THE SHADOW PLAY

Exploring narratives through shadow and light

Bachelor Thesis in Architecture and Engineering

Rafaella Al-Homsi

2025

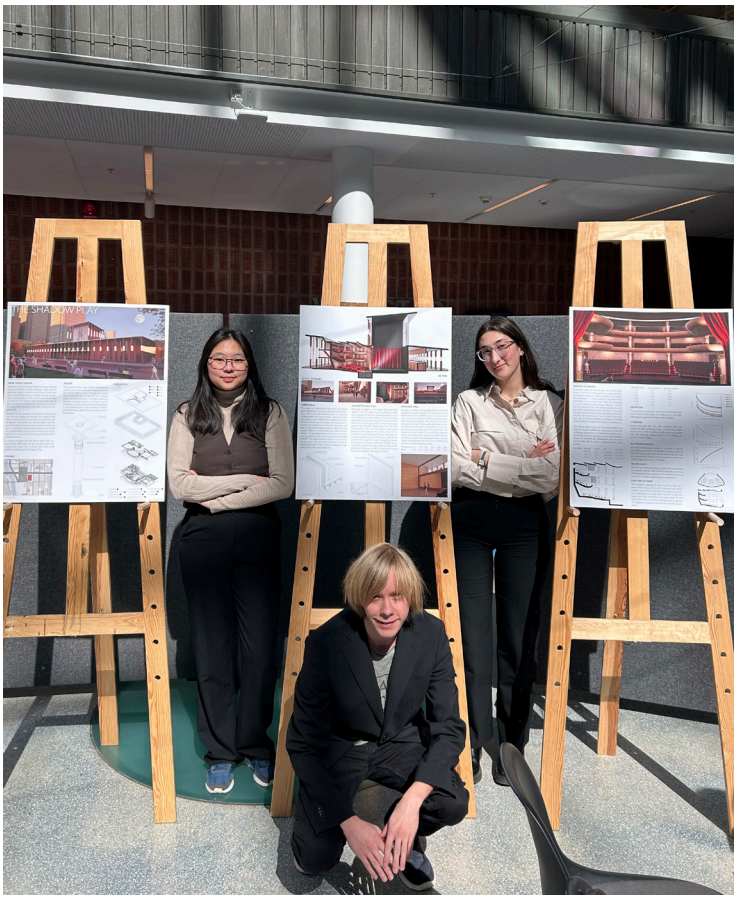
PROJECT DESCRIPTION

This project focuses on the design of a theatre with a strong emphasis on acoustic performance. The aim has been to create a space that not only supports high-quality sound experience but also encourages interaction and contributes to the cultural and atmospheric enhancement of the surrounding area. The theatre's design has been developed with great care and attention to detail. We have incorporated several unique elements to ensure that the space is not only acoustically optimized but also architecturally engaging and socially inviting. Every design decision, from material choices to spatial composition, has been made to support both the technical and experiential aspects of the theatre.

This project was carried out in close collaboration with acoustics students from the Sound and Vibration master's program. Working in interdisciplinary teams, we combined architectural creativity with acoustic precision to explore how design can shape sound and atmosphere. The project ran throughout the spring semester and included conceptual design, acoustic analysis, and architectural development. The final proposal reflects a balance between technical acoustic requirements and the social and aesthetic qualities of a lively theatre environment.

