

BUBBLES

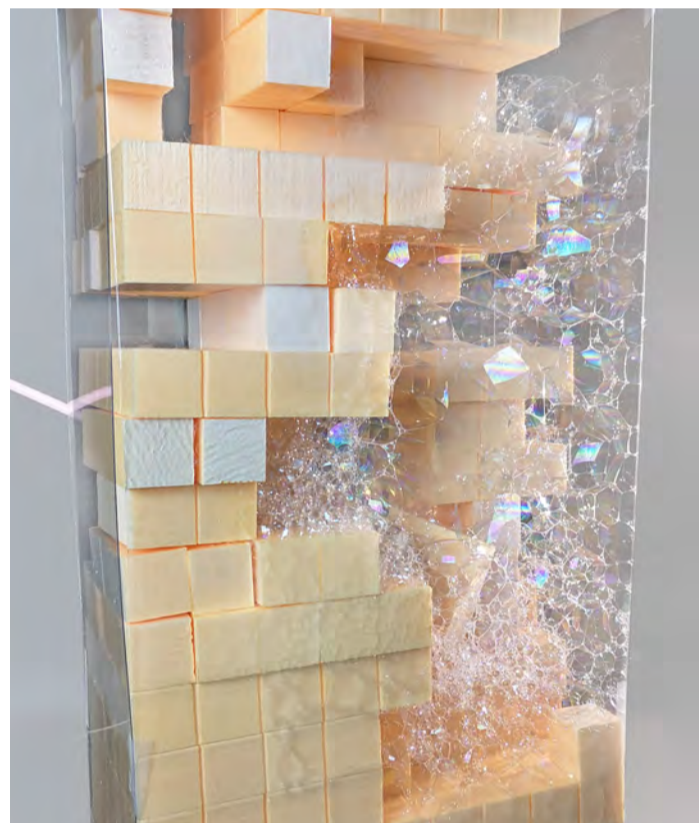
THE RULES

Throughout the project, the bubbles has been the centre-piece. Therefore, the following design criteria were developed, all from how physical soap bubbles actually work.



Bubblecolours

There are few things that can be as mesmerizing as colours and light, and nothing combines these two fascinations better than a soap bubble. Throughout the surface of the bubble, its different thicknesses refract the light differently, causing it to display a magnificent gradient of colours.



Bubblespaces

As bubbles are blown inside another shape, they fill the empty space with a variety of different sized bubbles and attach to the surfaces surrounding them. To experiment with this, soap bubbles were blown into a physical model of the existing building from which the project truly took form.



Bubblefossils

Switching the material concept, having the bubble as the stronger material and the concrete as the weaker, added a completely new shape to our toolbar. This concave shape is created when the bubble imprints its round face to the concrete and then pops, leaving behind the fossil of a bubble. This allowed for an interplay with the concave shapes within the design.



Bubblebars

A discovery from our soap bubble experiments in the model was that bubbles attach to other bubble and its surroundings using straight segments. This introduced a geometric system where spherical objects build a structural system using straight bars. A bubble space truss system.



