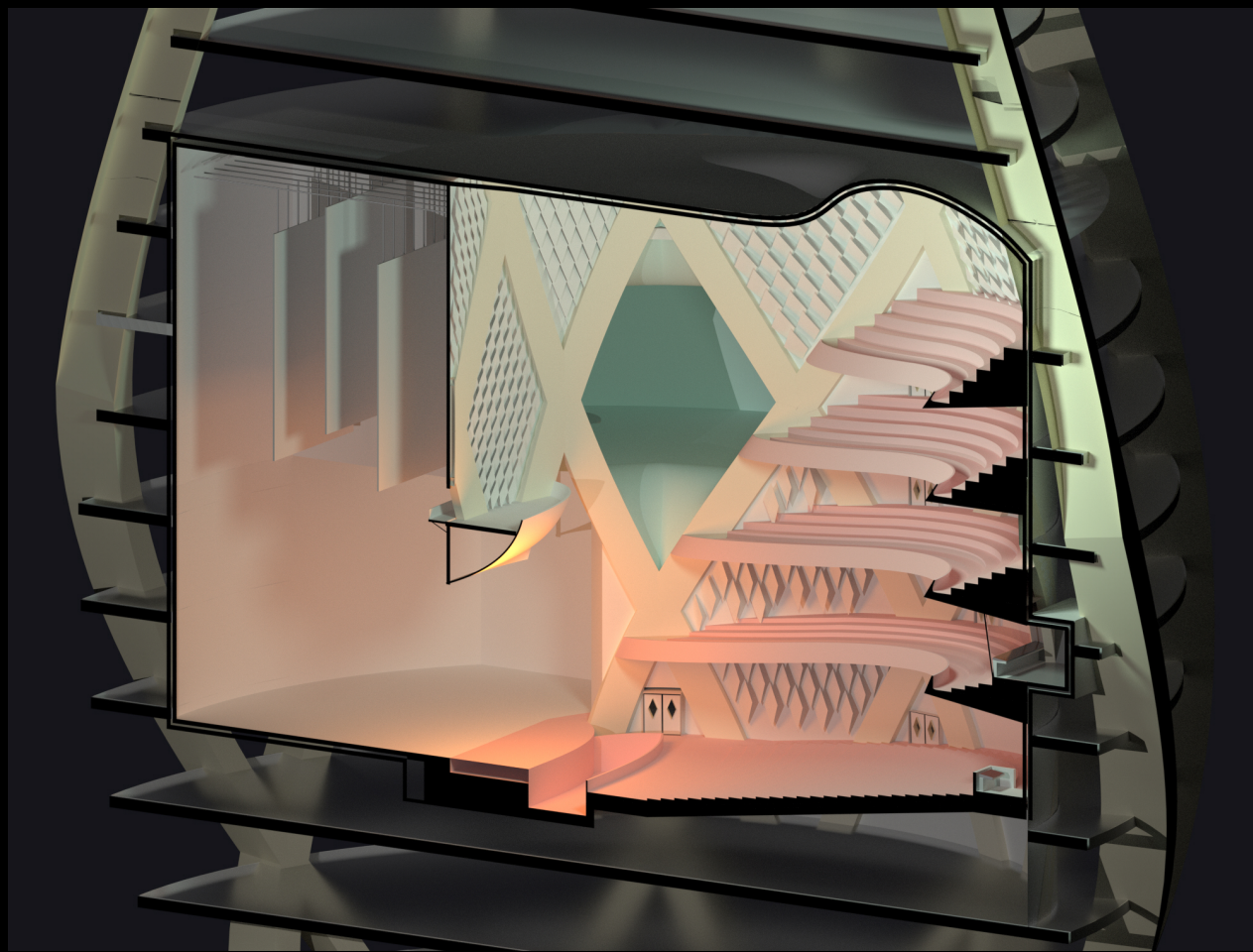
Från dessa ursprungliga idéer överlevde de två första. Att lyfta upp operahuset och att möjliggöra för orkestern att sitta runt publiken.

Processen fortsatte ganska naturligt med att först förfina storformen på huset. Sedan läste vi noggrant de krav som ställdes i tävlingen och utgick från dessa. Tävlingskraven var såpass omfattande att de i många avseenden begränsade de kreativa besluten. Vi placerade de olika rummen, lobby, ventilation, repetitionssalar, övningsrum, där de mest lämpade sig. Med hjälp av en student som läser en master i akustik kom vi fram till att om orkestern skulle placeras runt om publiken skulle vi behöva längre efterklangstid. För att möjliggöra detta lät vi två repetitionssalar agera ekokammare. För att utforma parken under huset gjorde vi en liten 3D-printad modell av den bärande strukturen och lät dennes skugga bilda de former som parken sedan fick.

De två huvudkoncepten



Formen av huset med limträbalkar som bärande struktur. Byggnaden ligger i Tokyo.



Den stora salen med ekokammare. Orkestern kan placeras på högsta terrassen och på så sätt omfamna publiken.

Reflektion

Projektets kvaliteter

Operahuset är spektakulärt, operahuset ska vara spektakulära. Jag är förtjust i hur resultatet blev och skulle verkligen vilja se det byggt i verkligheten. Det är dock inte speciellt trovärdigt att ett hus med dessa proportioner skulle byggas eftersom det skulle kosta för mycket. I kursen ingick inte att göra någon kostnadsanalys, inte heller att hålla sig till någon budget.

Processen har flutit på bra. Jag och min samarbetspartner Emanuel stötte aldrig på några större hinder i varken den kreativa processen eller i vårt samarbete.

Med avseende på den ovanliga formen på huset stötte vi på oväntat få problem. Det verkar faktiskt som att huset hade fungerat. Jag tänkte i början av processen att vi skulle bli tvungna att kompromissa såpass mycket med programkraven att operahuset skulle bli helt överkligt. Så är inte fallet. Operahuset är möjligt.

Reflektion inför framtiden

Denna byggnad skiljer sig ganska mycket från min smak. Jag brukar förespråka robusta byggnader i sten. Byggnader som ska klara sig utan underhåll i många hundra år. Denna byggnad gör inte det, den är mycket beroende av människors omsorg. Den behöver tas om hand om, ses efter och lagas. Trots detta gillar jag byggnaden, den är fin och tillfällig, som en tulpan eller ett vinglas. Den behöver inte stå för alltid, den kan ha sin tid, kanske 75 år och sedan rivas som allt annat vi bygger, och det känns bra. Denna känsla och acceptans för det bräckliga är den största förändring som skett inom mig under detta projekt. Denna acceptans gör mig mindre vresig mot vår samtid och det är skönt.