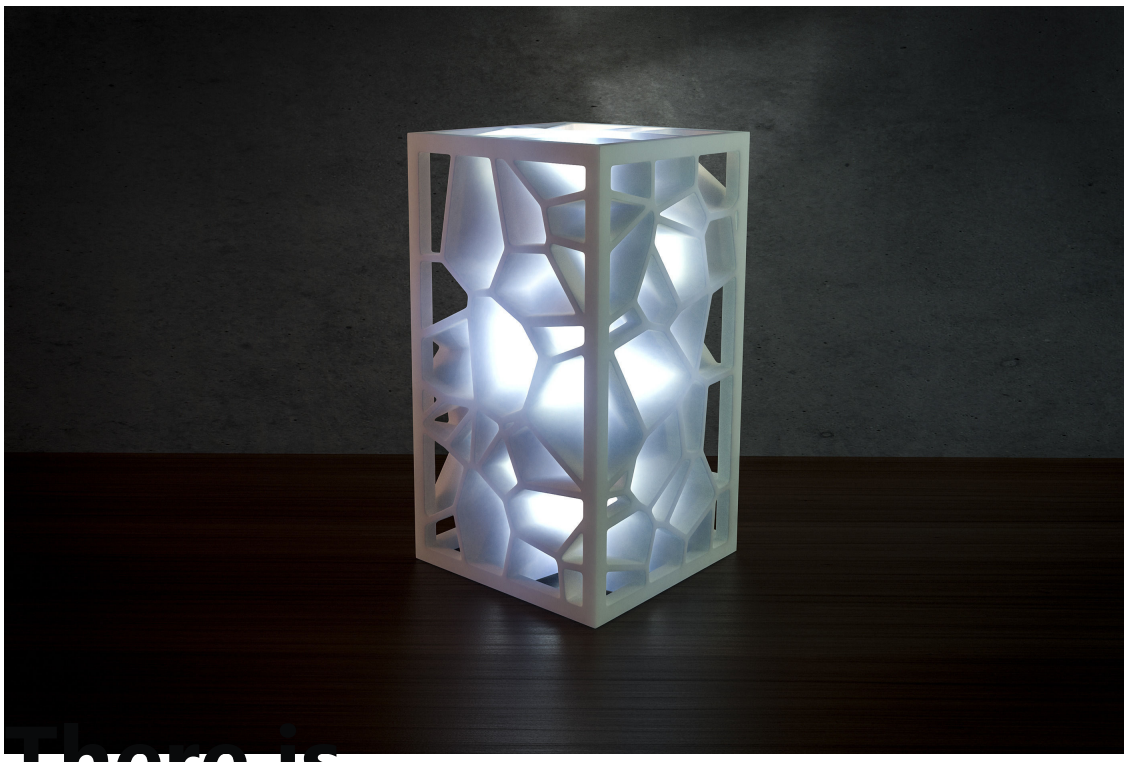
7 AUGUST 2019 / 3DPRINT

How to 3D Print Voronoi-Style Shapes with Inkscape and OpenSCAD

I've been into 3D printing for a while now, creating various shapes like mobile phone stands, different types of boxes or just replacements for broken parts. However, one design that I could never quite stop thinking about is the Voronoi Lamp. Once I saw this, I knew I had to find out how to create such shapes, not necessarily that lamp, but these kind of organic, random connection of edges just got me hooked.



There is...

tons of different software for 3D modelling out there. The most familiar ones are probably Blender (yes, you can also use it for modelling), FreeCAD or OpenSCAD. I can't really tell why, but I like using OpenSCAD. Albeit its slowness (just a single thread for rendering), its limited syntax, it is still quite powerful and more importantly, it let's me define the shapes programmatically, and I really like that.

So Voronoi in OpenSCAD?

Unfortunately not, at least not out of the box. Some people have written a Voronoi Generator. But in order to use that you have to manually sample the seed points and OpenSCAD has no way of giving you the rendered size of your object. There is another promising solution but it has the same shortcomings as the first.

Now what? Another tool?

