t-mag

Music taught me how to be an architect | Interview with Benjamin Koren

Umanesimo Artificiale
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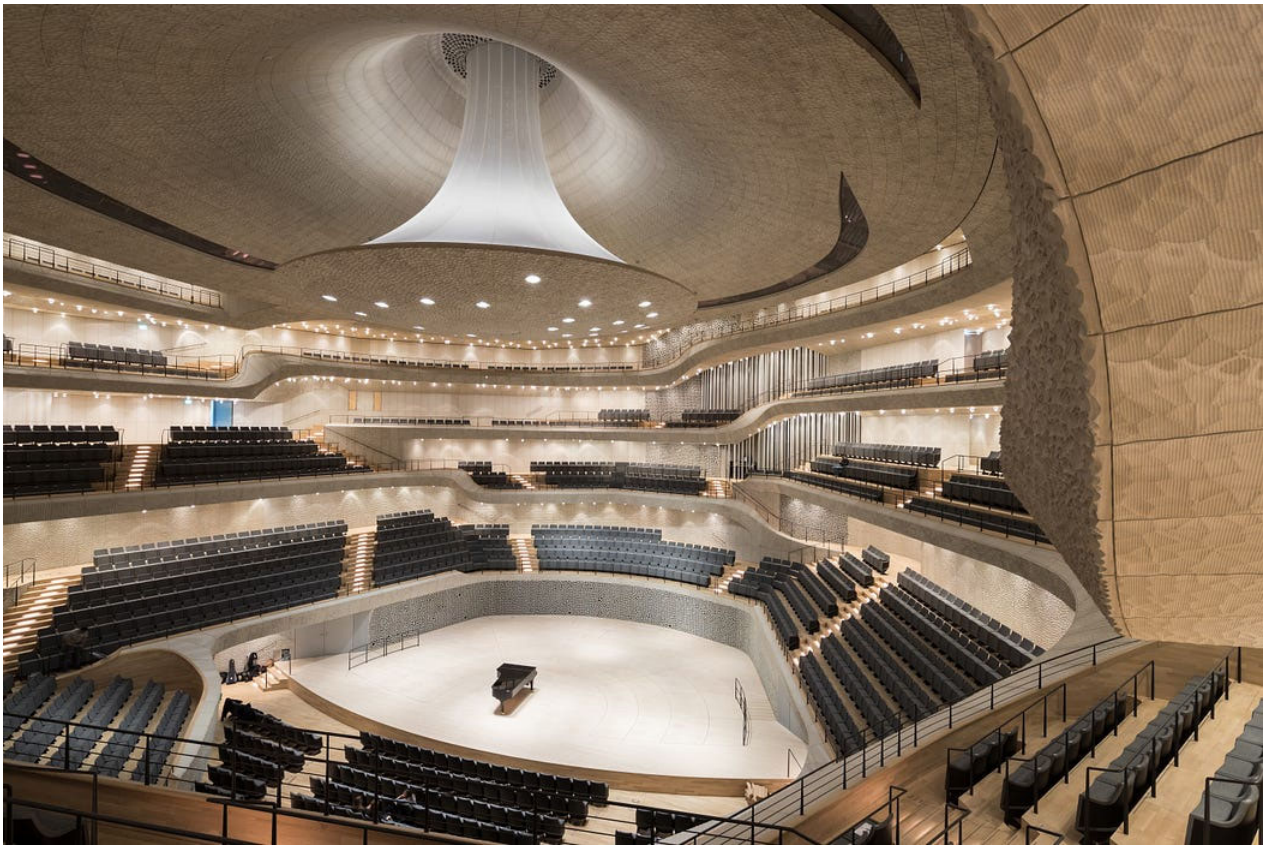


Interior View of the Grand Hall of the Elbe Philharmonic Hall in Hamburg | Photo: Iwan Baan

Umanesimo Artificiale: Hello Mr. Koren, thank you for accepting our interview. It is an honour for us. Let's start by introducing your broad and diverse background: you have studied architecture, film and music at New York University, the University of Miami, the Architectural Association in London and the University of Applied Arts in Vienna. How has your background influenced what you do today?
Benjamin Koren: In a certain way, music taught me how to be an architect. Music and architecture are linked by the same mathematical principles that govern harmony, proportions, and ideal beauty. The relationship between music and geometry, extolled by many before me from Pythagoras, Vitruvius, to Iannis Xenakis, was so appealing that I tried to capture these classical notions with new digital techniques. My first formal endeavor blending architecture, algorithms, and acoustics started at the Architectural Association and ultimately took me to Herzog & de Meuron. At the Architectural Association, I presented a final project in which I designed a music pavilion informed by harmonic proportions, the same principles that govern both classical architecture and musical intervals. In order to fuse the principle of harmonic proportions within the two disciplines of architecture and music, I developed an algorithm that created

