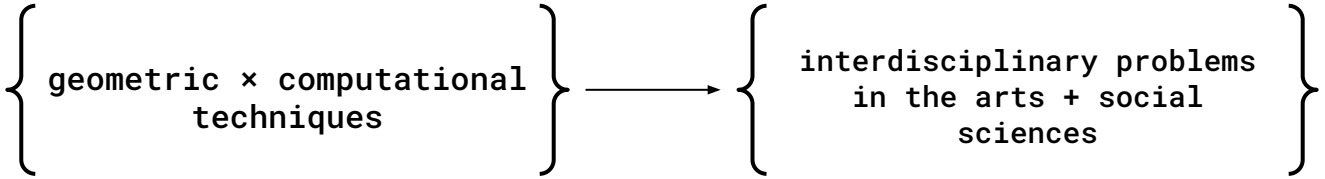
Thomas Sachen

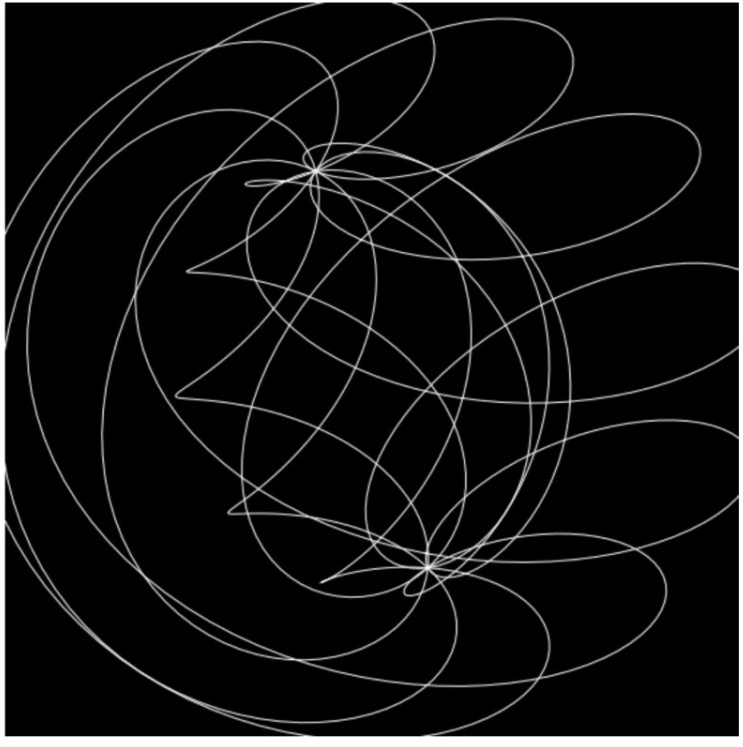
Thomas Sachen enjoys finding {design + ethics)-equivariant applications of the form

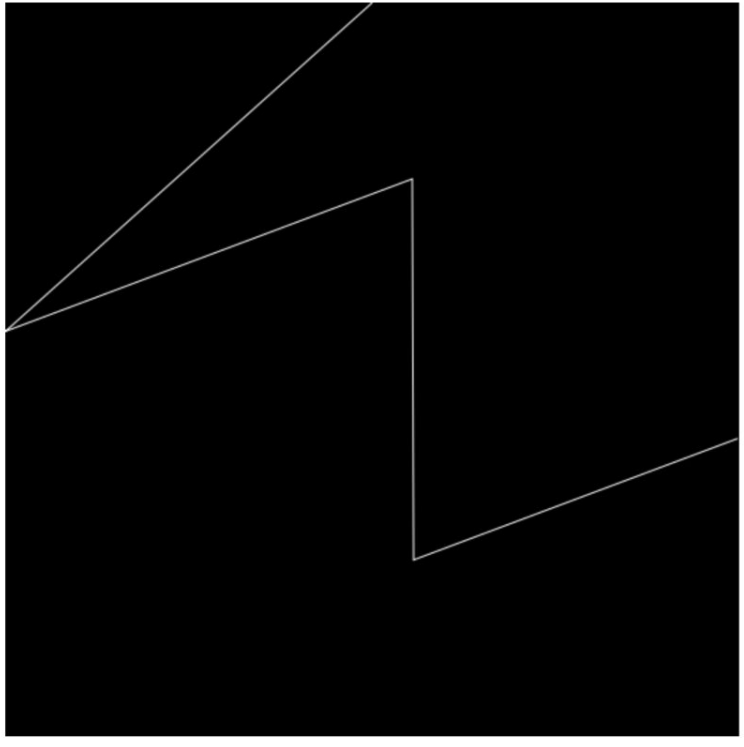


in order to reconcile mathematical beauty and natural beauty.

