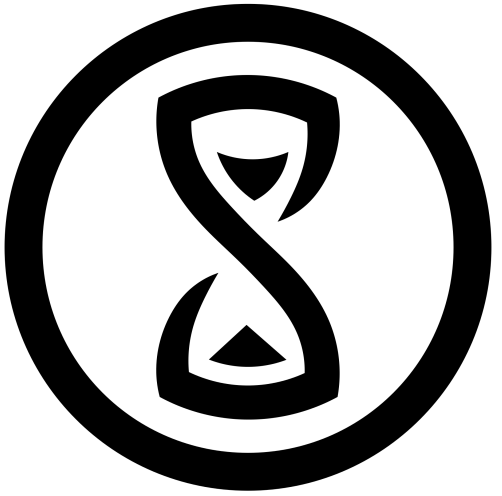
Selbst 3D drucken

rohieb	@daniel_bohrer
neo	@Karbrueggen
larsan	@larsan



BarCamp Braunschweig
24. November 2011

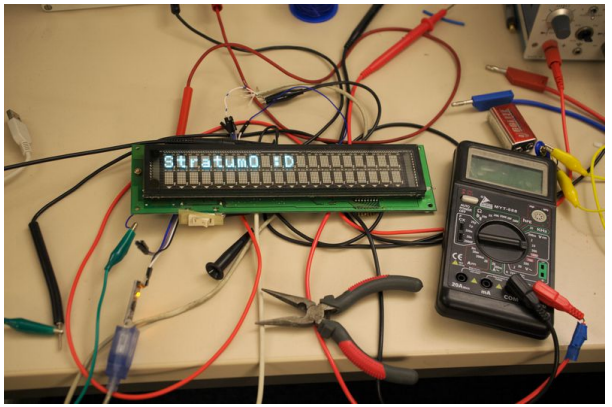
...selbst 3D drucken.

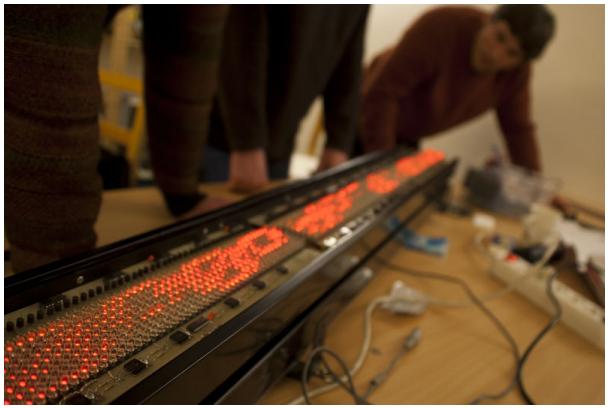
Quelle: http://www.3ders.org/articles/20111127-reprap-build-party-in-cologne-germany-in-december.html

stratum0.org

Quelle: https://stratum0.org/wiki/Datei:MV-2012-01-08.jpg, CC-BY-SA jh

stratum0.org





Quelle: https://stratum0.org, verschiedene CC Lizenzen.

Über was reden wir eigentlich?!

Stratum 0

- Was kann gedruckt werden?

Über was reden wir eigentlich?!

Stratum 0

- Was kann gedruckt werden?
- Workflow

Über was reden wir eigentlich?!

Stratum 0

- Was kann gedruckt werden?
- Workflow
- Vom Design zum Druck

Über was reden wir eigentlich?!

Stratum 0

- Was kann gedruckt werden?
- Workflow
- Vom Design zum Druck
- Was für Materialien gibt es zum Drucken?

Über was reden wir eigentlich?!

Stratum 0

- Was kann gedruckt werden?
- Workflow
- Vom Design zum Druck
- Was für Materialien gibt es zum Drucken?
- Was für Drucktechniken gibt es?

Über was reden wir eigentlich?!

Stratum 0

- Was kann gedruckt werden?
- Workflow
- Vom Design zum Druck
- Was für Materialien gibt es zum Drucken?
- Was für Drucktechniken gibt es?
- Community

Über was reden wir eigentlich?!

Stratum 0

- Was kann gedruckt werden?
- Workflow
- Vom Design zum Druck
- Was für Materialien gibt es zum Drucken?
- Was für Drucktechniken gibt es?
- Community
- Anlaufstellen im Netz

Über was reden wir eigentlich?!

