

Modeling in ShapeJS

Online system 3d printed products mass
customization

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Introduction

Growing popularity and affordability of 3d printing and other additive manufacturing technologies significantly reduces production cost of individual unique products. This makes mass production of individual customized products on industrial scale a reality. Very significant part of product development is the design and preparation of blueprint used for product manufacturing. When each product is unique, the automatization of product design is absolutely essential part of the whole process.

We are developing online system ShapeJS. It is used at Shapeways for mass customization of thousands of products without designer intervention. Main current use includes adding personal text or images to products developed by designers and rendering the product for sale in multitude of possible materials and display it to users in interactive 3D. ShapeJS allows building fully parameterizable product with as many or as little parameters as a designer desires. We offer ShapeJS free of charge to makers who design the products and can order it or offer customizable product for sale to other users.

ShapeJS Feature

Runs on any client platform which support web browser (including mobile devices)

Simple and standard scripting language (Javascript)

Programmatically generated maker and consumer UI

Strong intellectual properties protection - 3D data never leave the server

Robust scalable server side rendering. It renders all consumer facing interactive 3D view hosted by Shapeways.

Free to use for makers and consumers

Based on open source tools and standards (abfab3d, X3D, 3DMF).

Online IDE hosted at <https://shapejs.shapeways.com>

ShapeJS server is hosted at <https://shapejs.com/>

ShapeJS Architecture

Client side HTML user interface, server side java + OpenCL

Scene tree is created in javascript by user. Shapes are represented as signed distance function in the volume.

3D scene tree is converted into pseudo code which is executed by precompiled OpenCL kernel.

OpenCL rendering generates 3D view of scene and 3D model data suitable for 3D printing.

Up to 4 channels of data per point (distance + other 3 channels) allow representation of colored shape or shapes composed of multiple materials.

Simplest ShapeJS program

```
var uiParams = [  
  { name: "period",    type: "double", defaultVal: 18 },  
  { name: "thickness", type: "double", defaultVal: 2  }  
];  
  
function main(args) {  
  var radius = 25 * MM;  
  var sphere = new Sphere(radius);  
  var gyroid = new VolumePatterns.Gyroid(args.period*MM, args.thickness*MM);  
  var intersect = new Intersection(sphere, gyroid);  
  intersect.setBlend(2 * MM);  
  var s = 26 * MM;  
  return new Scene(intersect, new Bounds(-s, s, -s, s, -s, s));  
}
```

The program inside of IDE at <https://shapejs.shapeways.com>

Scene ▾

Model ▾

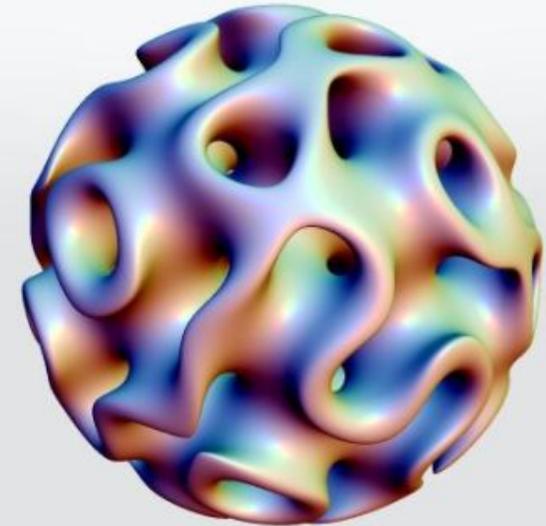
Render ▾

Help ▾

Material ▾



```
1 var uiParams = [  
2   { name: "period", type: "double", defaultVal: 18 },  
3   { name: "thickness", type: "double", defaultVal: 2 }  
4 ];  
5  
6 function main(args) {  
7   var radius = 25 * MM;  
8   var sphere = new Sphere(radius);  
9   var gyroid = new VolumePatterns.Gyroid(args.period*MM, args.thickness*MM);  
10  var intersect = new Intersection(sphere,gyroid);  
11  intersect.setBlend(2 * MM);  
12  var s = 26 * MM;  
13  return new Scene(intersect, new Bounds(-s,s,-s,s,-s,s));  
14 }  
15
```