He studied mathematics at Princeton University, with an emphasis on geometry and topology. His work has always been multidisciplinary in flavor. His senior thesis investigated new ways of applying geometry to the theory of prime numbers. Recently, he has explored applications of topology to data analysis algorithm development, epistemology/cognition, and music theory.

He has long held a reverence for various fields of design, and is now poised to use his technical acumen to nurture meaningful engagements between diverse practices in art, architecture, music, and the decorative arts. He aims to earn an advanced degree in computational (bio)design in the coming years.





use this tool to modulate the parameters of a 3D torus knot with an audible spectrum sound wave -- it is a toric oscilloscope.

eventually, this will function as an oscilloscope for external instruments, and will naturally handle (up to 4) polyphonic voices in a more compelling and useful way than current oscilloscopes.

it will also act as a stand-alone visual FM synthesizer, using evolving toric geometry to organically determine frequency.

the natural "mode of evolution" in the category of sound waves is oscillation; for topological spaces it is deformation. this is an early step to finding meaningful, functorial methods to compare these modes of change.

a: 2 ☐ modulate // **b:** 1 ☑ modulate // **p:** 3 ☑ modulate // **q:** 7 ☐ modulate

Frequency: 131 Amplitude: 5.2

☐ Sine Wave ☐ Triangle Wave ☑ Sawtooth Wave

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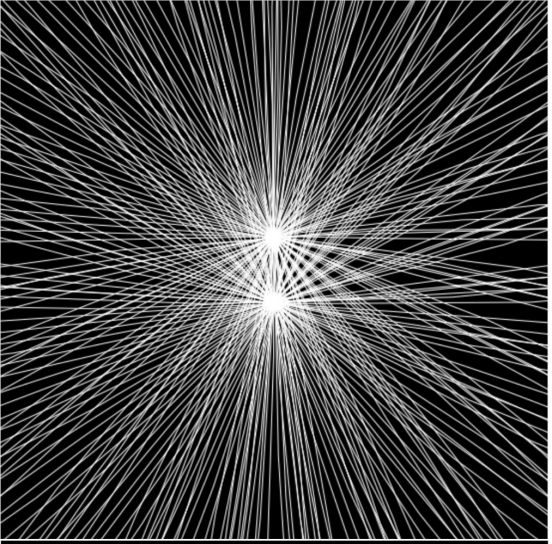
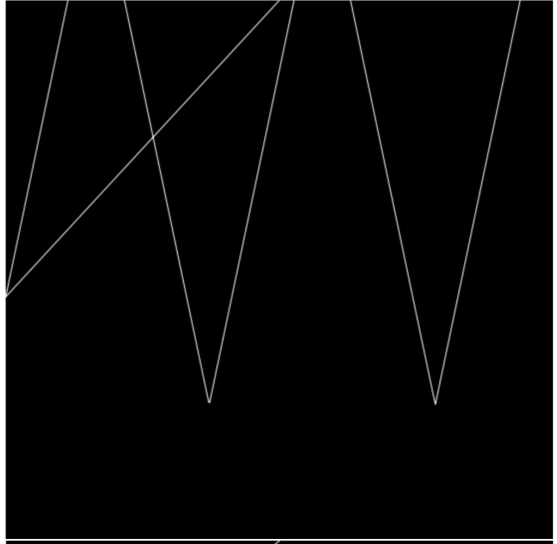
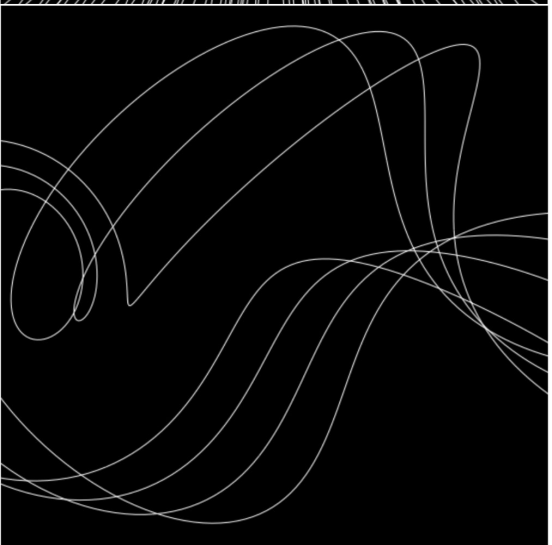
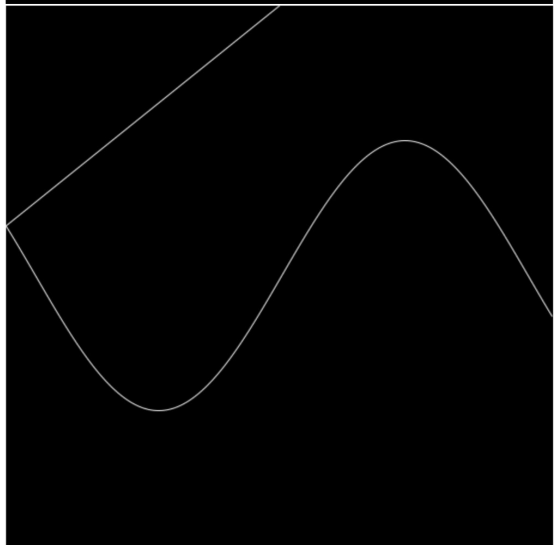
arrow keys *= rotate //* ***Enter*** *= reset rotation //* ***Space*** *= play/pause animation // use the checkboxes to engage target parameters*