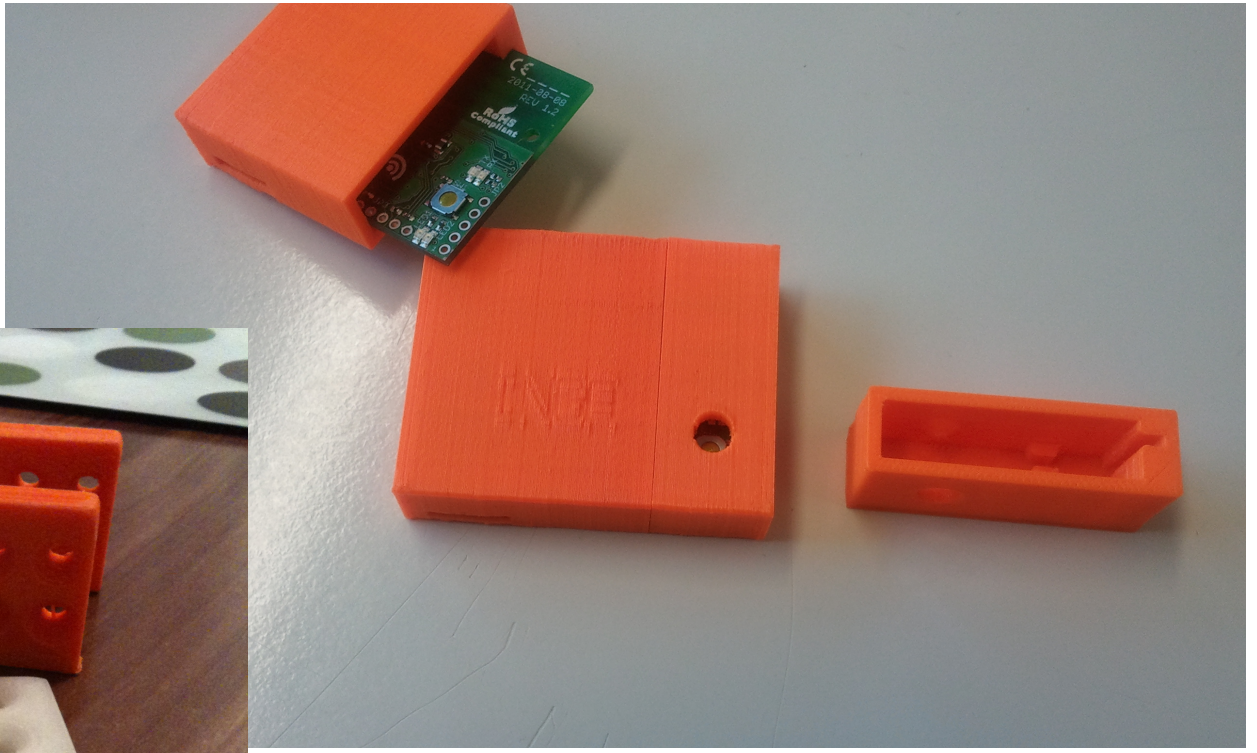
Stratum 0

- Was kann gedruckt werden?
- Workflow
- Vom Design zum Druck
- Was für Materialien gibt es zum Drucken?
- Was für Drucktechniken gibt es?
- Community
- Anlaufstellen im Netz
- Fragen?

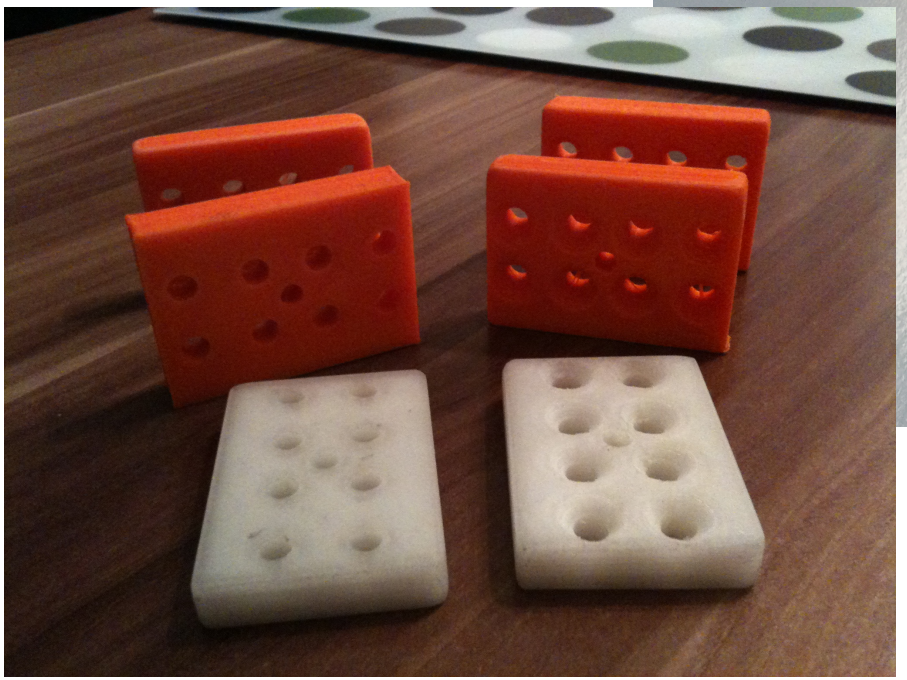
Was kann gedruckt werden?

Stratum 0

- Gehäuse
- Bauteile
- Ersatzteile



CC-BY-SA Daniel Willmann, Source: http://www.thingiverse.com/image:132242



Wolf-Bastian Poettner, Source: http://yfrog.com/nxtn7cmj

Was kann gedruckt werden?

Stratum 0

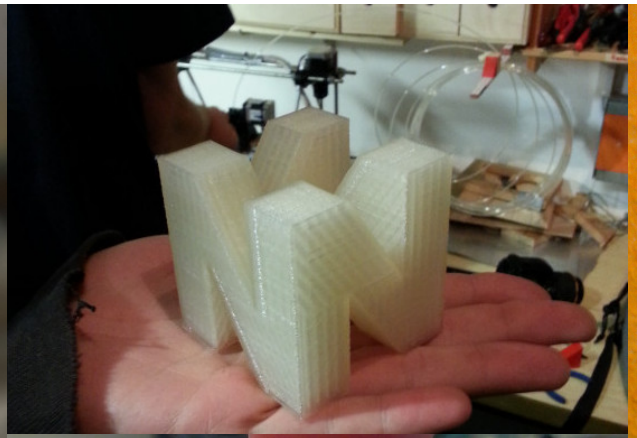
- Mate-Tags

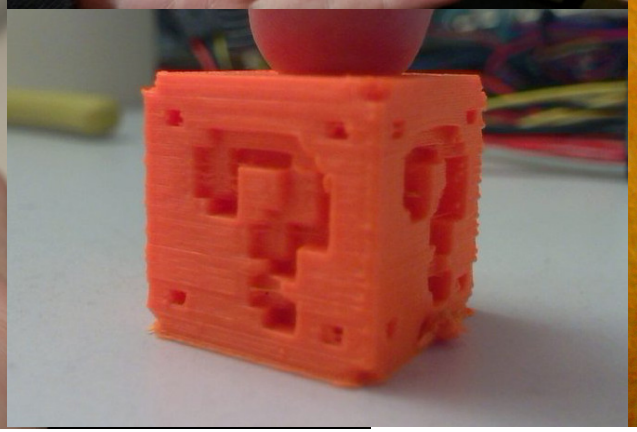
CC-BY-SA Daniel Willmann, Source: http://www.thingiverse.com/image:139061, http://www.thingiverse.com/image:117110

Was kann gedruckt werden?