GENERATE

SAVE MODEL

RESET PARAMS

CHECK MODEL



Model Title

UPLOAD

Main

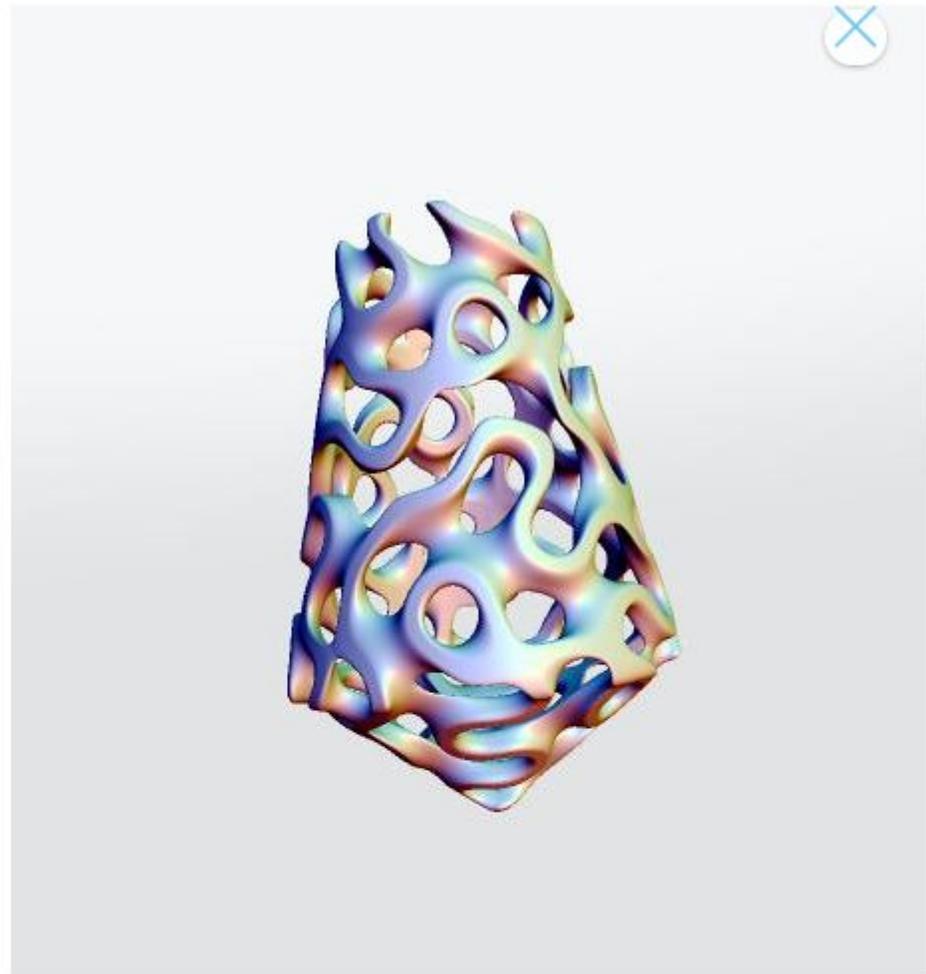
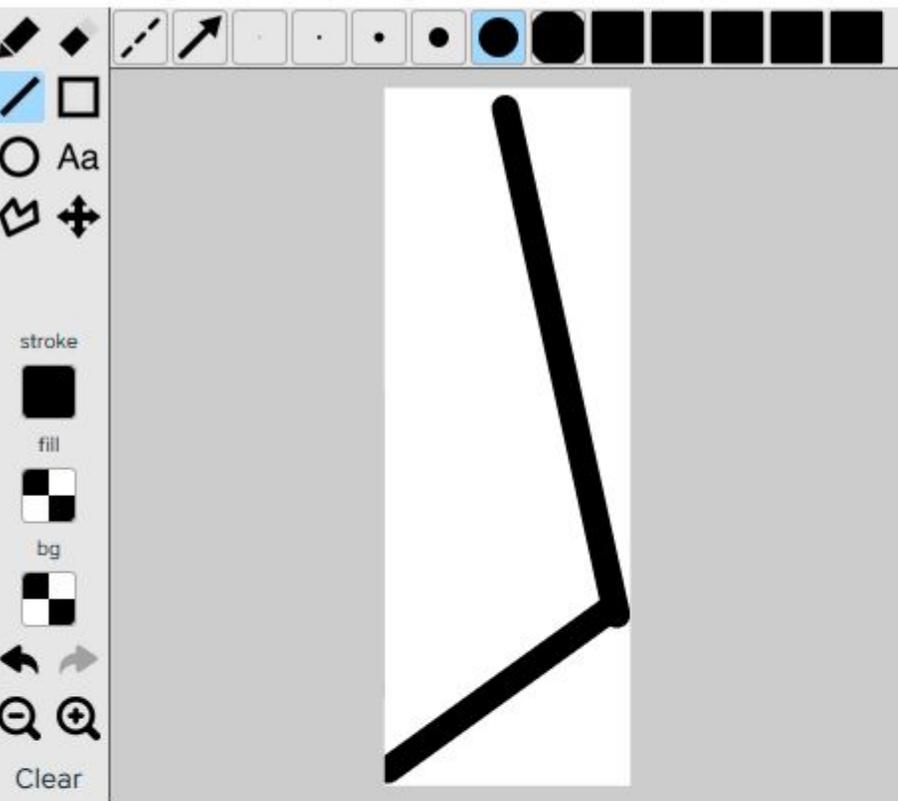
Printability