Final competition posters

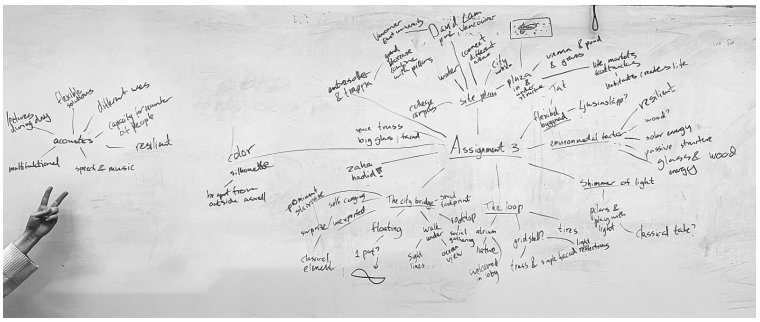
COLLABORATION

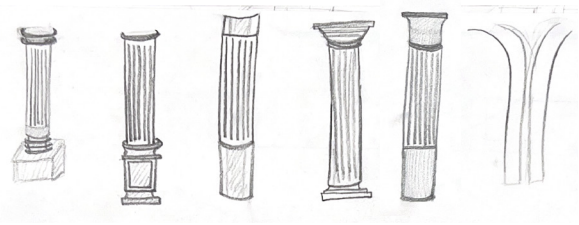


Working in a group and collaborating with acousticians was not only educational and rewarding, but also genuinely enjoyable. We learned a lot from each other, especially about how to communicate ideas clearly across different disciplines. When challenges arose, it was clear communication and thoughtful planning that helped us find effective solutions.

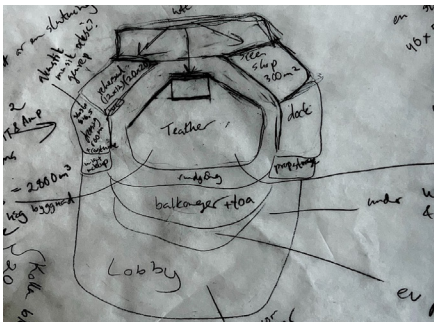
Leadership shifted naturally within the team, depending on each member's expertise. This dynamic approach, grounded in mutual trust, was essential for keeping the project moving forward. With the right support and guidance, I'm confident the project could be brought to life, we have already tackled most of the major challenges, however there is always room for refinement and minor improvements.

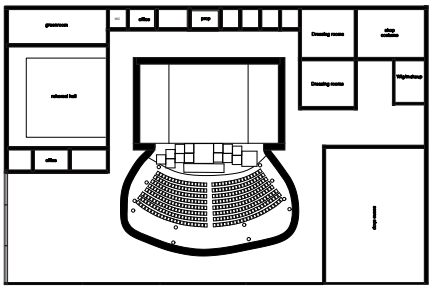
FROM PAGE TO STAGE

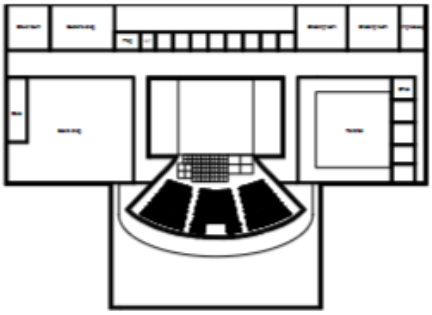




Our design process for The Shadow-Play was driven by exploration, collaboration, and continuous iteration. We began by freely brainstorming on a whiteboard and sketching early ideas for spatial layouts, pillar forms, and lighting elements. This phase was all about staying open to trying different concepts and allowing ideas to evolve. We initially explored a flowing roof but later shifted to a straight version that connected naturally with the pillars. Some ideas like the lit-up pillars remained central throughout, while others evolved or were abandoned as the project matured.

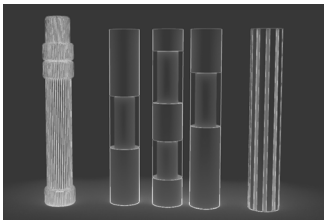


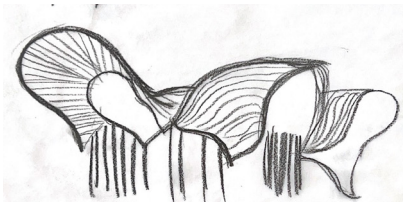


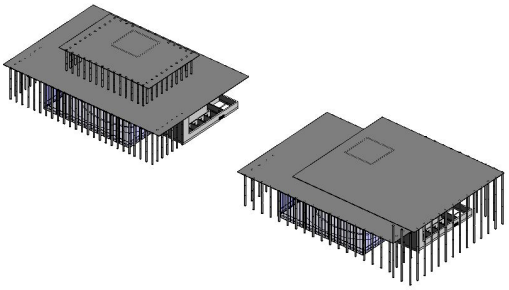


When designing the pillars, our initial focus was on aesthetics. We studied classical theatre styles as well as abstract forms, eventually refining their dimensions to not only support the structure but also shape the atmosphere and light. We carefully tested how different forms affected shadow, rhythm, and spatial experience.