Stratum 0

- (Spiel-)Figuren und anderer Nonsens

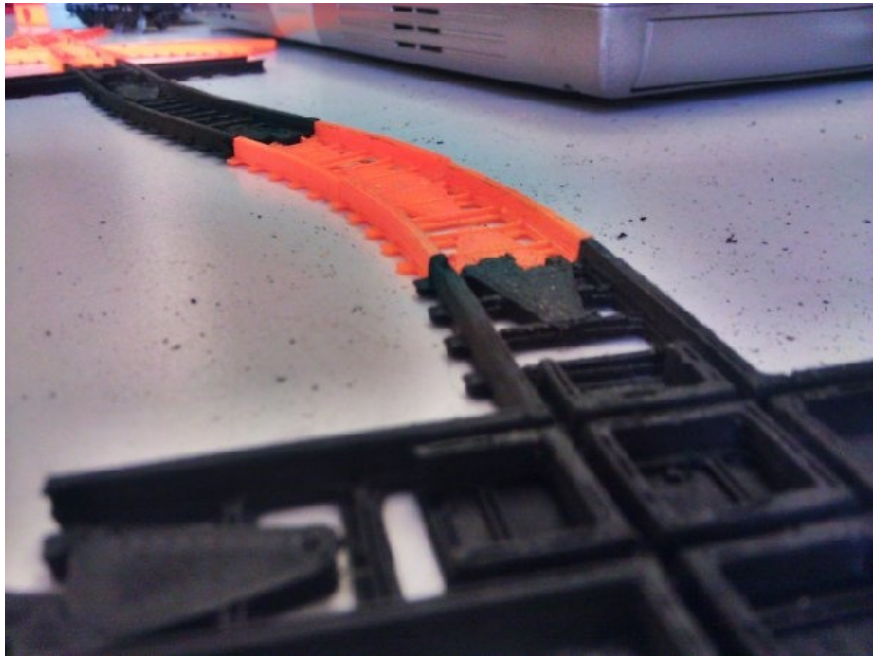


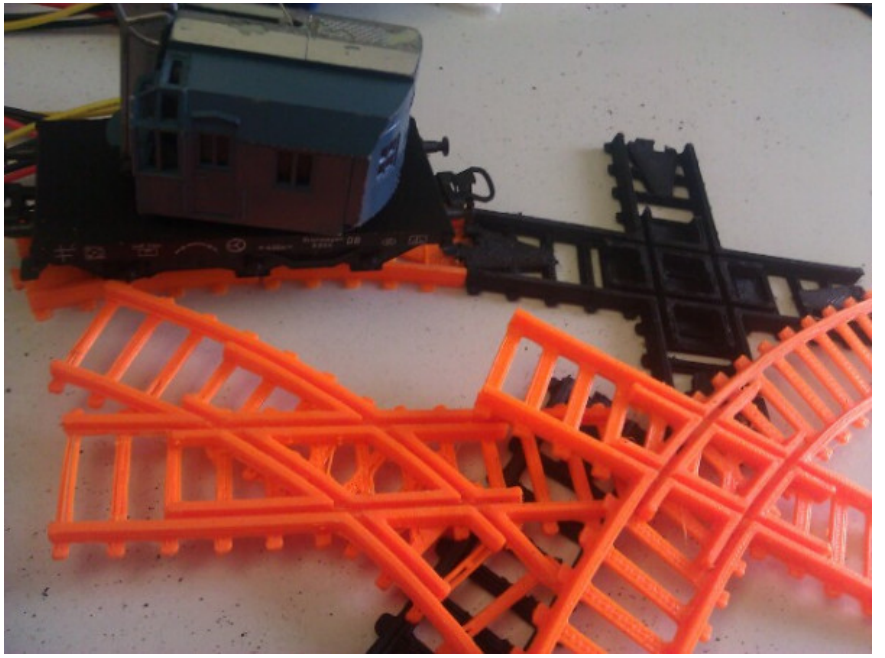


Was kann gedruckt werden?