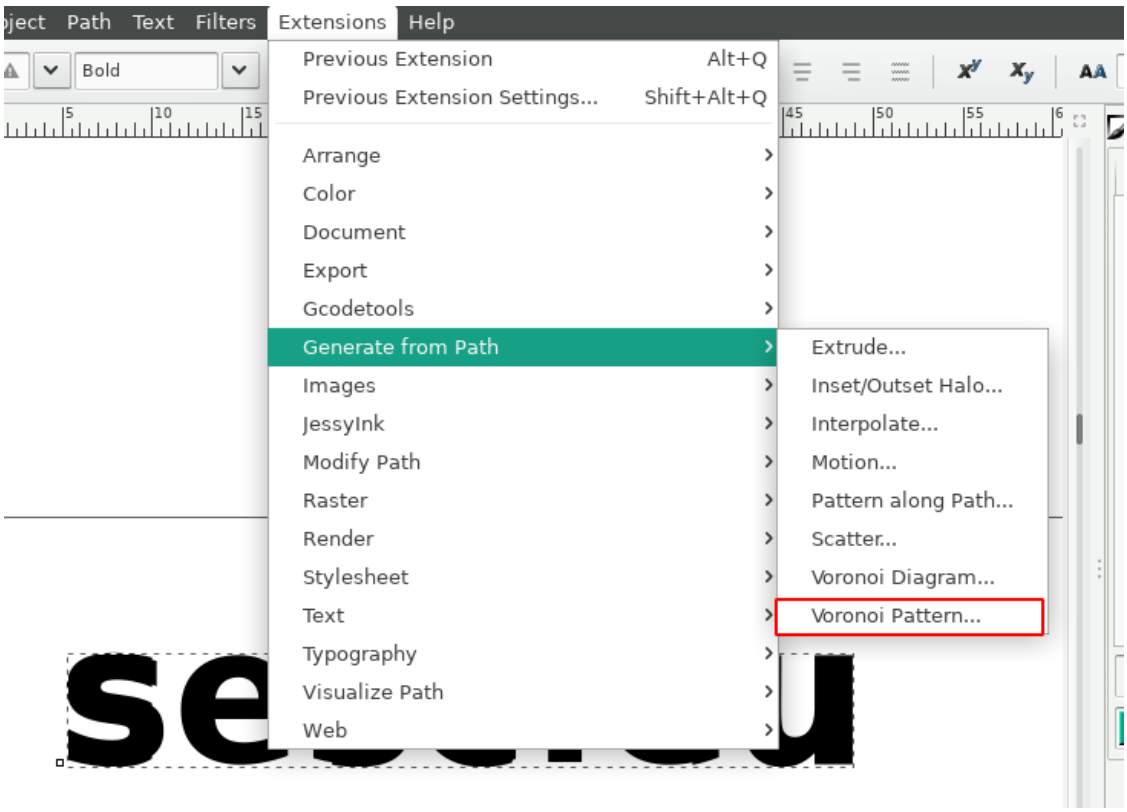
It turns out that I have a history with Inkscape. I use it for everything vector-graphic related, like birthday and invitation cards, diagrams, ... So I thought, why not try to predesign my shapes in Inkscape first and then further modify, e.g. extrude, them in OpenSCAD.

You may think, learning a second tool is not the way to go, and you are right. But for me it was not about learning an additional tool, but rather combining the power of the tools I already knew. If you don't feel confident with Inkscape, I suppose there are ways to get your content from other vector-graphic tools to OpenSCAD as well.

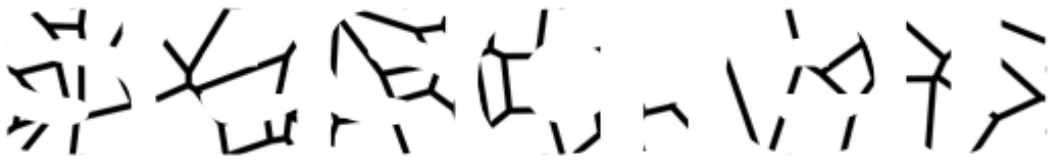
In order to get your design exported to OpenSCAD, I use the library from Gael Lafond, which you can find on thingiverse. Just download and extraxt the files into your Inkscape extension folder. Then, let's go and design our shape.