Starting from scratch with the floorplans was particularly challenging. Without initial constraints, we relied on intuition, quick hand sketches, and a trial-and-error approach. The tilted walls, balconies, and acoustics of the theatre hall grew out of this process and were later tuned to enhance performance quality. Our approach was highly iterative. We tested different façade designs, roof angles, and pillar placements to achieve a cohesive aesthetic. We decided to design a theatre without a defined front or back, encouraging openness and liveliness from all directions. Color exploration was spontaneous at times, introduced by emotion and visual balance rather than following strict logic. The pillars were carefully studied for their impact on light and spatial experience, not only functionally but atmospherically.







BRINGING THE STORY TO LIFE

- Exploring projections

Throughout, we built physical models, including an early wall prototype using rubber, to test ideas. One of the key tests involved a rough sketch model to explore how the projection of the shadow play would work and whether it could interact with stage lighting, an experiment carried out early in the design process. We worked across formats, starting with hand drawings in lead and charcoal, then moving into 2D and 3D digital tools. Still, quick sketches were always close at hand to communicate ideas on the fly. In the end, this project was as much about designing a space as it was about discovering it.

POSTER TEXTS

More than a theatre

Welcome to The Shadow Play! It's theatre, but not as you've known it. Here, shadows, light, and interaction unite to create something entirely new. In a world where privacy is highly valued, interactions are through a screen and people find it hard to connect, The Shadow Play brings back a social and interactive environment. It's not just a show, it's a dynamic interaction with the essence of theatre itself. Inspired by the grandeur of classical architecture and the rich legacy of theatre, The Shadow Play blends the old and the new with an innovative pillar design. The pillars, the shifting lights, and the play of shadows create an environment where you are constantly immersed, both inside and outside the performance. Here, you're invited not just to watch, but to step into the living, breathing world of performance.

In central Chicago you will find a lively spot, surrounded by traffic and city life, near Roosevelt University and across from a lovely park, with a hill perfect for enjoying The Shadow Play.

Pillars

The classical pillars are boldly reinterpreted as they are constructed with skylights, allowing natural light to pour through the pillars into the theatre hall. In contrast, the exterior pillars emit artificial light. The pillars feature a smooth, rounded design to enhance sound reflections. Constructed with small openings in the wooden parts, they function as Helmholtz absorbers, optimizing acoustics. at low frequencies.

Rubber walls

The walls are constructed with thick oak panels with high density to ensure sufficient sound reduction. Inside the wall assembly layers of synthetic rubber, made from recycled tires, serve as an isolation layer. As these layers move against each other, friction converts sound energy into heat, enhancing acoustic performance while introducing a new way to take care of waste products. Wall thickness reaches 500 mm in the theater and 300 mm elsewhere. This guarantees prevention of noise annoyance, including traffic noise from nearby roads and MEPFIT. The entire building follows a box-in-box construction, with the inner structure resting on springs to isolate it from external vibrations originating from the surrounding city.

Silhouettte glass wall

Recessed spotlights in the stage floor cast light upward into the stage house, projecting shadowy narratives to be seen on the glas wall. You can catch glimpses of these shadowy narratives during rehearsals, as well as during performances without flown scenery. The glass wall consists of two glass panels with different thicknesses, thus the critical frequency will not be the same, which gives better sound insulation. This means that the coincidence phenomena won't occur that easily. To maintain proper acoustic performance, absorbing panels in the stage house are integrated to ensure a minimum absorption coefficient of 50%. That is important because the glass wall has a dip in the reduction index around 160 Hz. Apart from at that frequency, it isolates well against sound.