Stratum 0

- Modellbahn-Schienen!
- https://stratum0.org/wiki/RepRails

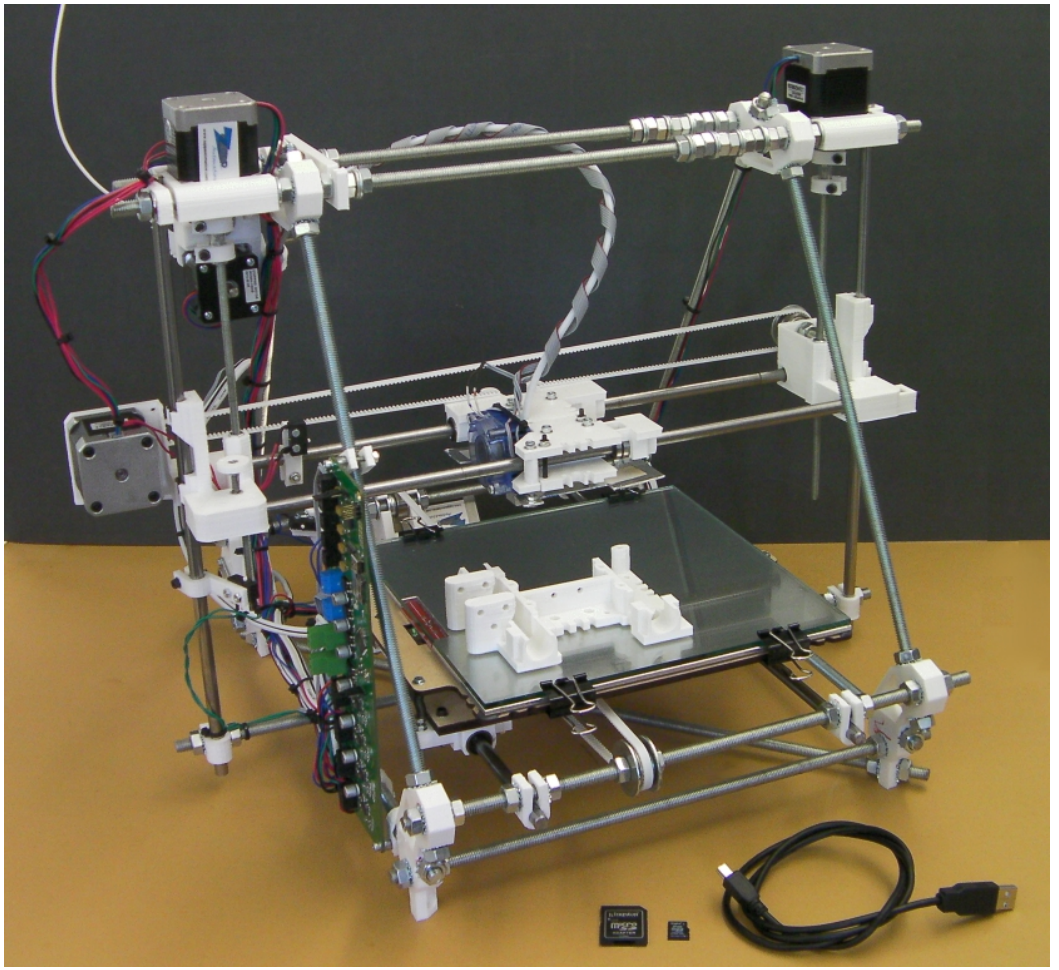




Was kann gedruckt werden?

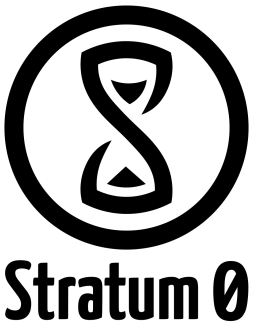
Stratum 0

- 3D-Drucker
  - (okay, bisher nur teilweise)



Source: http://reprap.org/wiki/File:Reprappro-Mendel.jpg

Workflow



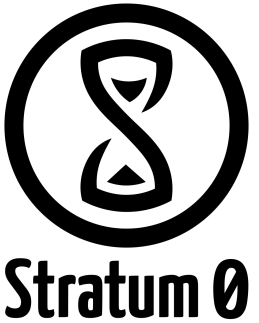
- 3D-Modell erstellen

Workflow: 3D-Modell

Stratum 0

- Software?
  - Die meisten 3D-Programme sind geeignet
  - einfaches Dateiformat: STL
  - Solid Edge, SolidWorks, Cinema 4D, ...?
  - Blender

Workflow: 3D-Modell




```
include <Write.scad>
$fn=100;
module name_tag () {
  difference() {
    union () {
      cylinder(r1=19.5, r2=15, h=26);
      rotate([0, 0, -45]) writecylinder(name, [0,0,0], 18, 14, h=8, t=3.5, font="orbitron.dxf");
      rotate([0,0,-45]) translate([0,-12,13]) rotate([90,0,0]) linear_extrude(height=6)
      scale(0.25) translate([-25,0,0]) import("stratum0-lowres.dxf");
      }
    cylinder(r1=17.5, r2=13, h=26.1);
    cylinder(r=17.5, h=1, center=true);
    difference () {
      cylinder(r1=24.5, r2=20, h=26);
      cylinder(r1=20, r2=15.5, h=26.1);
      cylinder(r=20, h=1, center=true);
    }
    translate([0,0,-1]) cube([50,50,50]);
  }
}

//translate([-22,  22, 0]) rotate(-90) name_tag(name="Yournamehere");
//translate([ 22,  22, 0]) rotate(180) name_tag(name="Yournamehere");
//translate([-22,  -22, 0]) name_tag(name="Yournamehere");
translate([ 22,  -22, 0]) rotate(90) name_tag(name="barcamp bs");
```

Workflow: 3D-Modell

Stratum 0

```
include <Write.scad>
$fn=100;
module name_tag () { difference() { union () {
cylinder(r1=19.5, r2=15, h=26);
rotate([0, 0, -45]) writecylinder(name, [0,0,0], 18,
14, h=8, t=3.5, font="orbitron.dxf");
rotate([0,0,-45]) translate([0,-12,13])
rotate([90,0,0]) linear_extrude(height=6) scale(0.25)
translate([-25,0,0]) import("stratum0-lowres.dxf"); }
cylinder(r1=17.5, r2=13, h=26.1);
cylinder(r=17.5, h=1, center=true);
difference () {
cylinder(r1=24.5, r2=20, h=26);
cylinder(r1=20, r2=15.5, h=26.1);
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translate([0,0,-1]) cube([50,50,50]); } }


//translate([-22,  22, 0]) rotate(-90)
name_tag(name="Yournamehere");
//translate([ 22,  22, 0]) rotate(180)
name_tag(name="Yournamehere");
//translate([-22,  -22, 0])
name_tag(name="Yournamehere");
translate([ 22,  -22, 0]) rotate(90)
name_tag(name="barcampmatetag");
```
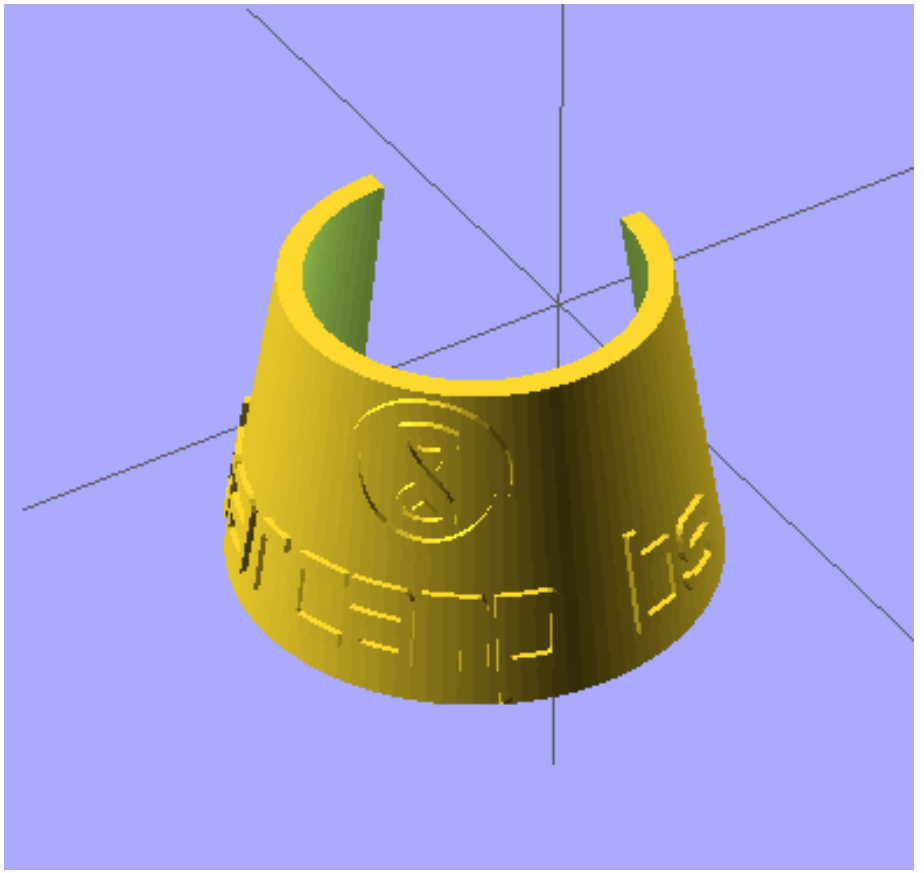
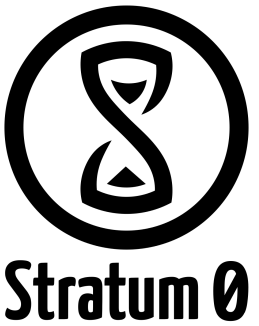