period 18

thickness 2

Eval time: 1

Example: Volume Patterned Vase



Main

Profile <https://dl.dropboxusercontent.com> File Sketch

Pattern Type Gyroid

Period 30

Thickness 3.25

Blend 2

X Translation 0

Y Translation 0

Top Rim 0.05

PRODUCT DESCRIPTION

A toothbrush holder created from a profile image that is revolved around a circle and then intersected with a volume pattern. Can also be used to make other items such as a vase, candlestick holder, or a wineglass.

Volume Patterned Vase photo and simplified code



```
function main(args) {  
  var shell=new Image3D(profile,  
    width,height,depth);  
  shell.addTransform(new RingWrap(radius));  
  var volume=new VolumePatterns.Gyroid(prd,thick);  
  var shape = new Intersection(shell,volume);  
  var bounds = new Bounds(-w,w,-h,h,-w,w)  
  return new Scene(shape, bounds);  
}
```

Example: Custom Coin designer.



Main

Top Image

Middle Image

Bottom Image



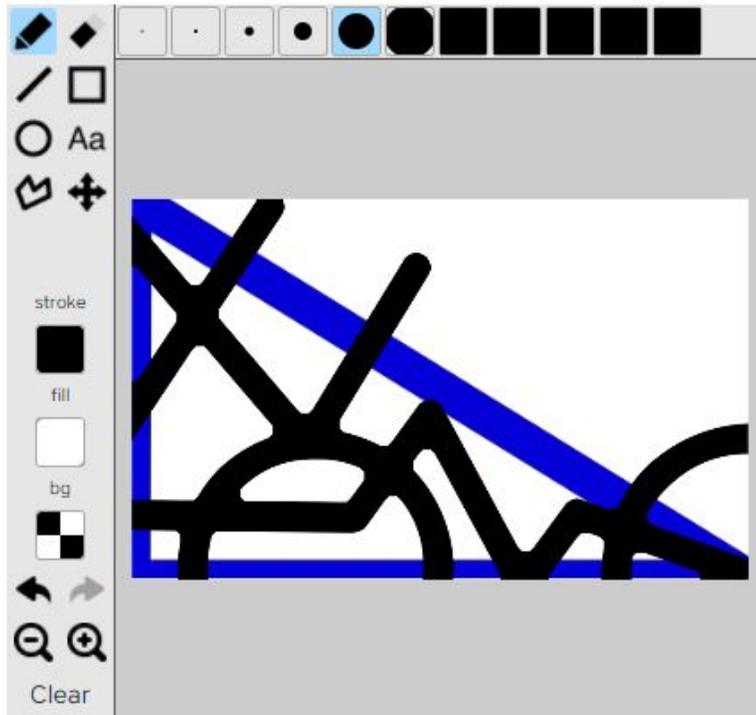
Example: coaster maker



PRODUCT DESCRIPTION

Create a coaster from an image

Example: Ornament creator



Main

image	<input type="text" value="https://dl.dropboxuserconter"/>	<input type="button" value="File"/>	<input type="button" value="Sketch"/>
xcoff	<input type="range" value="1"/>	<input type="text" value="1"/>	
ycoff	<input type="range" value="1"/>	<input type="text" value="1"/>	
zrot	<input type="range" value="0"/>	<input type="text" value="0"/>	
text	<input type="text" value="Shapeways"/>		