Rehearsal hall

Acoustic conditions comparable to the theater hall have been implemented in the rehearsal room. A floating floor in the MEPFIT room is essential, with thin connections between the floor and the wall to eliminate sound bridges. The 150 mm floor thickness combined with heavy walls, effectively reduces flanking transmission and fulfills NC curve requirements, preventing sound intrusion from the equipment room above. To control the rehearsal room's dominant 20 Hz frequency, Helmholtz absorbers are installed along the walls. These not only target low-frequency resonance but contribute to overall sound dampening as well.

Variable acoustics

To achieve optimal reverberation time, seats with heavy, sound-absorbing upholstery are used. Reverberation measures approximately 0.95 s when occupied and 1.1 s unoccupied. To replicate these conditions in an empty hall, ideal for rehearsals or varied performances, heavy discrete curtains can be lowered from the ceiling around the pillars which will function as an absorber. A movable partition wall at the balconies can reduce the hall's volume, by screening off one or both balconies, and add absorptive surfaces, creating a versatile space suitable for daytime lectures or conferences.

The theater hall is built with oak panels that has a high absorption coefficient, reducing the need for additional absorbents. 43 absorbing panels corresponding to 26 m2 near the orchestra pit and beneath the balcony are strategically placed to enhance edge effects without impacting the visual design.

Definition

The definition is another important parameter that can be seen in the graph. The difference in strength will require a good electroacoustic solution.

Strength

Sound strength will vary with distance from the stage, but early reflections help maintain an acceptable level at 7.9 dB to about 2.8 dB across the theater hall with minimal variation due to the carefully designed interior shape.

Electroaucoustics

An array loudspeaker system is installed to ensure that listeners perceive the sound as coming directly from the stage, with even distribution across the hall. An optimal gain factor of five provides a maximum reach of approximately 15 meters.

Orchestra pit

Absorbing panels are placed inside the orchestra pit. Four panels will be used inside to absorb sound and three panels will be used to scatter sound so that the musicians will get a good sound experience.

Early reflections

The theater is designed with a convex roof, outward-tilted walls and smooth surfaces that evenly scatter early sound reflections for optimal acoustics, especially in critical areas such as under the balconies. Early reflections are kept within 50 ms to prevent echoes, and the balconies are angled at 23 degrees to further enhance the sound experience.