Workflow: 3D-Modell

Stratum 0

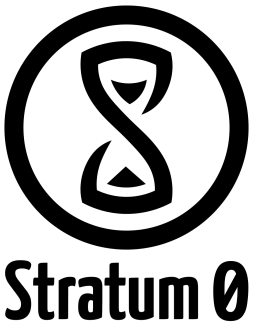
- Primitive:
  - cylinder
  - cube
  - sphere
  - …
- Operationen:
  - translate
  - rotate
  - union
  - difference
  - …

Workflow



- 3D-Modell erstellen
  - STL

Workflow

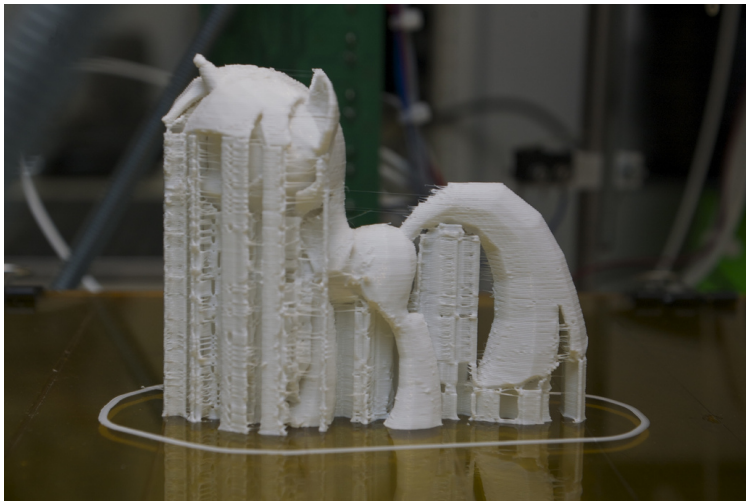


- 3D-Modell erstellen
  - STL
- Slicen

Workflow: Slicen

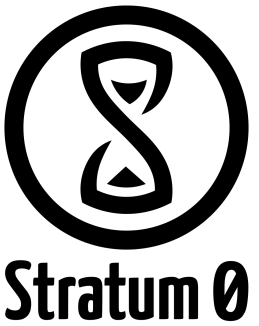
Stratum 0

- STL → GCode
- Software: Slic3r, skeinforge, …
- Kennt die Druckerparameter:
  - Druckbares Volumen, Filament, Düse, …
- Setzt die Werte für:
  - Schichtdicke, Geschwindigkeit, Temperatur, …
- Berechnet:
  - Support-Material
  - Füllmuster



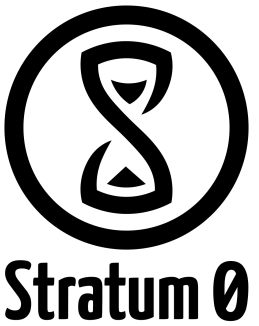
CC-BY-SA DooMMasteR: https://secure.flickr.com/photos/doommeer/8143518431