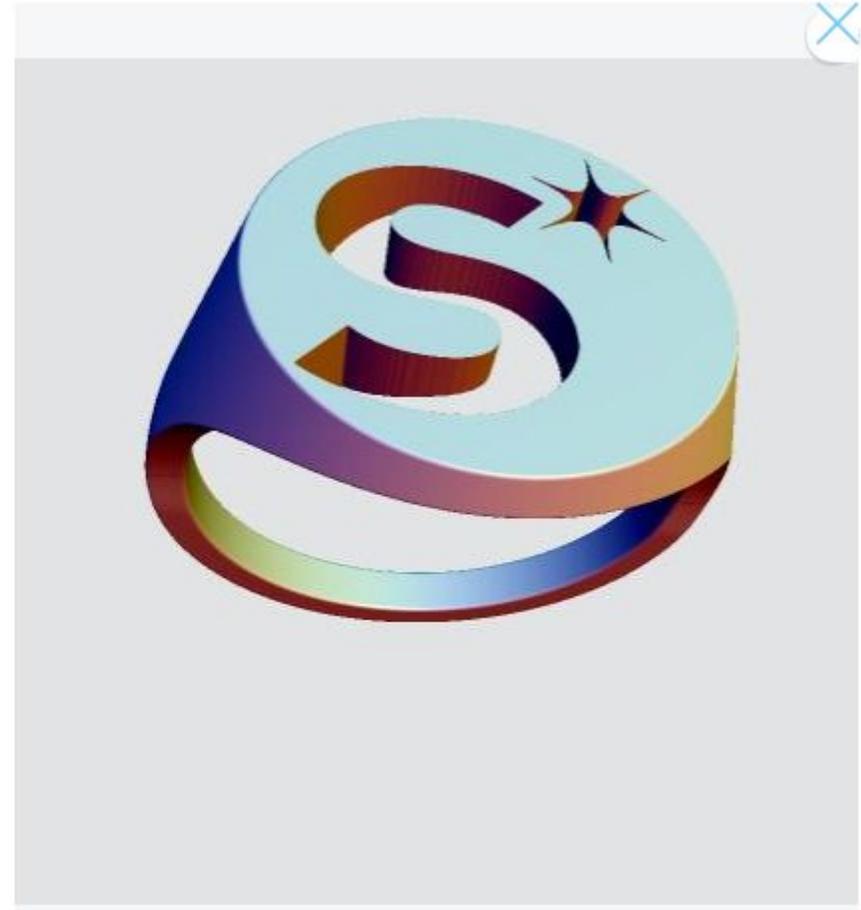
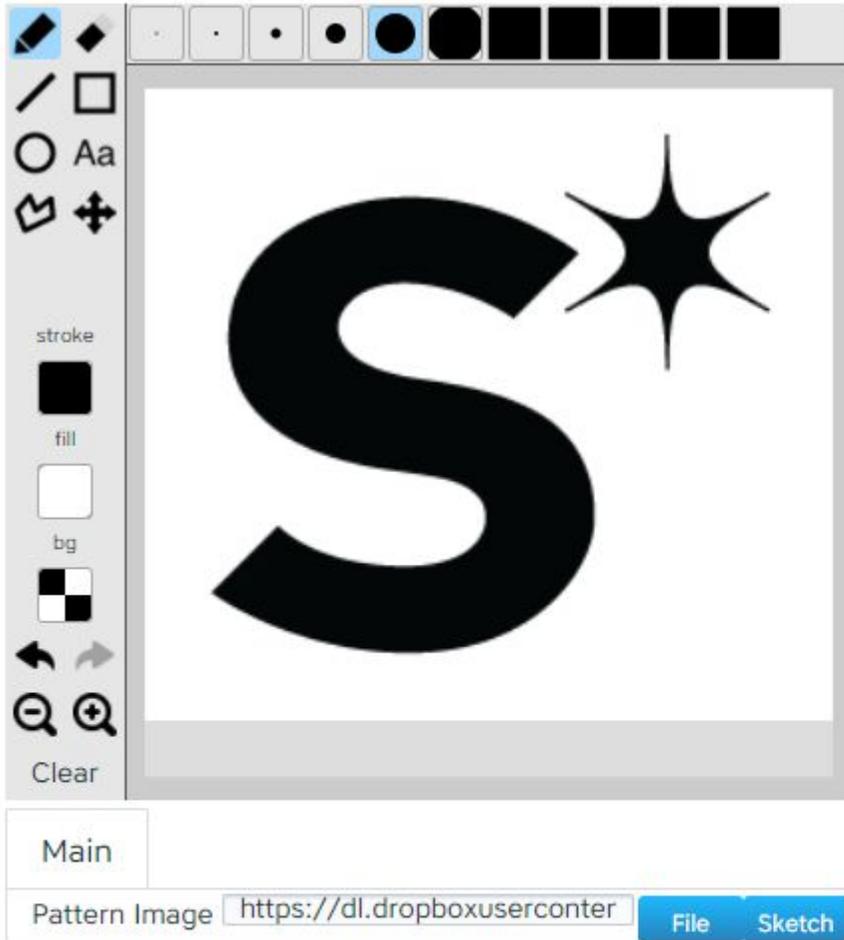
PRODUCT DESCRIPTION

Create a custom holiday ornament with a single image. This polyhedral kaleidoscope takes a source image and maps it onto a sphere. The reflections turn simple imagery into complex patterns.