Rafaella Al-Homsi, Mary-Ann Chang & Carl Höjdefors
Academic work
April 2025

THE SHADOW PLAY

-Theatre

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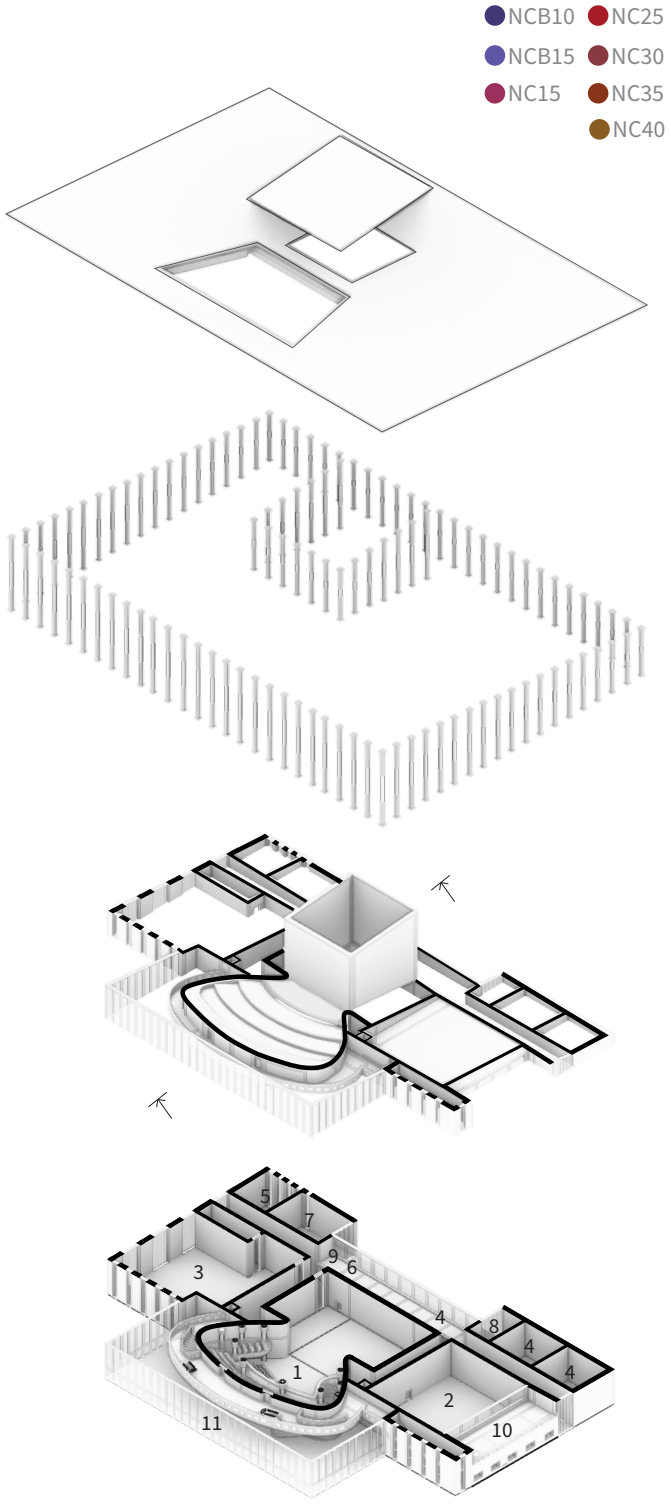
Programs: Rhino, Twinmotion, Grasshopper, Illustator, Photoshop

AXONOMETRIC

- Featuring noise levels

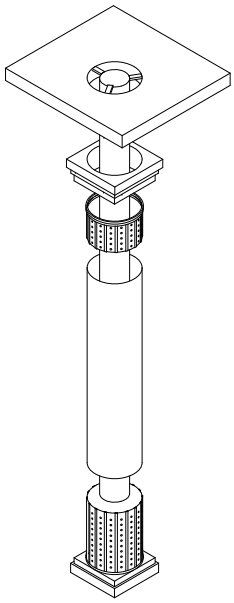


1. THEATRE
2. REHEARSAL HALL
3. SCENE SHOP
4. DRESSING ROOMS
5. GREEN ROOM
6. OFF-STAGE TOILET
7. COSTUME SHOP
8. WIG AND MAKE-UP
9. PROP STORAGE
10. OFFICES
11. LOBBY

DETAILED DRAWINGS

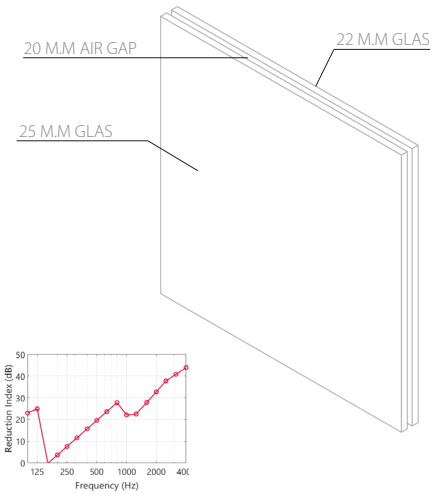
Pillar

The classical pillars are boldly reinterpreted as they are constructed with skylights, allowing natural light to pour through the pillars into the theatre hall. In contrast, the exterior pillars emit artificial light. The pillars feature a smooth, rounded design to enhance sound reflections. Constructed with small openings in the wooden parts, they function as Helmholtz absorbers, optimizing acoustics. at low frequencies.