use the first 2 keyboard rows ***(q-i --> a-k)*** *to play the oscillator in harmonic tuning, or* ***m*** *to play a selected frequency.*

toroscillator_

toroscillator_

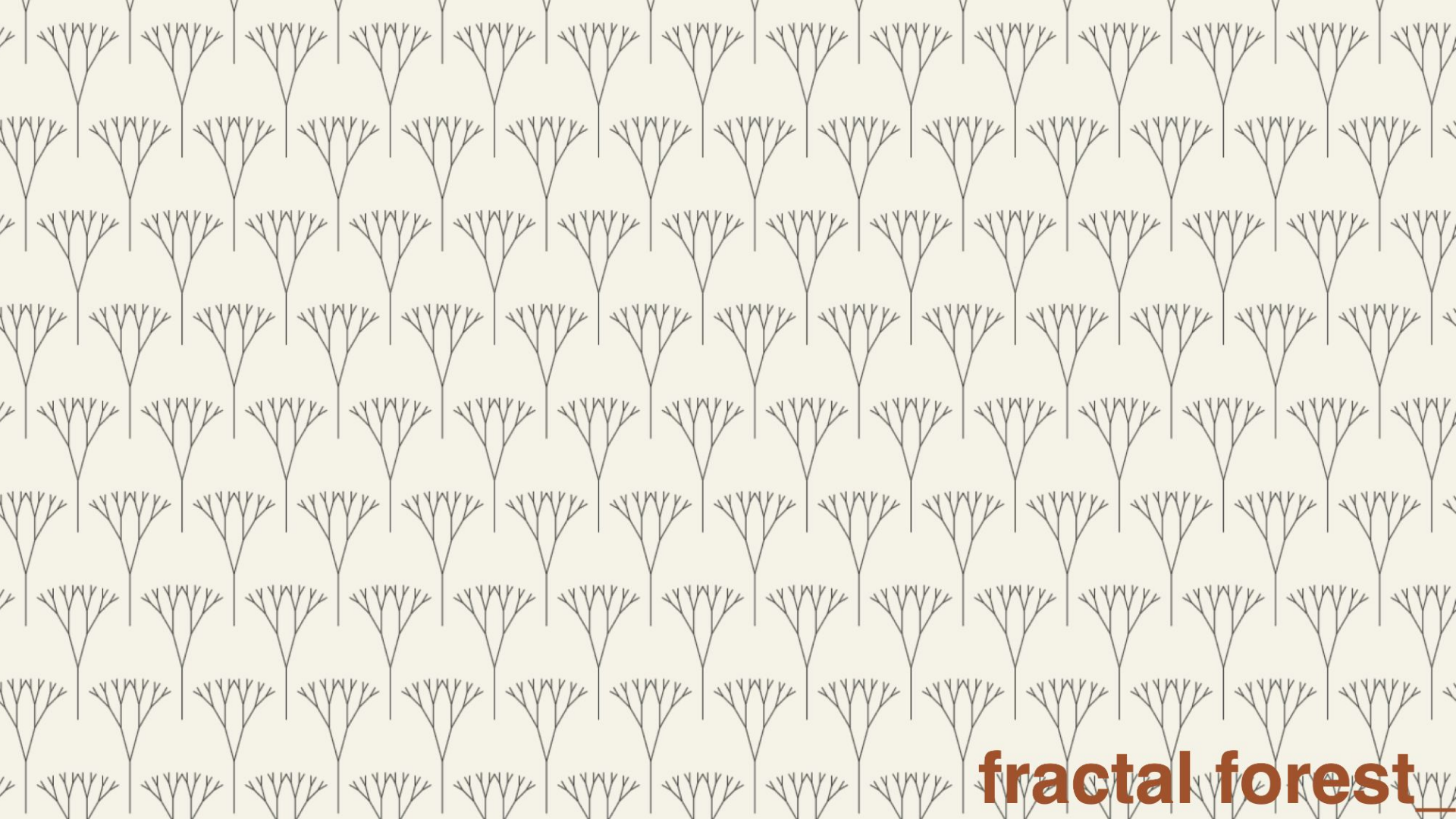
is a project that aims to understand the behavior of sound waves on non-flat surfaces, with many surprising and beautiful results.

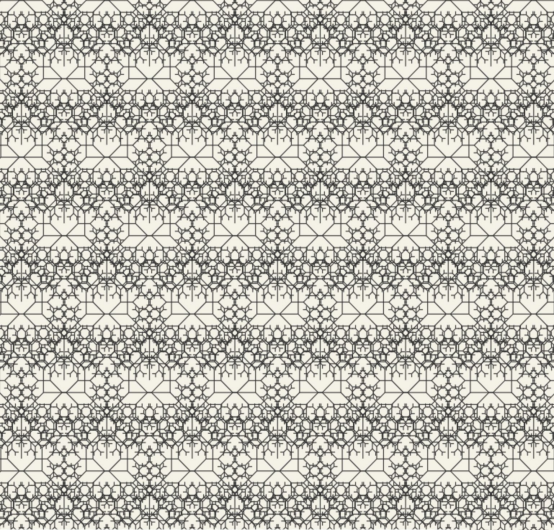
It is an interactive JavaScript applet that allows the user to directly modulate four parameters of a knot on the surface of a torus, using sound waves in the audible spectrum. It also acts as a basic synthesizer.

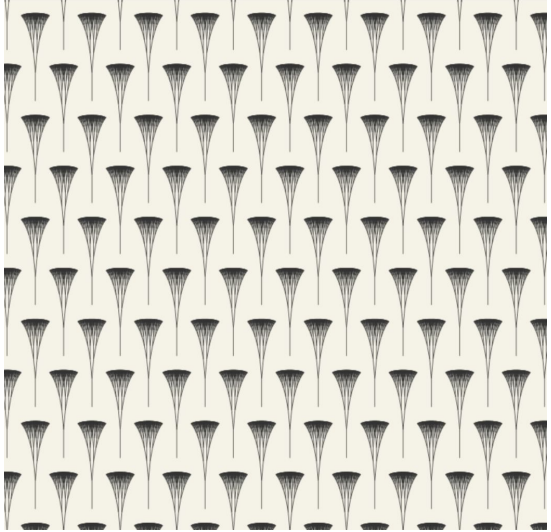
With this powerful geometric link between toric geometry and sound established, the ultimate goal is to reverse the process — to modulate sound waves using deformations of the torus.