We start with a simple shape, e.g. a text:

The menu entry for the **Voronoi Pattern** is a little bit hidden. You'll find it here (make sure, your object is selected):

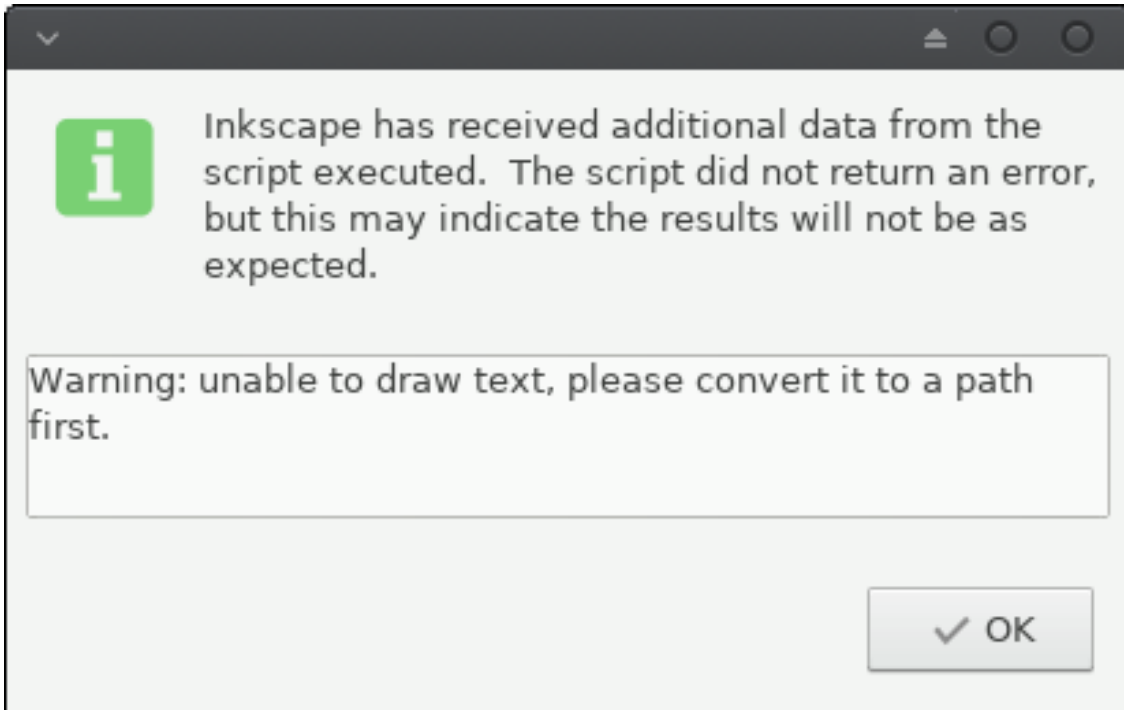


Once you applied the pattern, you should see something like this:



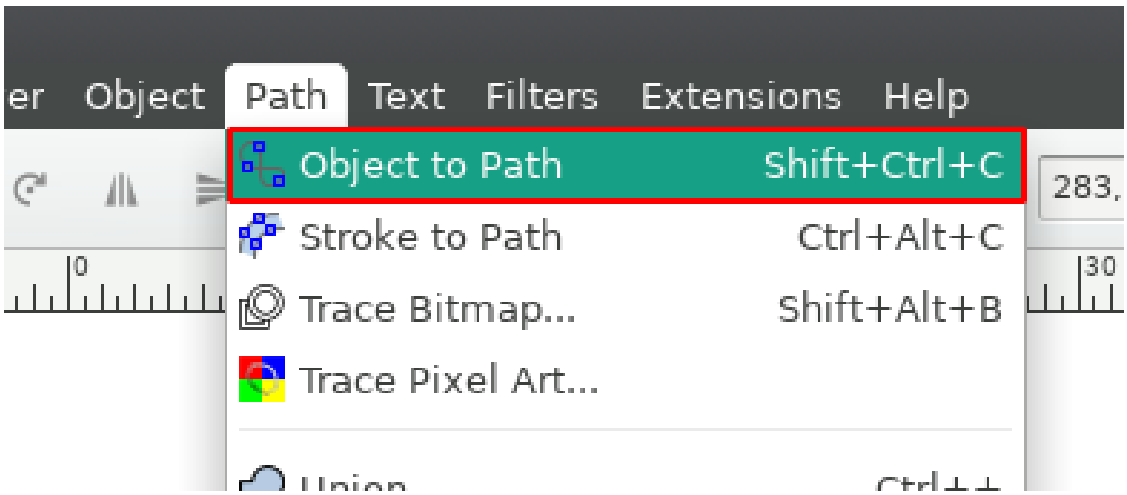
Hmmm, not quite. It turns out, that the pattern just becomes a fill pattern, thus you still have to enable the stroke.