Silhouette glass wall

Shadowy narratives are projected on to a glas wall. The glass wall consists of two glass panels with different thicknesses, thus the critical frequency will not be the same, which gives better sound insulation. This means that the coincidence phenomena won't occur that easily. To maintain proper acoustic performance, absorbing panels in the stage house are integrated to ensure a minimum absorption coefficient of 50%. That is important because the glass wall has a dip in the reduction index around 160 Hz. Apart from at that frequency, it isolates well against sound. Recessed spotlights in the stage floor cast light upward into the stage house, projecting shadowy narratives to be seen on the glas wall. You can catch glimpses of these shadowy narratives during rehearsals, as well as during performances without flown scenery.



Rubber wall

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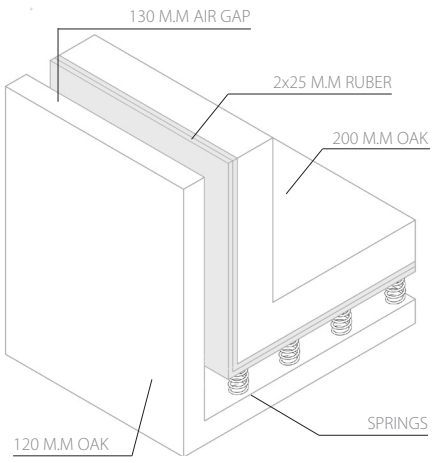

VARIABLE ACOUSTICS

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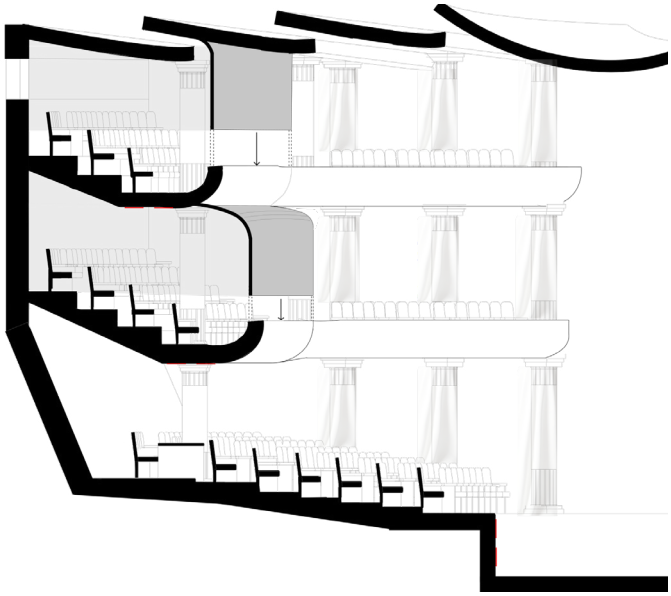

BALCONIES	VOLUME	SEATS	RT	RT with curtains
0	1900 m3	700	0.94-0.99 s	0.77-0.91 s
1	1541 m3	577	0.80-0.85 s	0.74-0.88 s
2	1197 m3	419	0.87-0.93 s	0.70-0.85 s

ACOUSTIC MEASUREMENTS

Eartly reflections

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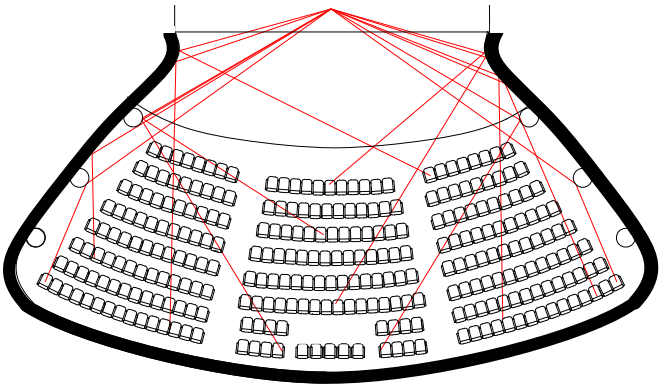