three-dimensional forms in the same way that a synthesizer creates sounds. One of the partners of Herzog & de Meuron was a juror in my final review and approached me afterward to offer me a job on the spot. They had just started the design on the Elbe Philharmonic Hall in Hamburg and assigned me to work on the acoustic interior of the Grand Hall and Chamber Music Hall. The job was the perfect marriage of both my interests and skills. I then founded ONE TO ONE, a computational design and digital fabrication firm. I named the studio ONE TO ONE for its manifold resonances — the ratio 1:1 not only refers to architectural scale, the scale at which I build concert halls, but also 1:1 in a musical scale refers to the keynote, the focal point for both melody and harmony in music. Through my studio ONE TO ONE, I continue to work at the intersection of music and architecture with projects including the Philharmonie de Paris, City of Music, and most recently the New York Philharmonic's Geffen Hall.

Exterior View of the Elbe Philharmonic Hall in Hamburg | Photo: Thies Raetzke

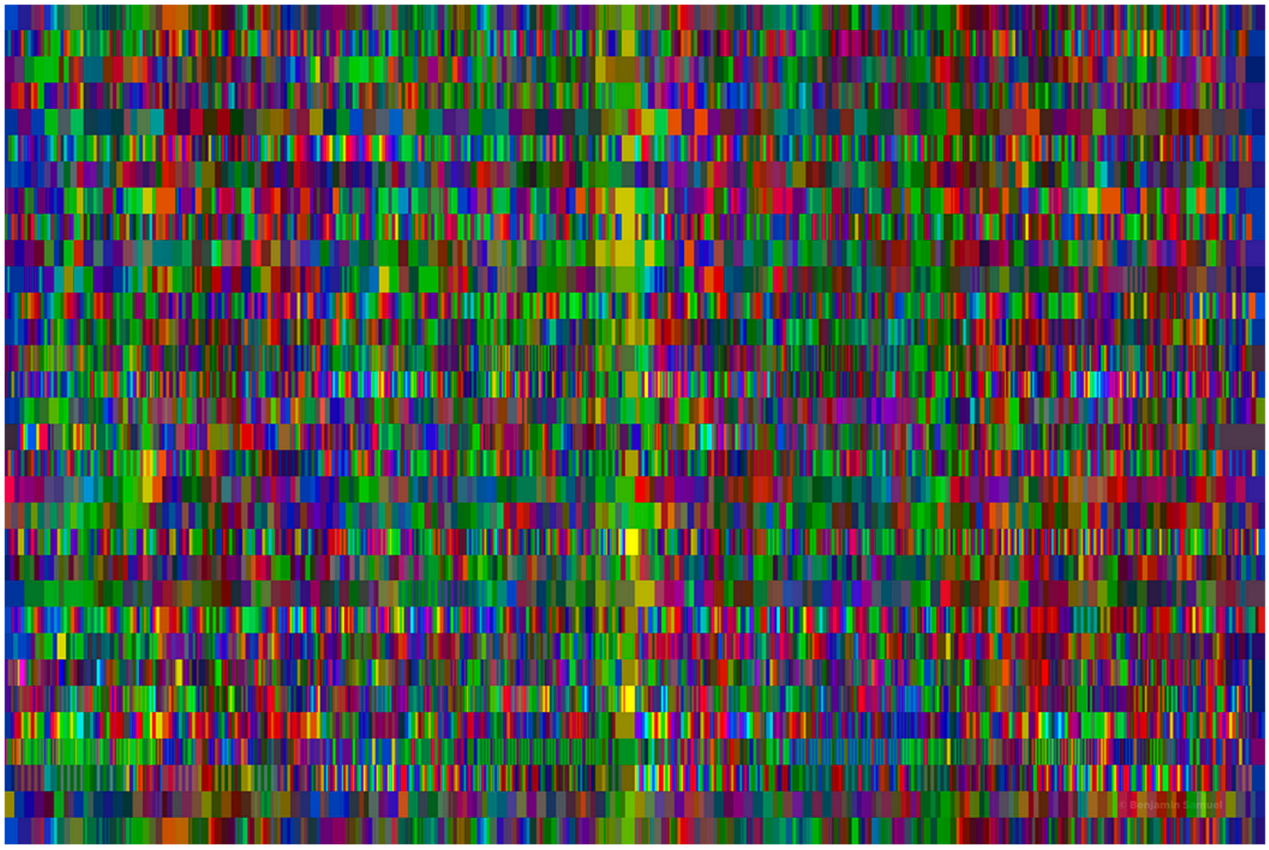
UA: You are not only an architect, a designer, a musician, but also a media artist that uses algorithms to create art, please tell us about it.