Look's pretty much like expected, right? Unfortunately, you cannot save it to a scad-file yet, because otherwise you'd the the following error:



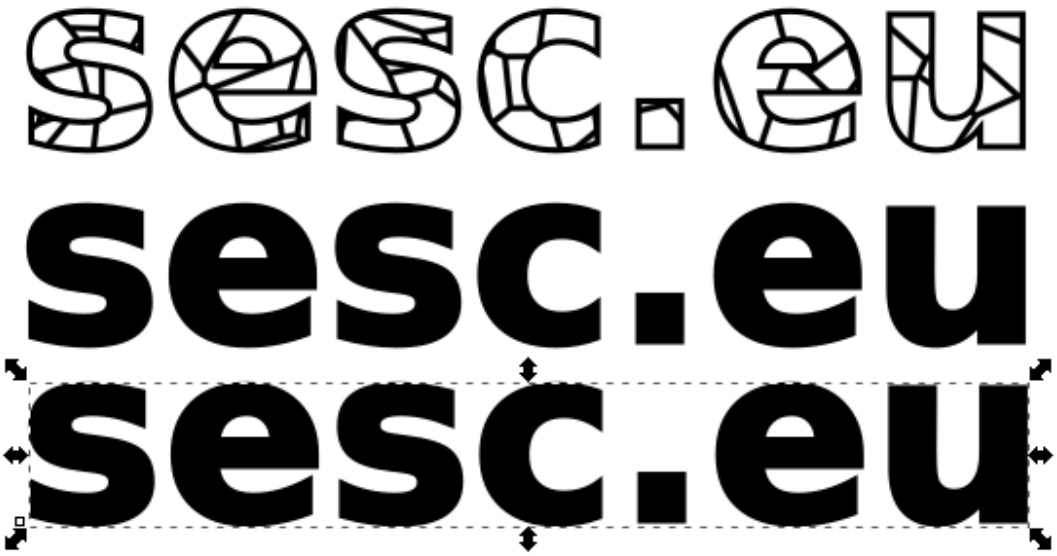
It seems, the extension does not support text. Thus, prior to

saving, you need to convert the text to a path, first.

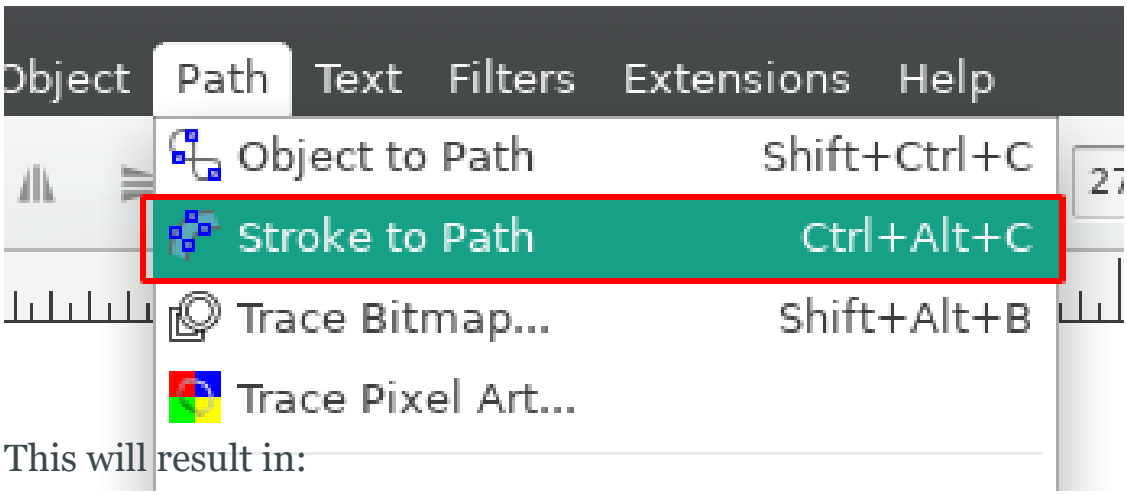


Although it looks finished, remember that the voronoi shape still is just a fill pattern, which OpenSCAD cannot handle. The good thing is, that there is an option to convert the pattern, but we need two solid filled copies of our current shape first., because we want a solid shape that covers both, the fill and the stroke of the object.