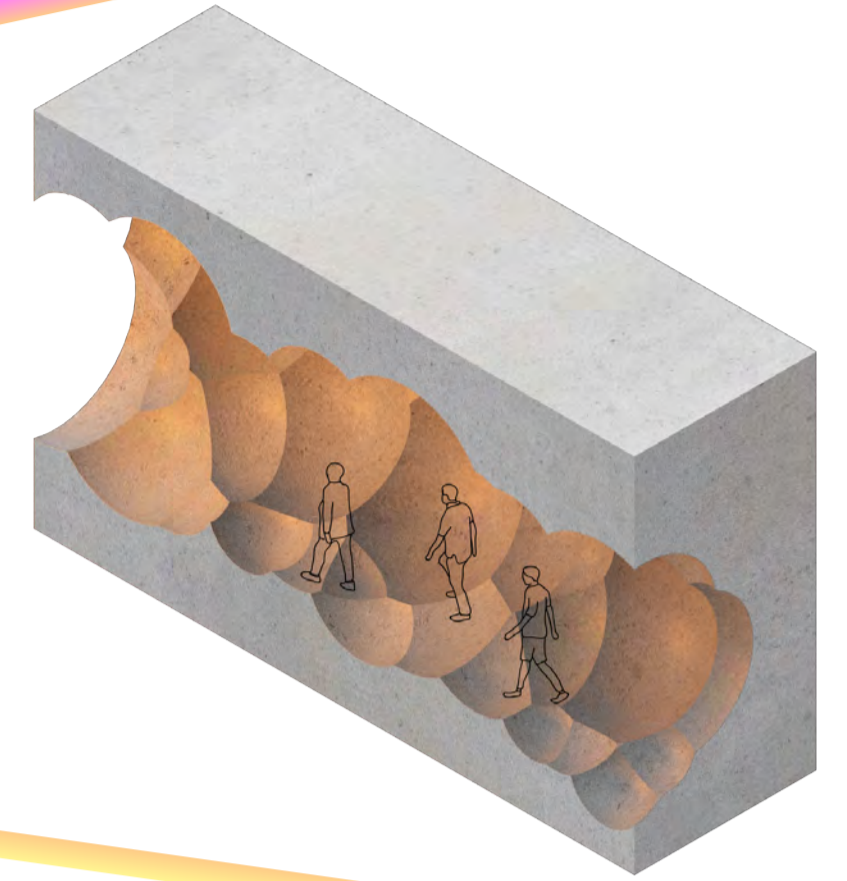
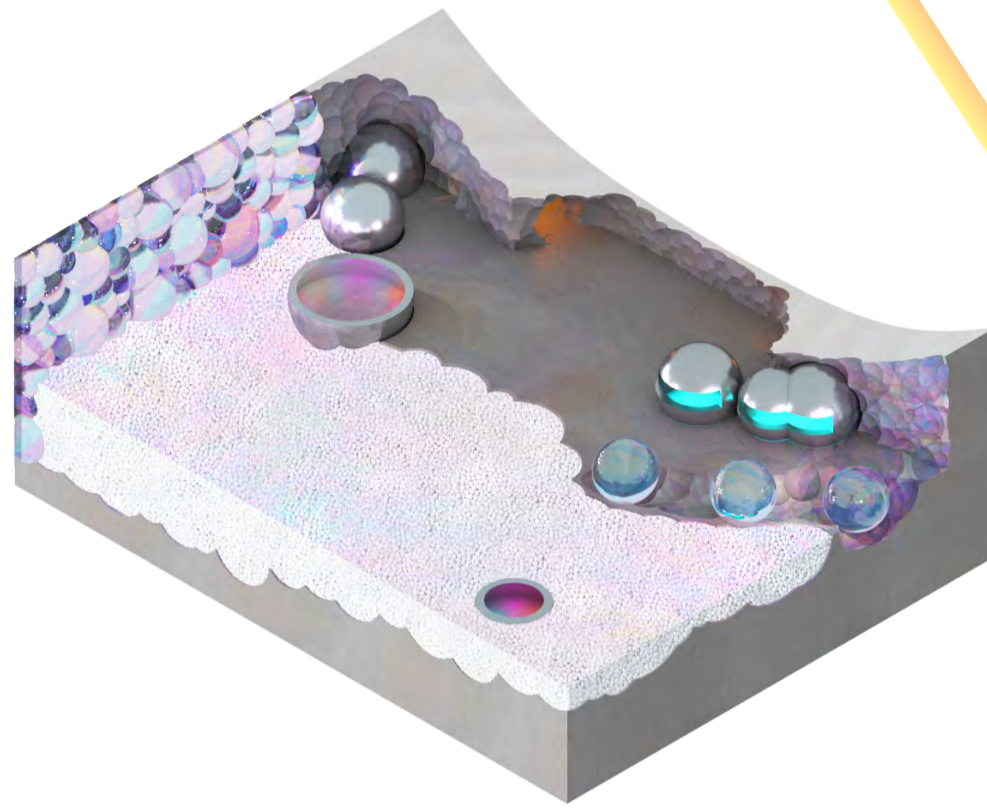
Dance or swim

So where were we heading? If our destination was a symphonic orchestra, this is where we find our seats, bubble pools. Along with our fellow concertgoers we swim to our assigned pool, get comfortable and allow ourselves to be embraced by bubbles and music. Was it a pop concert you say? Then we already met the bubble pools out in the foyer, which now leaves the terraces of the pools in the concert hall empty and just waiting for a dancing crowd!