Printed ornaments



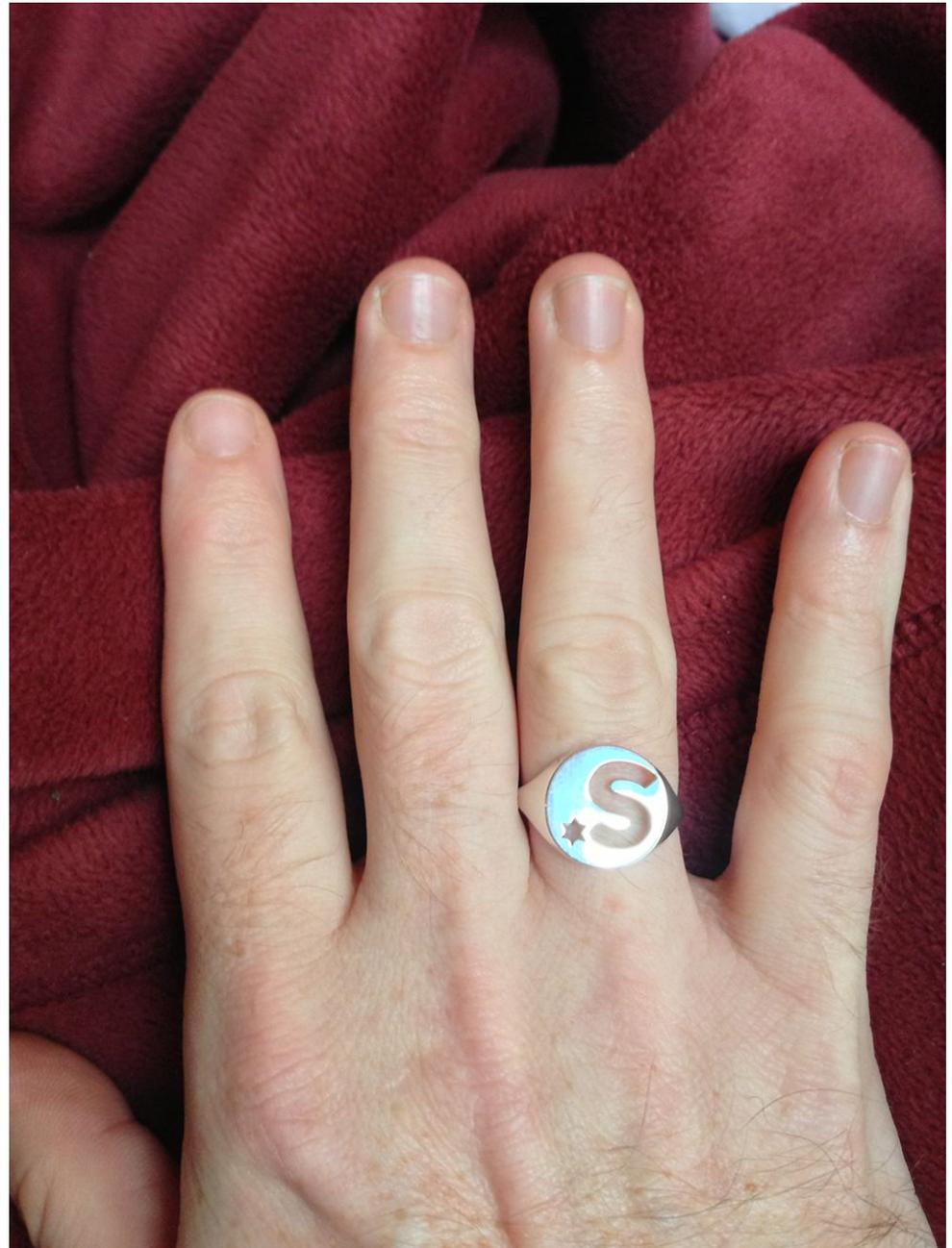
Example: Signet Ring



PRODUCT DESCRIPTION

A signet ring where the user can provide the image for the ring. The script is fully parameterized for creating different ring sizes and widths.

Signet ring samples



More samples



More samples