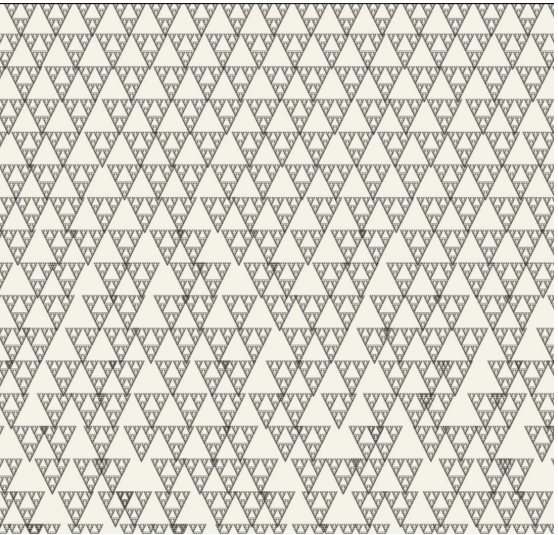
This will allow us to “hear” topological change in a useful and significant way. **toroscillator_** has already led to several interesting links between the phenomena of oscillation and deformation.

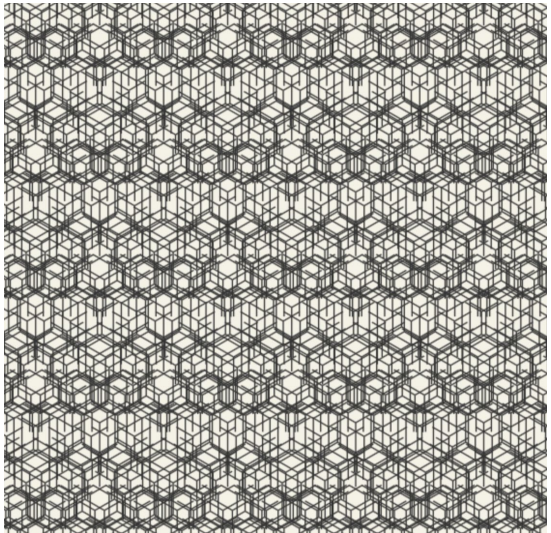
(access **toroscillator_** at tomsachen.github.io)