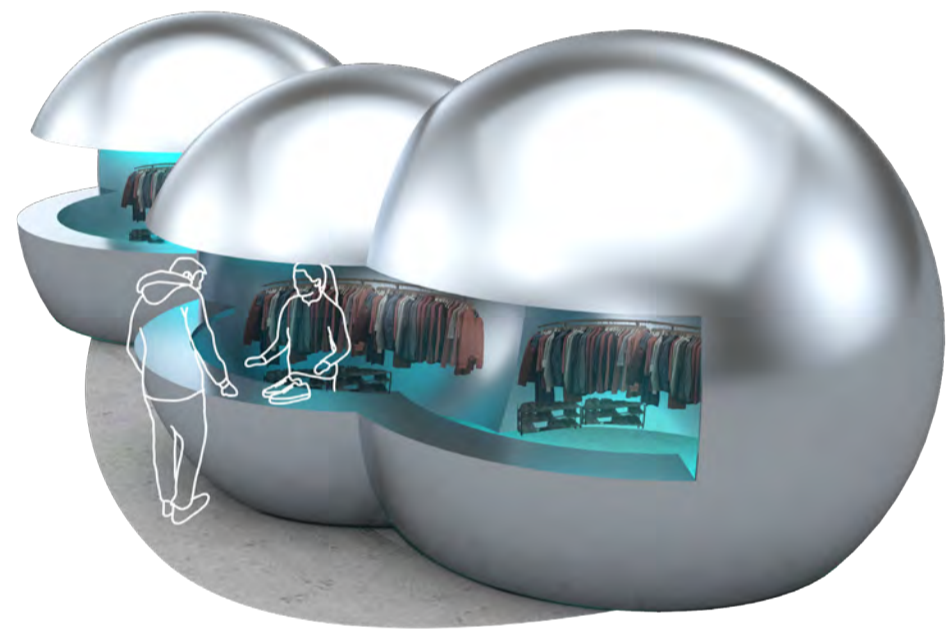
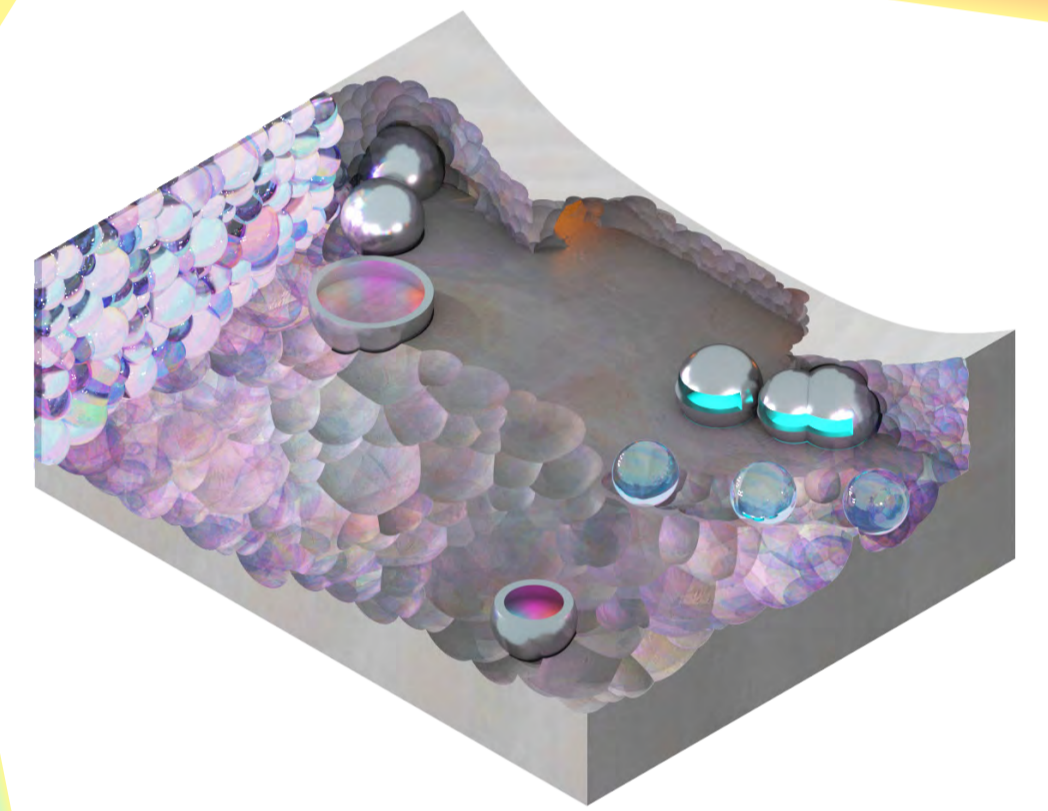
The last climb

Now, get ready for the finale, it's time for the concert. Together with the excited crowd we make our way through the hallways leading us to the heart and lungs of this spectacular place. As we step over the fossils, now small enough to resemble a staircase, the light guides us to our final destination. Without passing through any doors, we enter the great hall.