BK: Creating media art was an unavoidable turn, a return to an obsession of mine — coding. To some extent, creating artworks in the information age necessitates an awareness of the problems and potential of algorithmic data processing. I am particularly attached to the idea of synergy: that human intuition coupled with computer processing creates more than the sum of their constituent parts. In my artworks, I not only create algorithms that schematically process human-made cultural artifacts, such as stock market data, film frames, comic strips, music notes, etc. But of course, the algorithm only produces what I predetermine, and I always seek to highlight humanist approaches to art, literature, and society. It is a rich paradox, which I relish, to highlight the humanistic via the computational. For example, one of my works is based on the entire music of Johan Sebastian Bach's Goldberg Variations. I translated each series

of notes, the pitches and rhythm, into color patterns. In part due to Bach's methodical compositional style and his rigorous use of fundamental harmonies, a golden middle axis appears down the middle of my canvas. Beyond the usual listening of Bach's Goldberg Variations, which takes 70 minutes in real-time, my artwork now allows the viewer to visualize the genius of Bach in one glimpse. Last year, I sold the first edition of this work to the Bach House and Museum in Germany where it is on permanent display. A corresponding work is based on Beethoven's Diabelli Variations, which is now owned by the Beethoven Museum in Bonn, as well as two works based on the films of Alfred Hitchcock and Stanley Kubrick, which are both in the German Museum of Film in Frankfurt.

UA: In your work you make use of mathematics and big data. How and why are you fascinated by big data? What makes mathematics beautiful to you?

BK: It is interesting you draw a distinction between mathematics and data, which I do as well. I consider math and big data to be two sides of the same coin, both the building blocks of modern computers. Any artwork that is created with the aid of computers necessitates both data and algorithms to work and transform the source material. I make artworks that at times highlight the mathematical and at other times the data side. I consider mathematical works, such as the 3D form-synthesizer that I mentioned earlier, to be about organic unity, natural and fundamental beauty scaffolded by abstracted rules and concepts. On the other hand, my data-driven projects, aim to find beauty in the abundance of man-made data, for example, all 75,730 musical events of Bach's musical work. Beyond the primary utility of any given data set, there is always the potential for information to be more, to be human, to be art.



Benjamin Samuel Koren's Artwork Goldberg Variationen 30+2 | Photo: Benjamin Samuel Koren

UA: The way I have been introduced to your work is through the Elbe Philharmonic Hall in Hamburg where you coded the software to algorithmically create the 10.000 non-standards acoustic panels that cover the interior walls of the main concert hall. In this work of what has been called "parametric design", what can you tell us about the algorithm and what were the parameters you considered?
BK: The acoustic panels are made up of close to 1 million sound-diffusive divots or cells, each about the size of a tea cup. Like the 10.000 panels, every single cell of the 1 million divots is unique in shape and size. To achieve this variety with determination and to a high degree of mathematical accuracy, I programmed each cell to be an iteration of a prototypical cell, defined using a number of parameters, such as depth and width of divots, and the sharpness of edges, etc. The parameters driving my software, which resulted in the algorithmic generation of all of the cells for the walls and ceiling of the concert hall, were drawn from the sonic, structural, and aesthetic requirements defined by the architects, acousticians, and the building contractor.