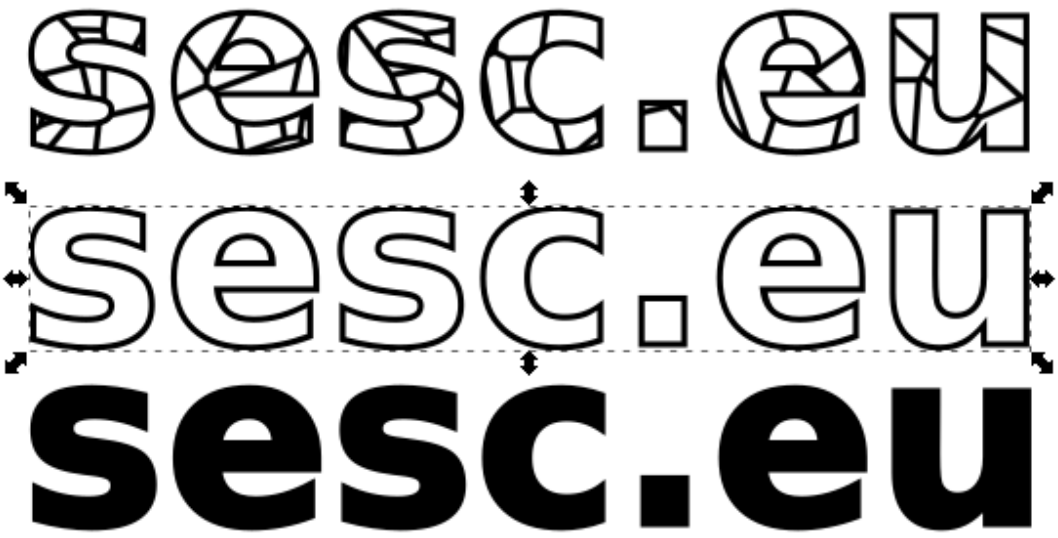
So, create the copies and apply a solid fill:



For the first copy, we convert the stroke to a path:

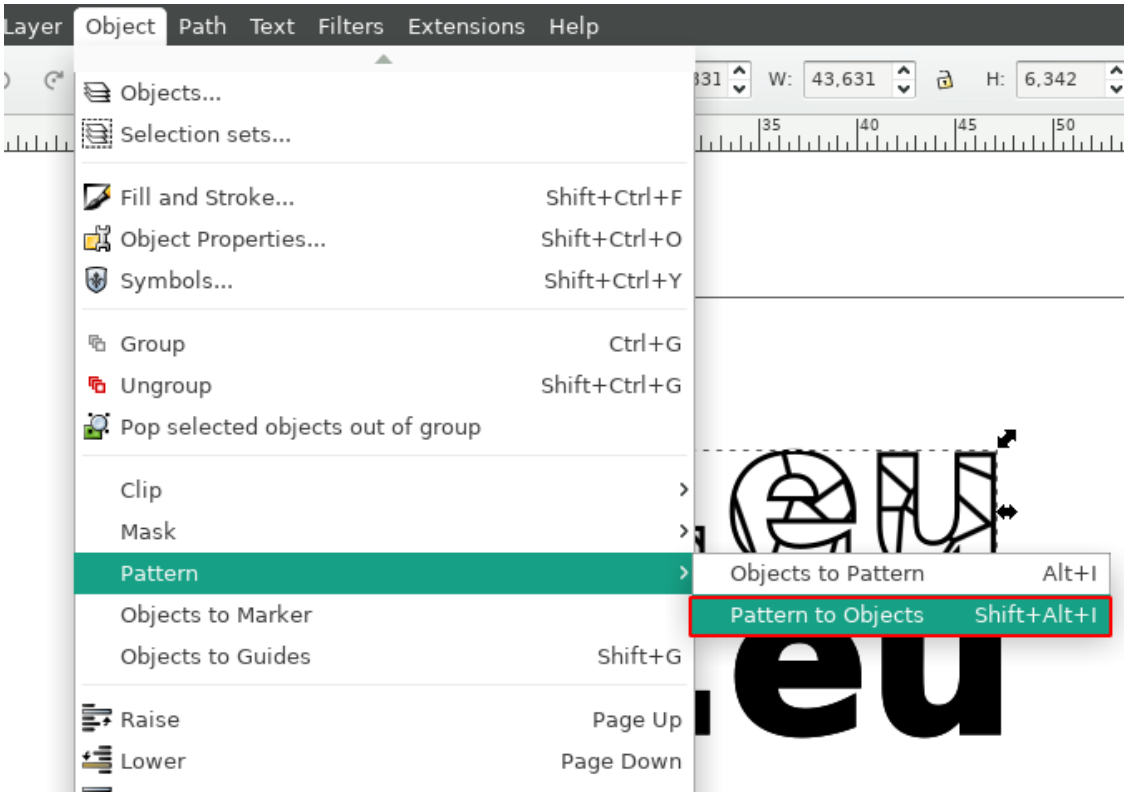


This will result in:



For the second copy, we convert the fill to a path, then ungroup the elements and union them back together:

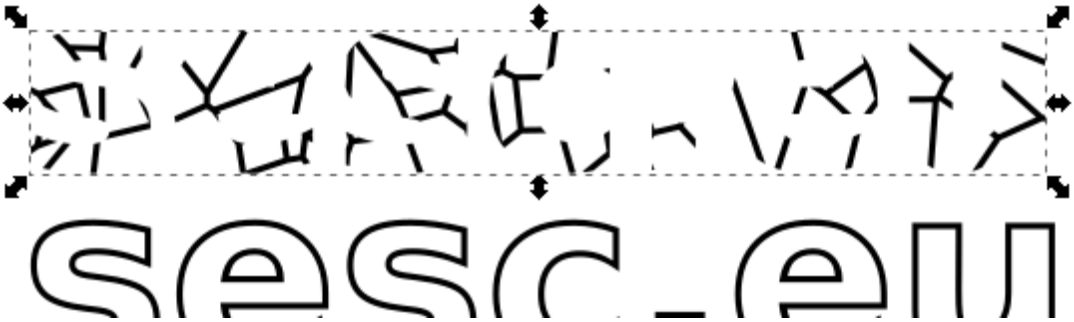
Now it is time to convert the voronoi pattern from a fill pattern to an object.



As you can see, that resulting pattern extends the shape of the original text. You can remove the underlying text with the pattern

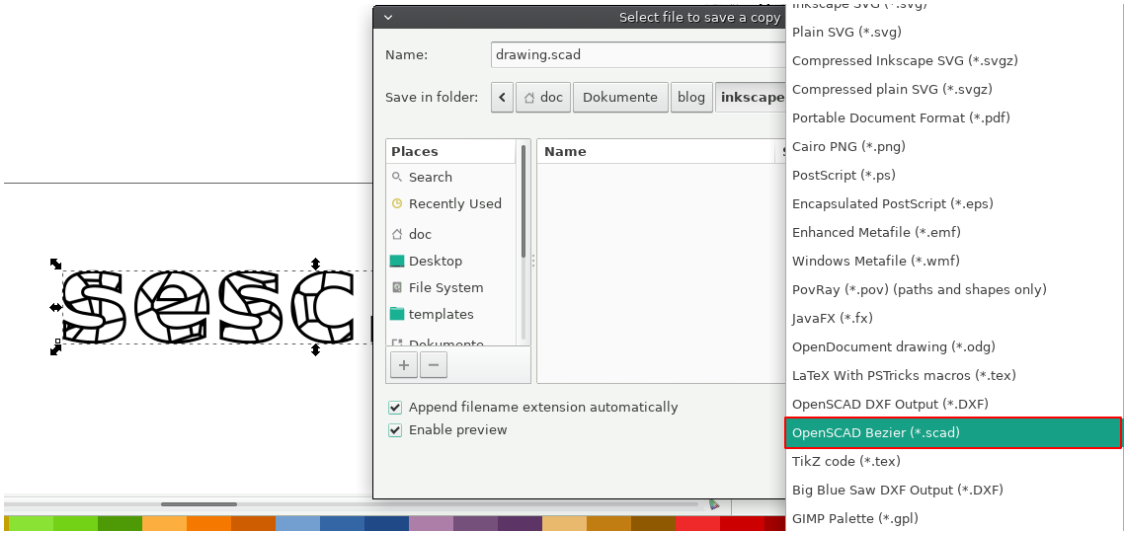
original text. You can remove the underlying text with the pattern so that only the pattern as an object remains. In addition the resulting pattern consists just of a stroke, which we convert to an object.