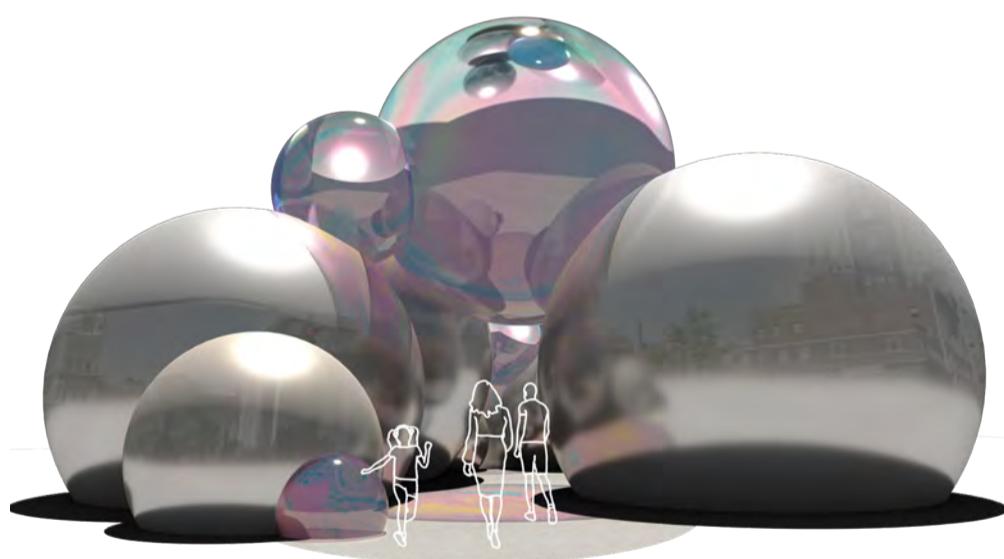
Ballpool or bubblefossils

Now, what kind of concert are we going to? If we are on our way to a concert performed by an orchestra, we find ourselves in a vast space where bubbles seem to have scraped the surface of the floor, leaving a cliff-like scenery. We climb down the landscape and at one of the bars we stretch to reach the drinks we ordered and take a seat anywhere on the bubblefossils. If we instead were going to a pop or rock concert, the story is something entirely different. Half of the vast space is nothing other than a sea of translucent foam bubbles. Swimming through thousands of bubbles we reach one of the bars, order some bubble tea and relax while enjoying a characteristically distorted view through the bubbles in the windows.



Leave your shoes

Once out of the bubble, the now familiar shapes of the polished steel bubbles welcome us, this time hosting the wardrobes. Leave coats, bags and yes, your shoes, we won't need them. Put on a pair of slippers, awake your inner explorer, we have even more to see now!



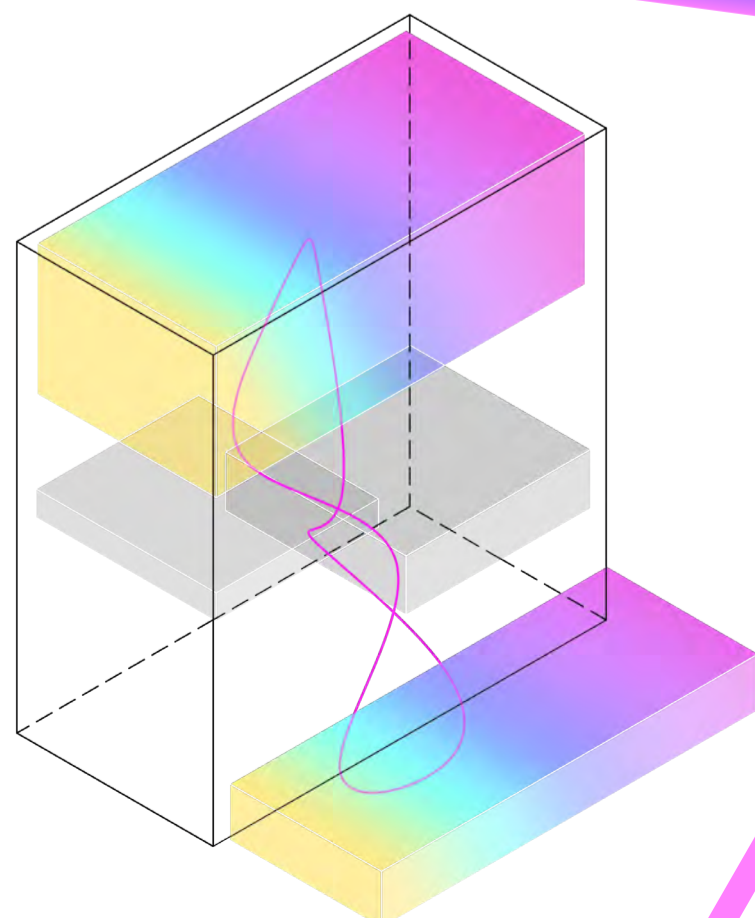
Bubble to heaven

Stepping in to one of the bubbles, we find ourselves surrounded by colours. As the bubble enters the shaft, millions of tiny stars are all we see. Floating through the building, passing the entrances to the nightclub and jazz club, we are met by the natural light of the outside world. Now 11 floors up, we've reached the foyer of the concert hall, expectations high and a mind set for anything.