Workflow



- 3D-Modell erstellen
  - STL
- Slicen
  - GCode

Workflow

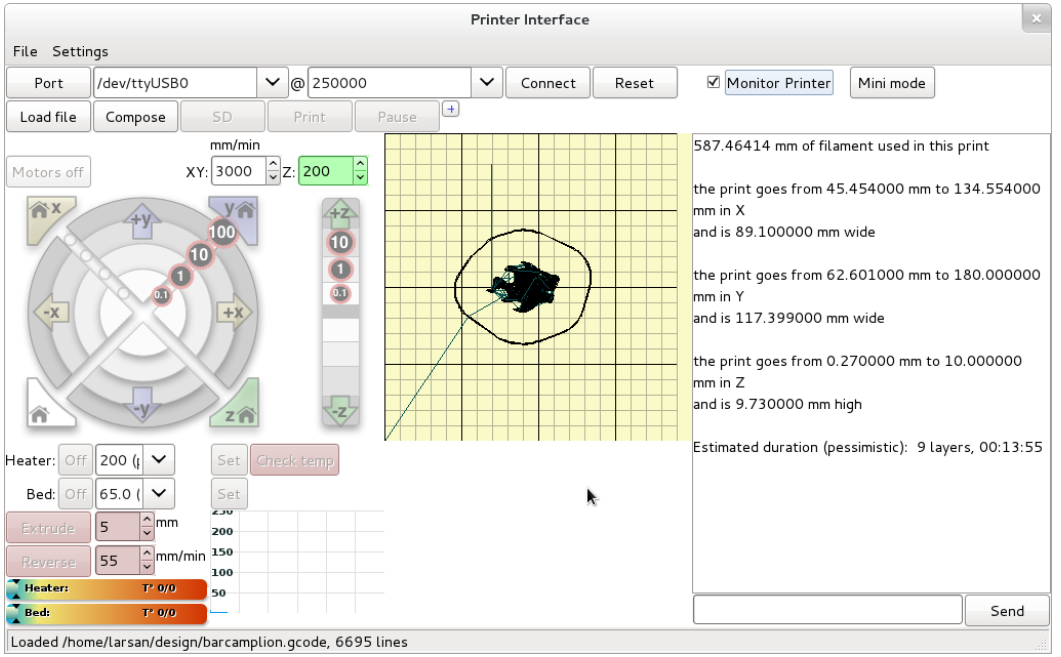


- 3D-Modell erstellen
  - STL
- Slicen
  - GCode
- Drucken

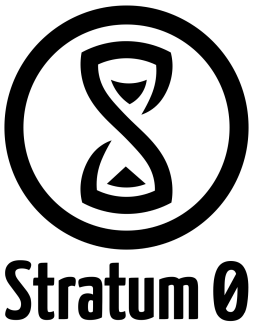
Workflow: Drucken

Stratum 0

- Pronterface
  - Verbindung zum Drucker
  - gibt GCode weiter
  - manuelle Kontrolle der Motoren
  - Eingriff in den Druck



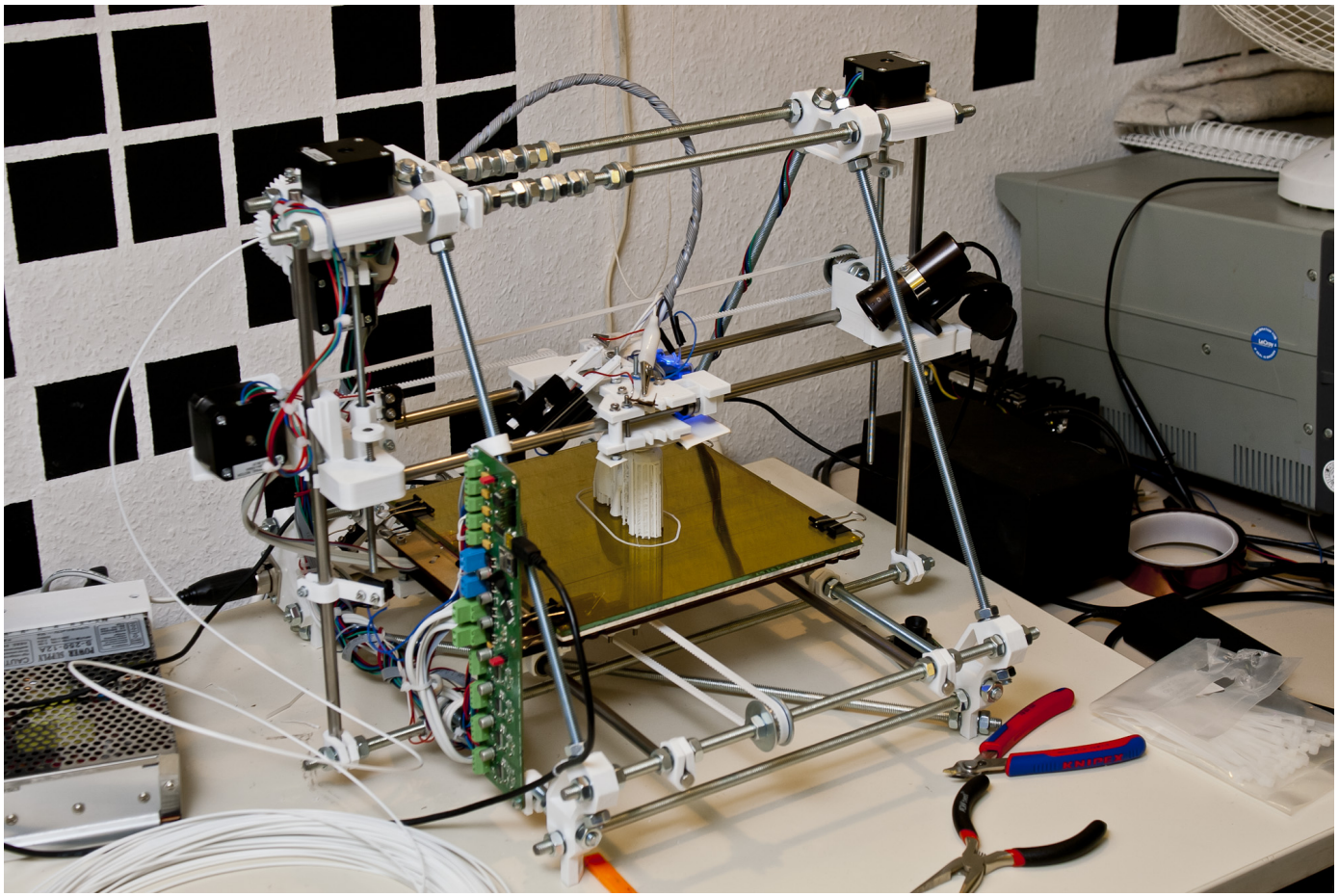
Workflow



- 3D-Modell erstellen
  - .stl
- Slicen
  - .gcode
- Drucken
  - .atom

Drucken

Stratum 0



Drucken (live und in Farbe)

Stratum 0

- Toolchain:
  - Gimp: Grafik bearbeiten/zuschneiden
  - Inkscape: Grafik vektorisieren
  - OpenSCAD: 2D-Grafik linear extrudieren
  - Slic3r: Modell in Pfade des Druckers umwandeln
  - Pronterface: drucken