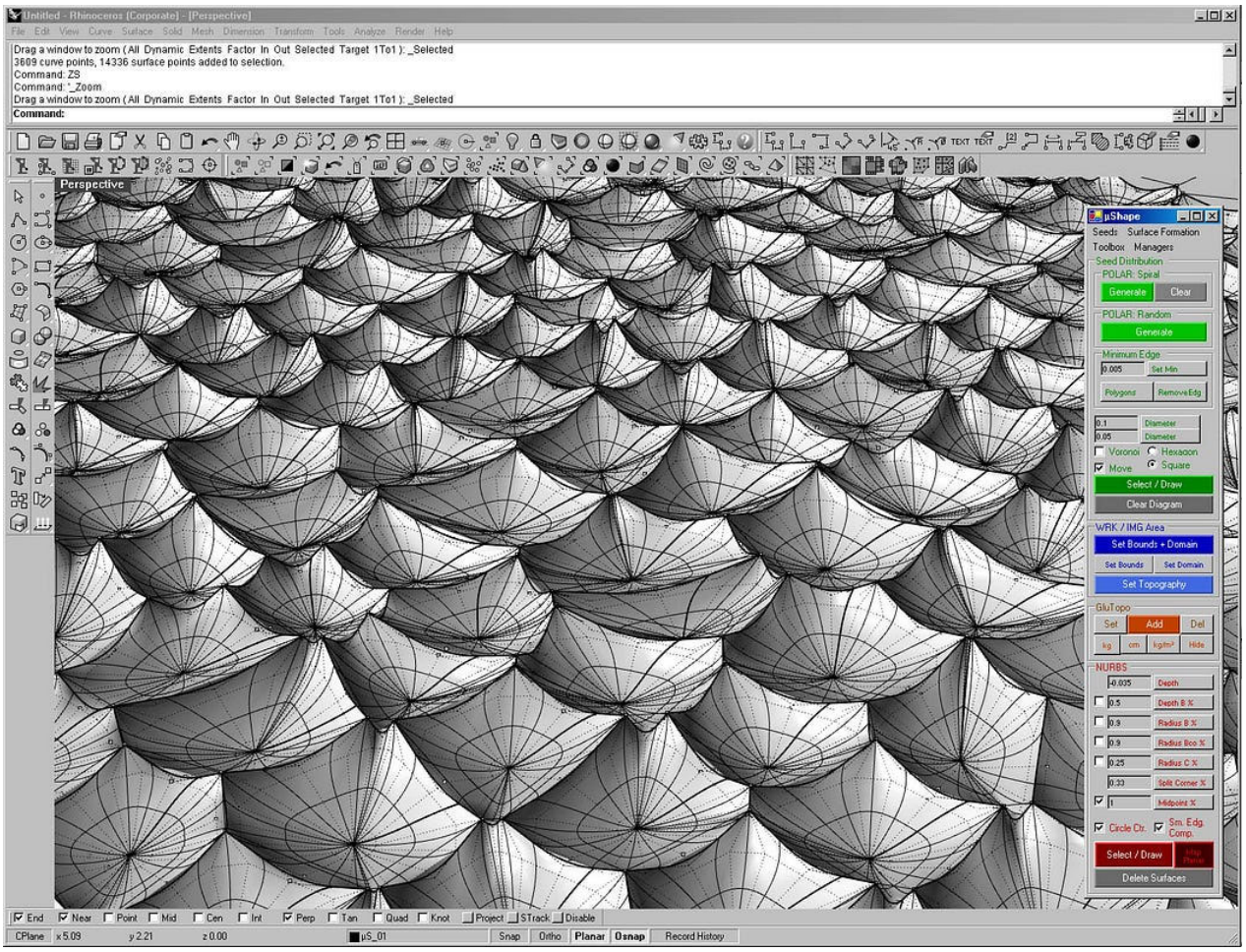
Interior View of the Grand Hall of the Elbe Philharmonic Hall in Hamburg | Photo: Maxim Schultz

UA: ONE TO ONE — the company you founded — created the software, Herzog & de Meuron designed the building and the acoustician Yasuhisa Toyota created the sound map for the auditorium. How was the process to work with such diverse professionals and how did you translate all their (and your) inputs into an algorithm?
BK: The Grand Hall of the Elbe Philharmonic Hall was of course an amazing project to work on due to its large-scale, interdisciplinary, and technical nature. It was my job to codify all the real-world requirements and specifications of the parties involved into numerical data. Unlike other projects of this scale, where compromises have to be made due to the conflicting requirements posed by the various parties involved, the Elbe Philharmonic Hall is distinct in that every single requirement was actually implemented and to a