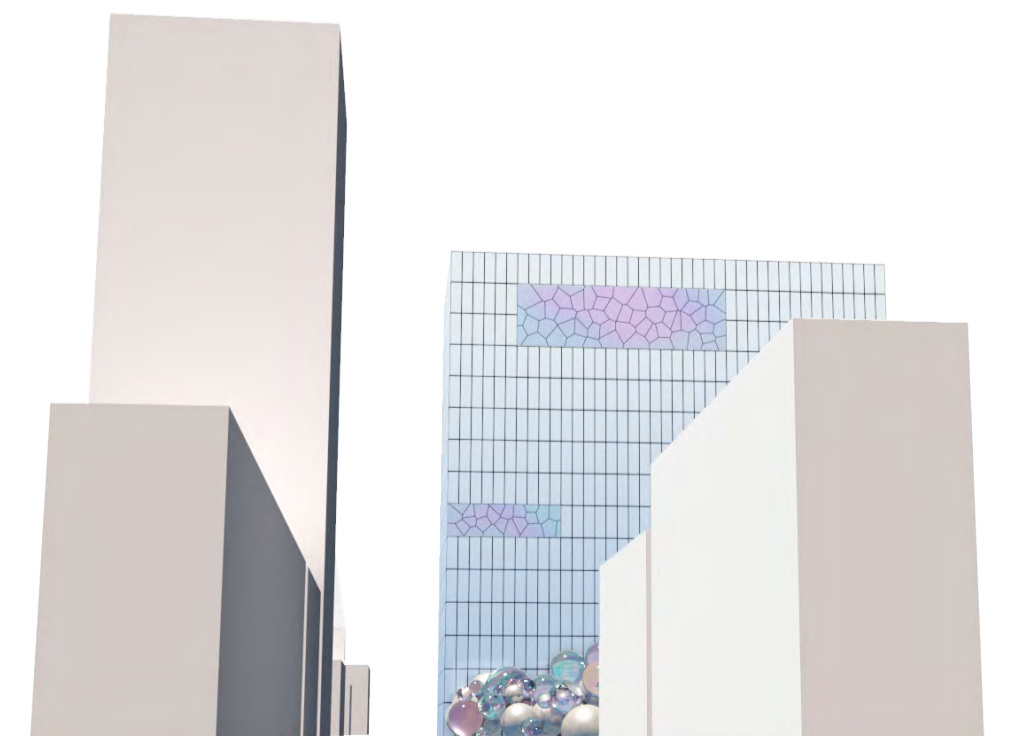
Enter the bubble park

At the foot of the building, huge bubbles of polished steel and colourful glass create the sort of spaces we dream of as children. The colours reflect in all that surrounds it and the convex steel surfaces of ticket services and cafes shows distorted reflections. In the midst of it all, bubbles, seemingly floating and in constant motion, awaits to take us up, up, and away.



Oh, what's that?

Either side of South 5th street in downtown Louisville, Kentucky, are lined with a mix of skyscrapers and historical buildings. It's an area of serious character. However, in the centre of it a building like no other takes its place. A former office building of 15 floors has become a home for energy and colour. Between the floors of boring offices there is a pulsating nightclub, a relaxed jazz club and a completely unique concert hall for symphonic orchestras, as well as energetic pop and rock concerts.



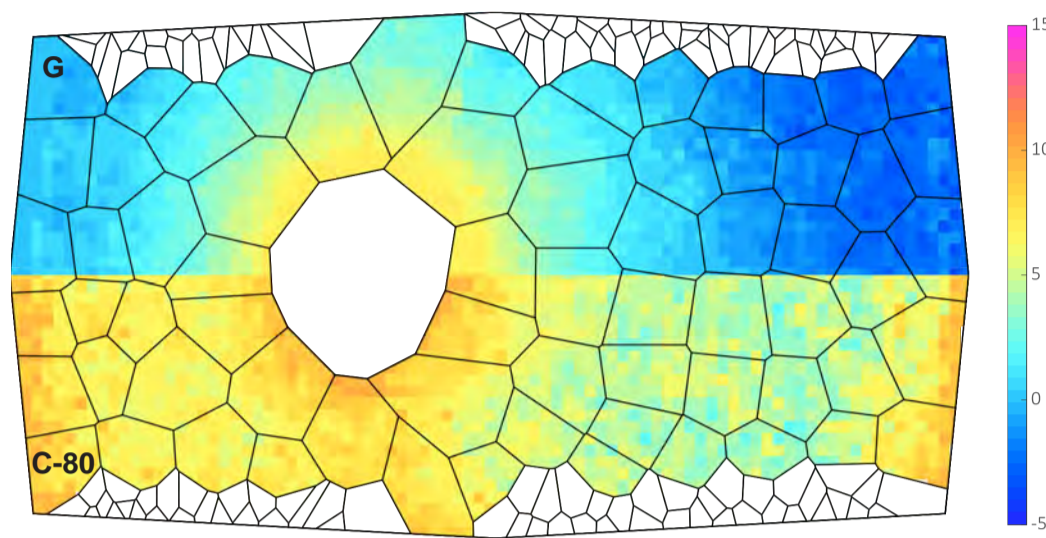
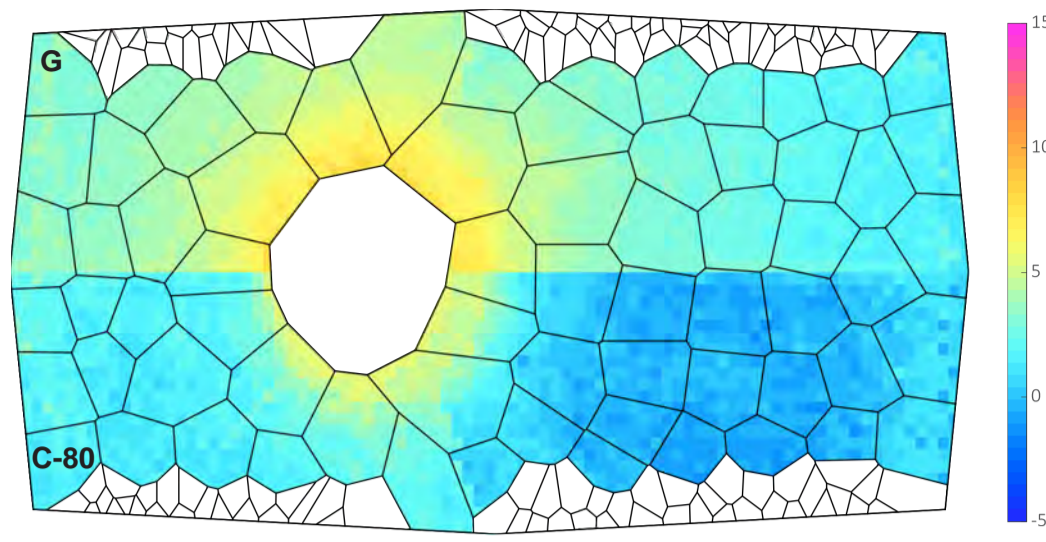
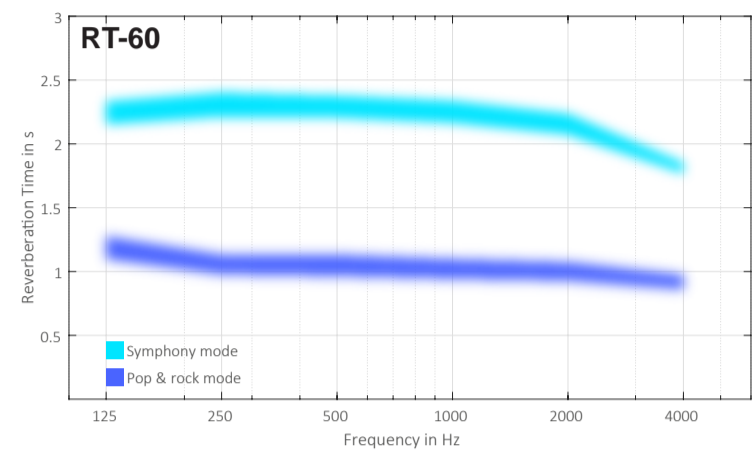
THE JOURNEY