Drucken: 3D-Modell

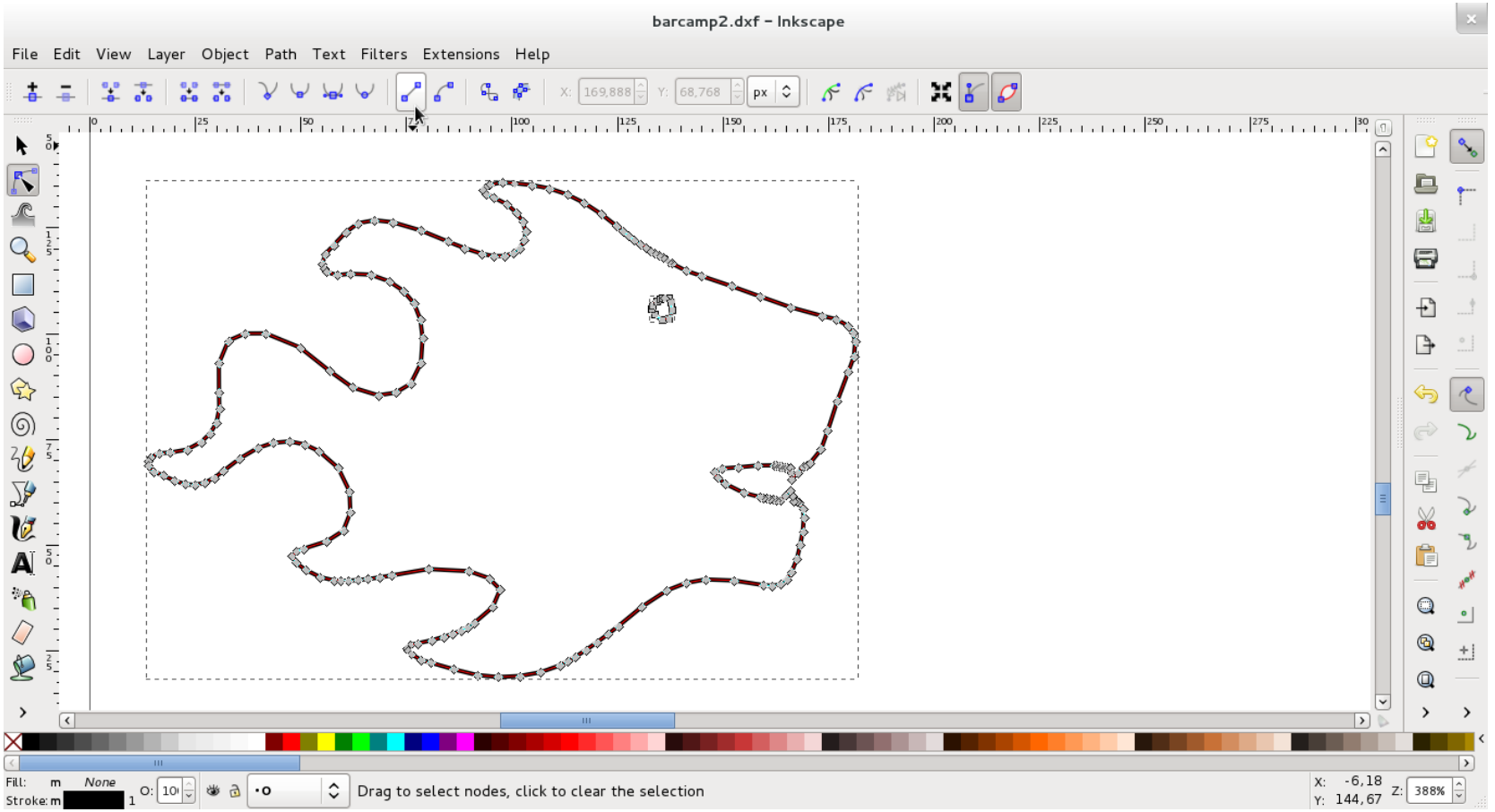
Stratum 0

- Gimp

Drucken: 3D-Modell

Stratum 0

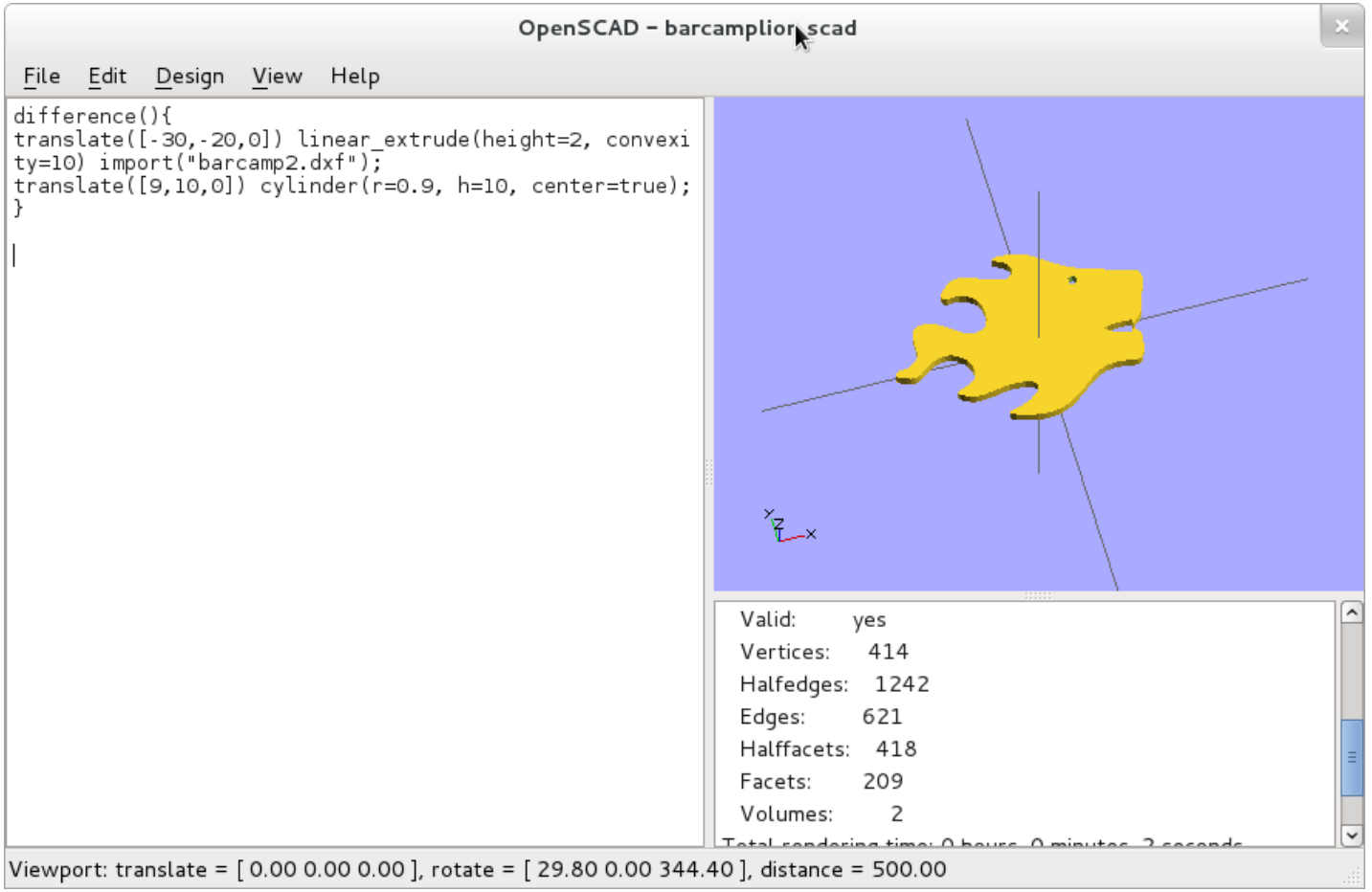