This is why you created the solid (second) copy. You now align the solid copy and the pattern, make sure both are selected and ungrouped and create an intersection of both.



Finally, you need to select the outer stroke and the intersected pattern, align the two and union them.

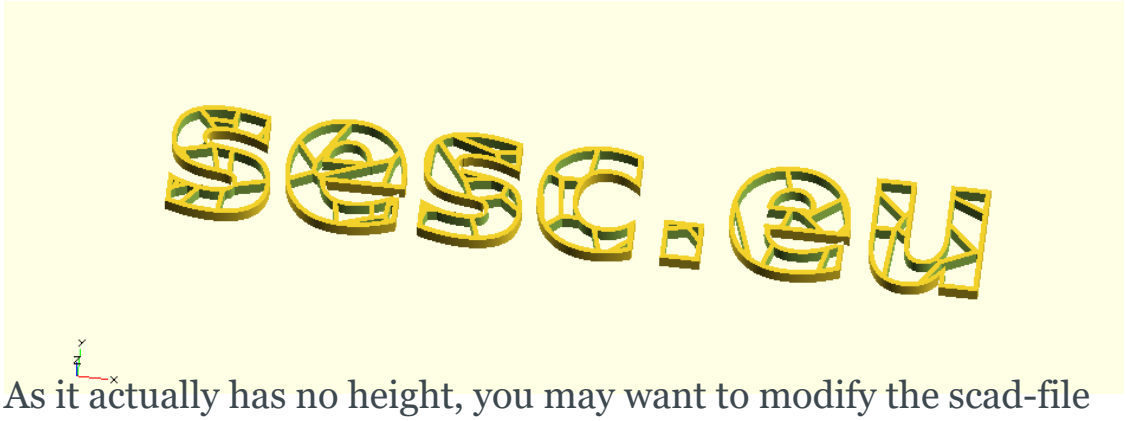
Then, save the final drawing as a scad-file, using the OpenSCAD Bezier extension.



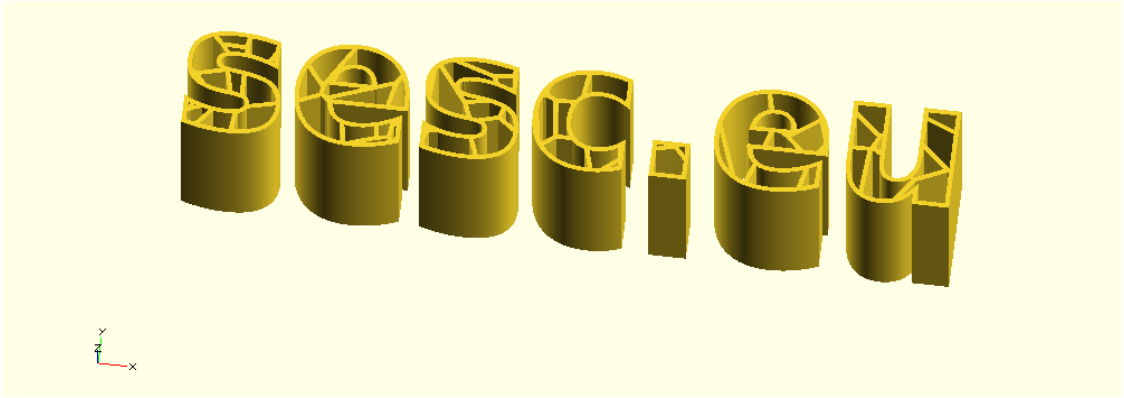
And that's it, at least for inkscape. You should now have a scad-file with the the voronoi pattern.

3D Processing in Inkscape

You can directly open this scad-file in Inkscape. You should immediately see a 3D rendering.



As it actually has no height, you may want to modify the scad-file by adding a `linear_extrude`. Just look for the line with `Layer_1();` and turn it into `linear_extrude(height=10) Layer_1();`:



Conclusion

You now should know, how to turn arbitrary shapes in Inkscape into Voronoi patterns, which you may then load into OpenSCAD for potential further 3D processing.

I have to admit, there are quite some steps involved. At least more than I anticipated, which was part of the reason, I wrote this post.

If you have any improvements, just let me know. If you found this post helpful I would be happy to see your designs.

Sebastian Schneider
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