THE SOUNDS

A hall for music

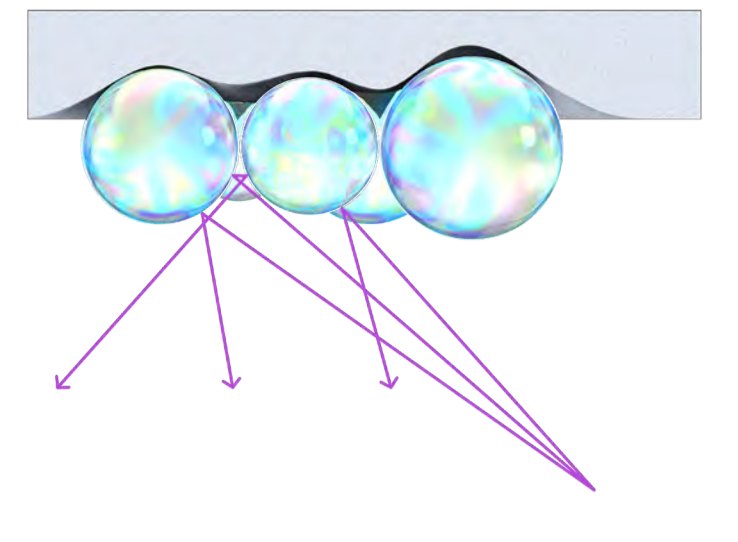
A concert hall is nothing without its acoustics. Several acoustical challenges were to be overcome in this project. The stage is surrounded by the audience, no doors and the stage is to be used for two very different kinds of music, both symphonic orchestras and rock concerts. The key to solving this has been the interplay of volume, material, and geometry.

The entire ceiling of the concert hall is covered in bubbles hanging from a system of bubblebars, forming a bubble space truss system. These bubbles, with their convex surface, makes sure that the sound is distributed evenly throughout the vast space. As a result, the clarity (C-80) and strength (G) lies within a desirable range throughout the hall, with a higher clarity on pop and rock concert than during a symphonic.