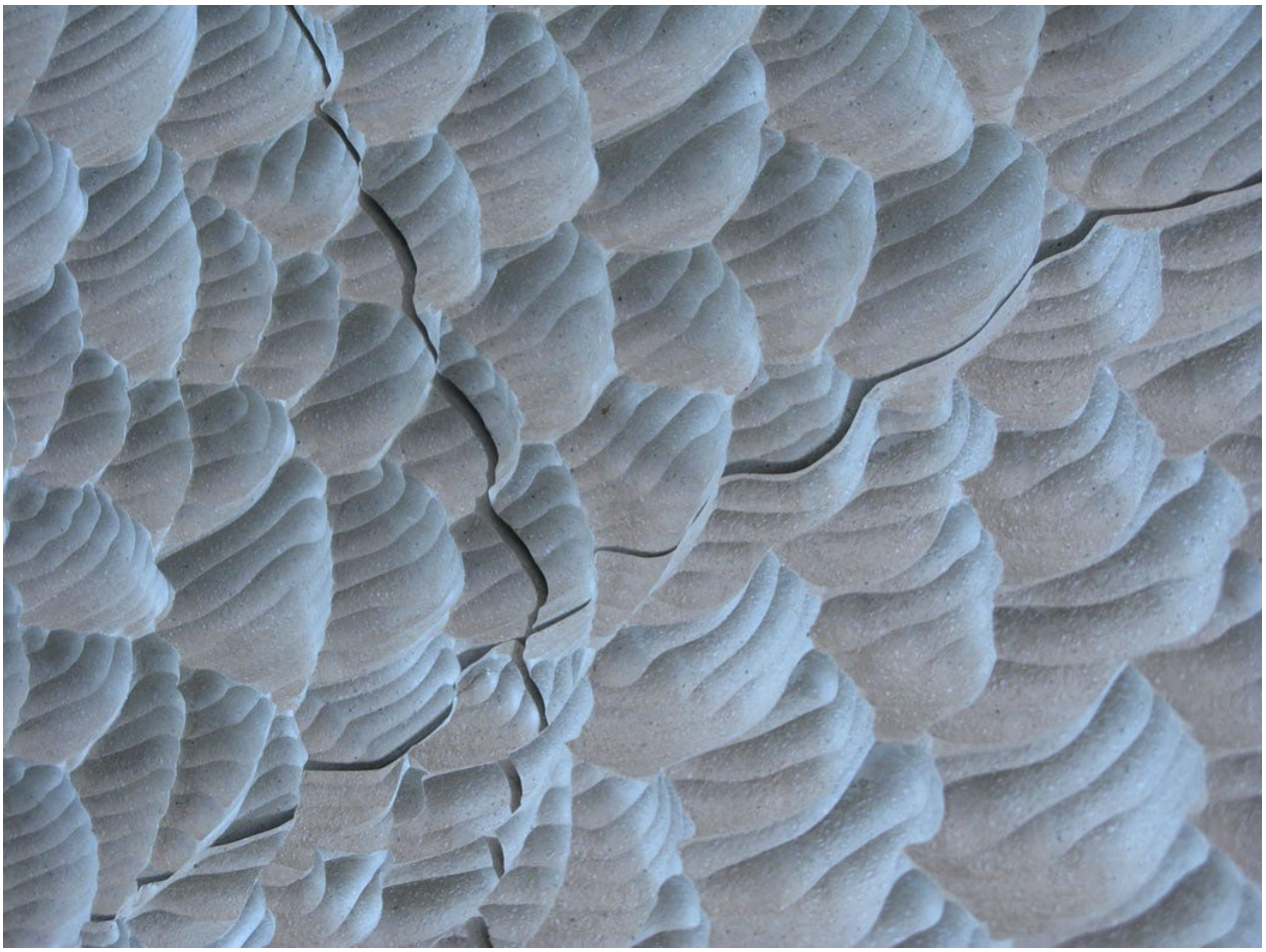
precise degree. This is not only a testament to the incredible teamwork of all the experts involved, but also to the power of the computational design and digital fabrication techniques that I employed.

UA: What has been your "relationship" with the algorithm? Have software influenced your ideas and your process while you were programming it? If so, how?

BK: The algorithm evolved in parallel to the project. Since it was custom-tailored to the specific tasks and requirements, I developed it with as much flexibility as possible. In the end, the final program that generated the 10.000 unique panels and the 1.000.000 cells was about 18.000 lines of code. Computational design techniques are often curiously paradoxical — while the development of the algorithm takes time and many iterations for testing and improvement to be perfected, the actual run-time, the time it takes for the computer to actually process and generate the final data, is very fast, almost instantaneous.



Developed Software Program to Generate the Acoustic Pattern for the Panels of the Elbe Philharmonic Hall in Hamburg | Photo: Benjamin Samuel Koren



Close up View of the Acoustic Panels in the Grand Hall of the Elbe Philharmonic Hall in Hamburg | Photo: Benjamin Samuel Koren

UA: Lastly, a question that pertains also to the realm of human and machine interaction: algorithms can make buildings, but could they ever become architects?

BK: Architecture is a creative venture. Asking the question if computers could ever become architects or even artists, therefore, would be to ask the question if computers could ever become creative. Creativity is often defined as an endeavor to see cross-connections between seemingly unrelated things. In that regard, I believe computers have already demonstrated that they are capable of being creative (whether they could ever be conscious about their own creativity is a different matter). The 2020s will undoubtedly see an accelerated advancement in artificial intelligence and machine learning. With that said, the distinction between computers as mere workhorses and as creative entities will become more and more blurred; it is this increasingly blurred distinction that I explore in my work to come.

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