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The power of silent sounds

The constant here or there, back and forth, ups and downs, front row or back seat?

The Elbphilharmonie and the search for the perfect sound.

How a young German architect computed the special sound of the large concert hall



Inventing sensuality

Benjamin Koren in his apartment in New York. He is an architect, an acoustician, a musician - and he worked on the perfect concert experience

It is almost an erotic moment inside the new Hamburg Elbphilharmonie: Blixa Bargeld, frontman of the band “Einstürzenden Neubauten” lights a cigarette towards the end of the show and inhales it close to the microphone. The crackling of the cigarette can be heard all the way to the last one of the 2,100 seats.

The first concert of a rock band in this concert hall right on the Elbe (of course by the “Neubauten”, which is German for “new building”), in particular this moment, becomes a shining example of its grand acoustics. It is obvious, just like during the opening classical concert, that the concert hall is demanding, almost merciless, and transports every single noise or sound precisely, every cough, every whisper and every squeak. During loud parts of the performance, it can be overwhelming. But when it gets quiet,

nothing can beat it as this “Elphi” turns to one of the best concert halls in the entire world, as judged by such experts as conductor Kent Nagano.

The Japanese chief-acoustician Yasuhisa Toyota (also known as “Dr. Sound”) warned early on: play softly in the Elbphilharmonie! Otherwise the music might get out of balance as the musicians might not hear themselves while playing loudly.

The biggest challenge for Toyota and his team was the enormous room height of 25 meters. In order to scatter the sound evenly, a 50-ton reflector was mounted above the stage. But more importantly, Toyota commissioned the creation of the so-called “White Skin”: 10,000 gypsum fiber acoustic panels mounted along the walls, each weighing between 35 and 200kg to reflect sound, especially the low frequencies, back into the hall. The construction of this skin is based purely on mathematics. None of the cells were to be identical in order to avoid any unwanted reflections. Out of chaos came harmony.

A young, German architect was responsible for figuring it all out: the Frankfurt-born Benjamin Koren. We visited him at his current residence, a small apartment in New York, around the time of the Elbphilharmonie’s opening concert. Koren, 35, sits at his piano and plays the jazz piece “The Lonely Monk”: “this song really fits well with my current life here” he says. A lonely monk, who is currently admired by the world of music for having left his mark on the sound of the “Elphi”.

Koren wore headphones while listened to the opening concert on his computer: “of course it was not ideal but it was noticeable how during the first piece of Benjamin Britten, the oboe slowly faded”. It was exactly how he envisioned it. He moved to the US two months ago in order to establish his architectural company “One to One” in the United States. The Elbphilharmonie, his first major project, is now history.

Koren talks softly. His hair is cut short but barely tamable, even though he prefers things to be “orderly”. His black shirt tucked into his checkered pants, his socks show a white, black and gray pattern. “I am a geometry-fan” he says, “as are probably all architects, but me especially”.

He is currently working on realizing a small pavilion by Zaha Hadid, which she showcased right before her death at Miami Art Basel. Every night, the hobby-musician plays an hour of jazz on the piano to relax.

Koren grew up in Frankfurt, where he learned to program on a Commodore 64 computer. When he was 14 years old, he moved with his mother and brother to Miami. On his mantle, you can find two corinthian capitals, a reminder of his time as a student in Miami, which is known for its affinity to classicism. He later switched to the Architectural Association in London.

Koren was able to jump start his career: while being a student, he created a music pavilion for London’s Hyde Park based on harmonic principles found in music using the computer. When he presented his work, a partner of the Swiss architectural firm Herzog & de Meuron was in the audience taking notice and instantly offered him a position to work on this world-renowned project.

Koren is an architect, musician, programmer and aesthetician – and his work is about the point where all these traits meet. Every time a geometric project become too complicated and incalculable, architects

seek out Koren to solve their problems: “contemporary obsessions for freeform architecture guarantees that I get a hired” he says.

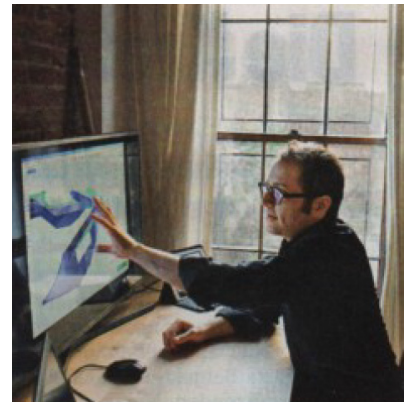
He created a model of the dome for Jean Nouvel’s Louvre Abu Dhabi. He is regularly commissioned to work on realizing complex works of art for Jeff Koons, not by the artist himself but rather by the German metal company Arnold AG that builds half of his sculptures.



The white ceiling in the Great Hall.
Chaos creates harmony - the surface must be irregular, such that the sound is scattered evenly, explains Koren.



Building blocks of good sound.
The wall of the Elbphilharmonie is constructed from 10,000 individual panels. Here's a sample in Koren's New York office



18,000 lines of computer code
Koren worked eight years on the white skin. A 1:10 model of the hall was built for the initial tests

Koren creates a custom-designed computer program for each of the projects he is hired to do. These programs translate the designs into a language that the fabrication machines can understand. Most involve machines such as CNC milling machines, laser cutters, bending machines or 3D printers.

The “White Skin” of the Elbphilharmonie is a computational masterpiece. Koren worked eight years on this project. Aesthetics and acoustics had to work in perfect harmony: the boards had to have the exact acoustic properties demanded by acoustician Toyota while at the same time meet the visual demands of the architects by reflecting the wave-like pattern found throughout other parts of this project.

At first, Koren overlaid the walls with an algorithm-based grid of organized chaos. “In order to create a beautiful chaos, one must expect order” he explains. “Just like the bars on a piece of sheet music”. Using randomization algorithms, he distorted the honeycombs in such a way that they would vary between three and eight walls. On average, each groove has a diameter of eight centimeters.

Koren programmed 18,000 lines of code over the course of six months (in comparison, the first version of facebook had 10,000 lines of code). After 2.5 hours of continuous computation, the computer finally produced the pattern for 1 million different cells on 10,000 panels.

Finally the fabrication could begin: according to Toyota’s demands, the thickness of each board is different, depending on the amount of sound waves each panel is supposed to reflect. There are 20 different variations that all have to seamlessly fit together. Koren also created the substructure of the

“White Skin” that would carry its weight. The total weight exceeded 500 tons – another 25,000 lines of code.



Sound artist

Chief-Acoustician Yasuhisa Toyota examines the white skin. The architecture industry calls the Japanese an “Dr. Sound”

Has there ever been a job that was simply impossible to implement? Koren thinks for a while and says “no, no matter how crazy a pattern is, it follows mathematical rules that can be explored”. He is now eager to finally experience his “White Skin” in person. He already knows where exactly he would like to sit: all the way in the front, the fifth seat from the right, as the proximity of this seat to the wall sounds exceptionally well in the “Elphi”.