fractal forest









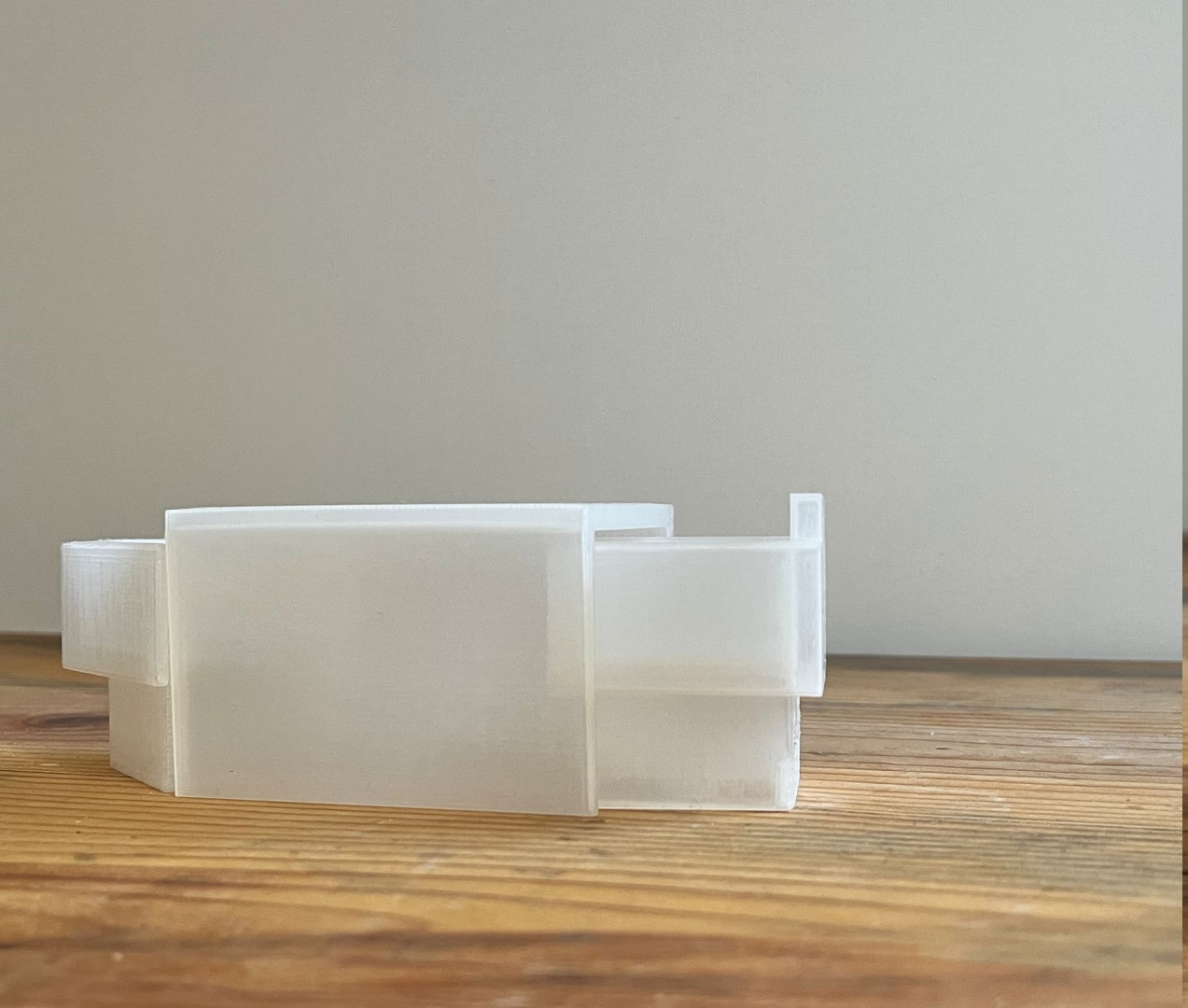
fractal forest_

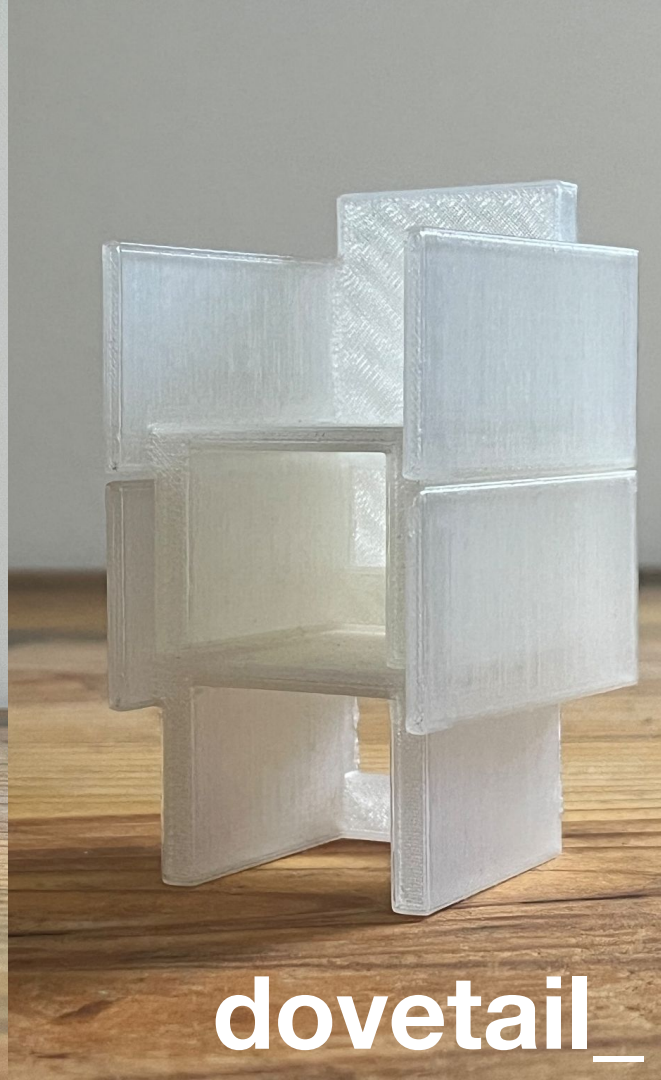
Is a project that captures the beautiful isotopy between Sierpinski sieves and fractal trees. It is an interactive JavaScript program that allows the user to freely explore and deform fractal tilings.