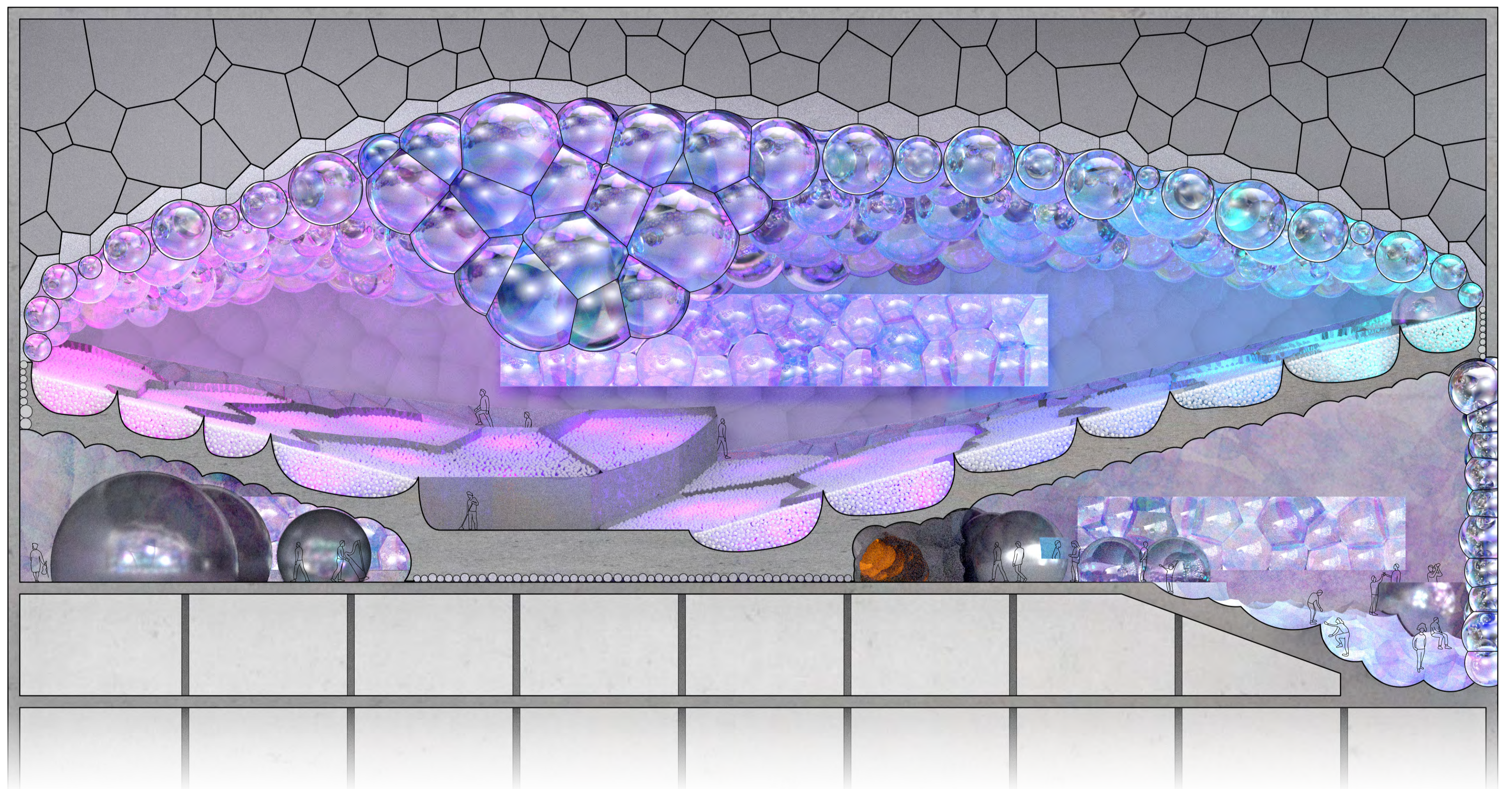
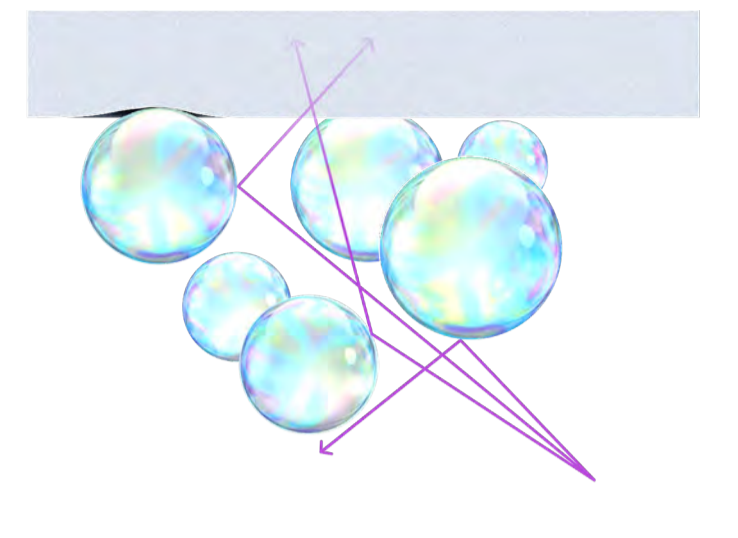
Symphony mode

When the orchestra is playing, reverberation time has to be increased to the desired 2 seconds. This is mainly done by maximising the sound's path length before a reflection and decreasing the absorption area. Glass bubbles are lifted up into the highly absorbant flexible polyurethane foam, creating a reflective ceiling instead. The stationary crown of bubbles over the stage reflects the sound in all directions, including back to the musicians. The audience is submerged in the absorbing bubble pool of foam-filled bubbles. This ensures that the room will have the same absorption coefficients whether the audience is present or not.