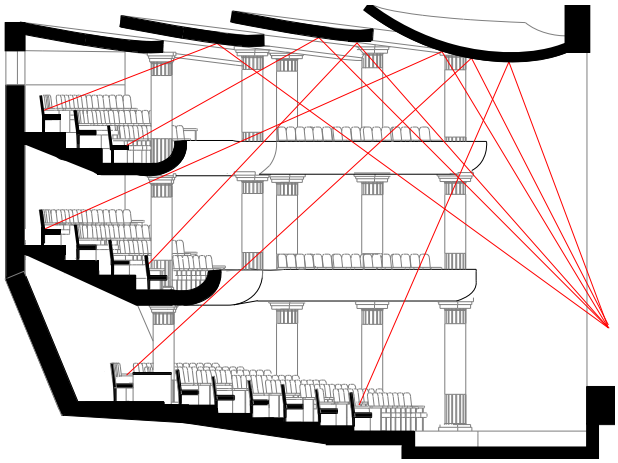

FREQUENCY (Hz)	T60 OCCUPIED (S)	T60 UNOCCUPIED (S)
125	0.97	0.98
250	0.97	0.99
500	0.95	0.98
1000	0.91	0.94
2000	0.94	0.97
4000	0.89	0.94

Strength

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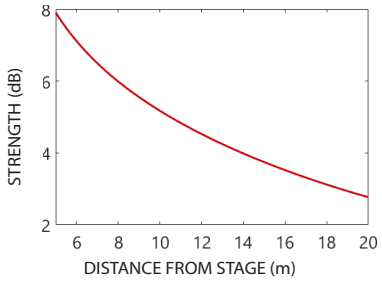

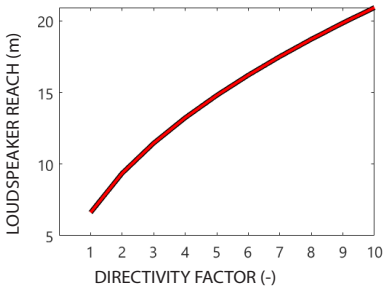

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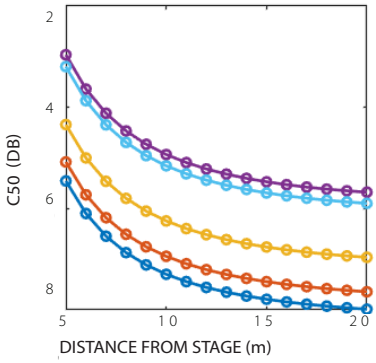
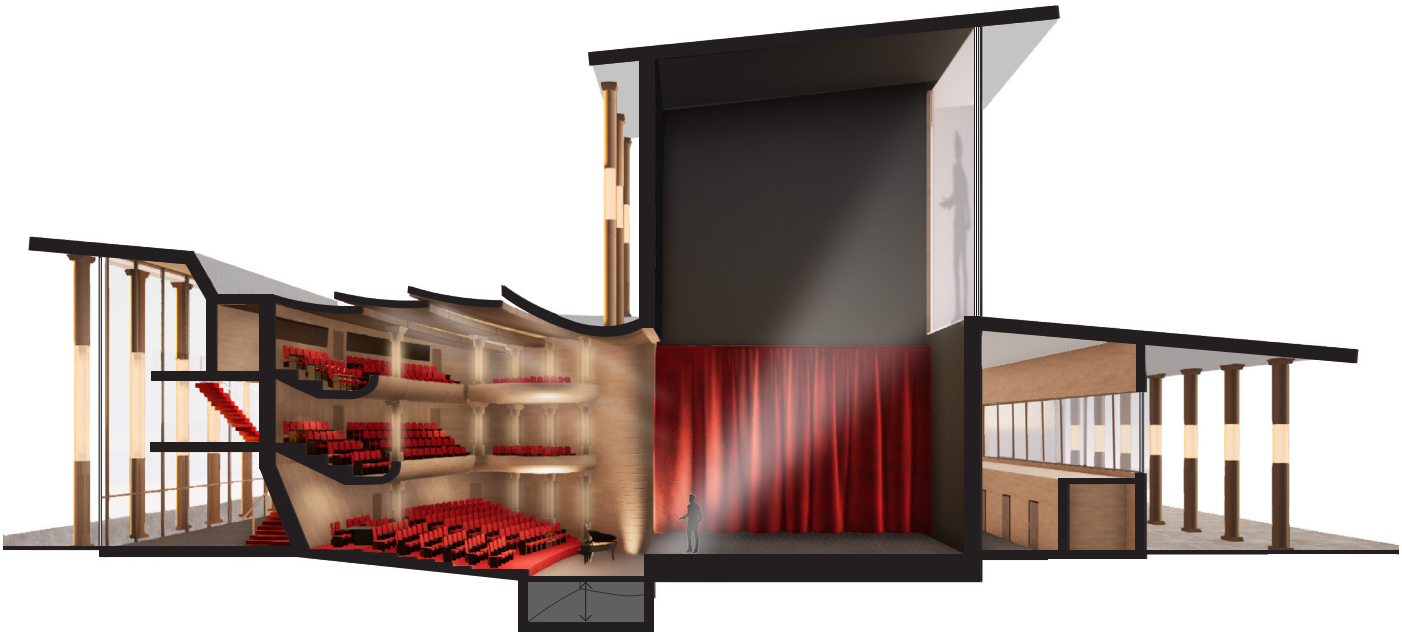