Rather than showing selected frames of the map between sieves and trees, **fractal forest** empowers the user to participate in each time step of the isotopy, contributing to richer understanding, as well as unlocking an infinite family of intermediate fractals.

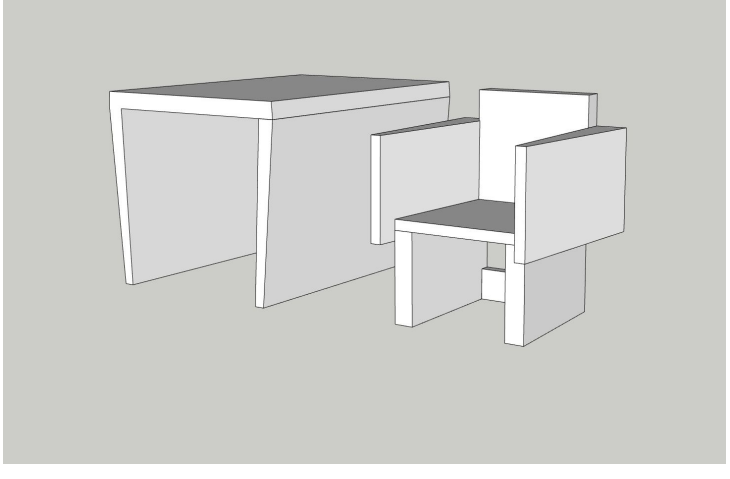
The principal in mind is the concept of “fractal evolution” or how fractals change their state over time, with the goal of introducing a new family of continuous cellular automata.

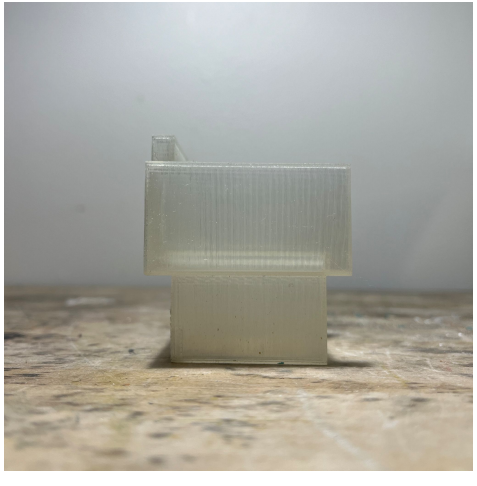
(Find **fractal forest** at tomsachen.github.io, and see `here` for my writing on the epistemological weight of interactive visualizations in mathematics)





dovetail_





dovetail_

These chairs furnish a *homotopy*, or the continuous process of deformation of one shape into another. The base is a reflection of the top of the chair. These opposing faces are the coboundaries of the homotopy, and this intrinsic symmetry allows for tessellation-like stacking of the chairs; a single point traveling through an infinite stack of chairs traces out a helix in space.

This dining set was designed for small apartments; the chairs are easily stacked and stowed inside the table, and even function as a bookshelf while stowed. The trapezoidal base evokes the image of a dovetail joint, emphasized by the seamless marriage of stacked chairs. I am currently in the process of building this dining set in unfinished birch wood.

I can be found at

tomsachen@protonmail.com *and* (262) 914-8590

for more information on these projects + music and academic work, visit

tomsachen.github.io *and* linkedin.com/in/thomas-sachen