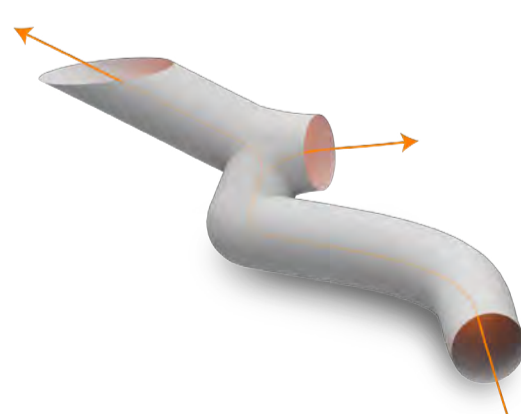
Pop & rock mode

For the rock and pop concerts the room has to be altered, not only functionally, but also acoustically. A reverberation time of 1 second is desired, this without the help from the highly absorbant bubble pool. The glass bubbles are lowered to expose the roof's absorbant polyurethane foam, and effectively increasing the surface area of the glass bubbles, thereby increasing both absorption and scattering. Instead of reflecting all of the sound back down to the audience, the bubbles now reflect a portion of the sound upwards to the absorbant ceiling and some to the audience.



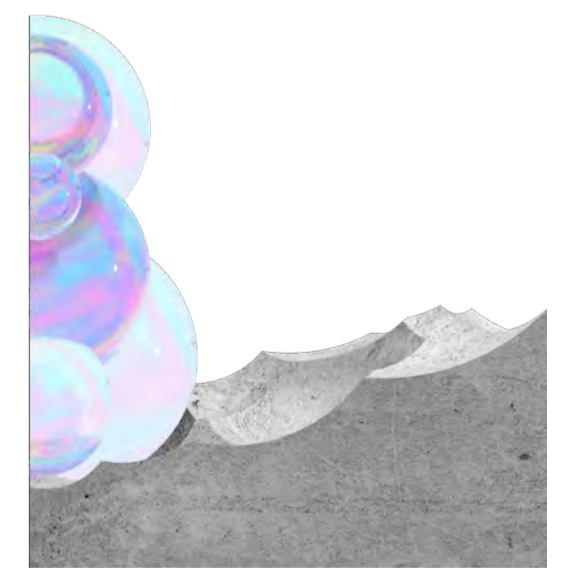
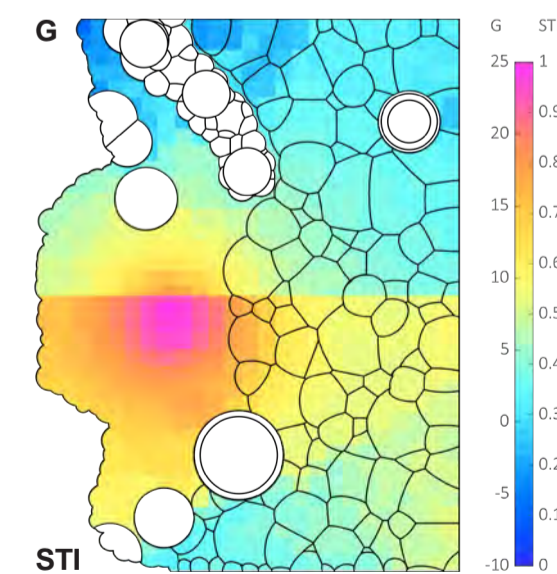
No doors

Keeping true to the concept of bubblespaces, where the overall room is created from the bubbles that fill the space, doors simply do not fit. Still, no noise from the foyer is to disturb the experience of the concerts. Therefore it is up to the corridor to make sure that no noise bleeds through from the foyer to the concert hall. To reduce the sound travelling through the corridor the highly absorbant bubble concrete is used, as well as the geometry of the bubblefossils which scatter sound and reflect it back into the foyer. Finally the opening into the concert hall is as vertical as possible, creating a sharp turn, and projects any remaining sound upwards into the empty air.



Not your ordinary foyer

No matter if the foyer is partly filled with an absorbing bubble pool or exposed bubblefossils, it has to work either way. As the space is to be used for both relaxed conversation and more formal talk, the speech transmission index is to be around 0.6. To do so, the bubbles in the windows are used as Helmholtz resonators, absorbing a variety of frequencies. As the room is filled with the bubble pool, the openings of the helmholtz resonators are covered allowing for approximately the same speech transmission index on both occasions.



Bubble concrete

The bubblefossil concept runs through the building from the macroscopic level to the microscopic. When cement and hydrogel bubbles are mixed together and left to dry the hydrogel evaporates leaving imprints within the concrete. These imprints are similar to the bubblefossils on the walls and floor. The concrete increases in porosity, increasing its sound absorption capability. For standard concrete the absorption coefficients are about 10%, whereas in this concrete it increases to about 60% for frequencies above 500 Hz, with absorption of some frequencies up to 80%. Though the size and number of pores can be altered to fit the absorption requirements of the space.