Interior



Section

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JOURNEY IN FRAMES

Interaction

As the audience moves through the space, the design invites to exploration. The various elements placed throughout the building act as fragments of a story, each offering a different perspective. This is the only theatre that can be experienced both from the inside and the outside, creating a unique relationship between the performance, the architecture and the audience. The audience watches, but they also wander, they encounter, and they engage!

Reflection

I am proud of the architectural quality we achieved both in concept and execution. For us, quality meant creating a cohesive spatial experience where structural expression, light, and shadow worked together to define the character of the building. We faced technical, acoustic, and architectural challenges, but met them with curiosity and collaboration. One of our central ideas was the shadow play, both a poetic and structural element that we developed from early sketches through to final design. It was both a design and engineering challenge that we embraced fully.

The columns were given space to stand out, shaping the rhythm and visual identity of the theatre. Throughout, we worked consciously with light and shadow to create a dynamic and memorable atmosphere. We learned a lot, but most of all, we created something unique that we are truly proud of and that is how we could create The shadow-play, the only theatre visible from outside, with its projections onto the stagehouse.

Acoustics were a key focus in our design process, leading to close collaboration between architecture and acoustics students. Many discussions centered on how the design could best enhance the acoustic qualities of the space. A major challenge was reducing the theatre hall's volume to improve sound performance, we succeeded in bringing it down to 1900 m^3, a result we're proud of.

We worked deliberately with light and shadow through the pillars as well as working with the Shadow play. Color and light were allowed to interact, creating a warm and inviting atmosphere. The reddish-brown tone of the concert hall glows through the glazed entrance façade, giving the building a strong identity. Inside, deep red furnishings and subtle golden accents in the columns recall classical theatre interiors, tying tradition to a contemporary design language.

AT <3

These three years have been a journey of immense learning, through lectures from inspiring professors, guidance from our tutors, and experiences from our trips. But above all, it is the conversations and discussions with my fellow classmates that have truly shaped my time in the program. The mutual support we have given each other has been crucial, we have supported and uplifted each other through every challenge, constantly learning and growing together.

Thanks to the Architecture and Engineering program, I have secured an internship at Buro Happold, where I am excited to continue developing my skills in both architecture and engineering. Looking ahead, I plan to pursue a master's in structural engineering, and I'm even considering a double master's to deepen my expertise even further, simply because this is my passion.

Thank you for stepping into the world of
The Shadow Play!

The play continue beyond these pages.