- Inkscape



Drucken: 3D-Modell

Stratum 0

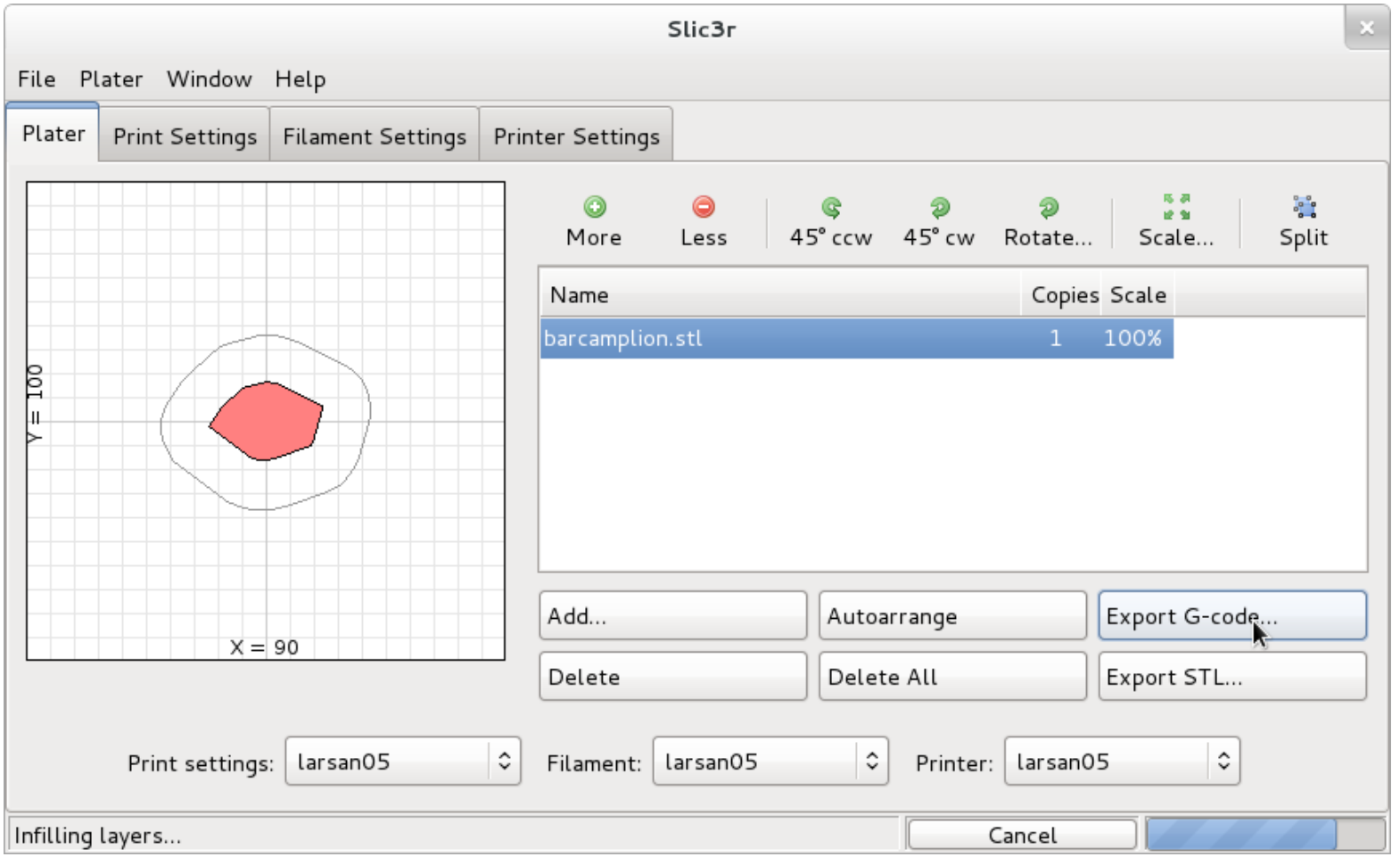
- OpenSCAD



Drucken: Slicen

Stratum 0

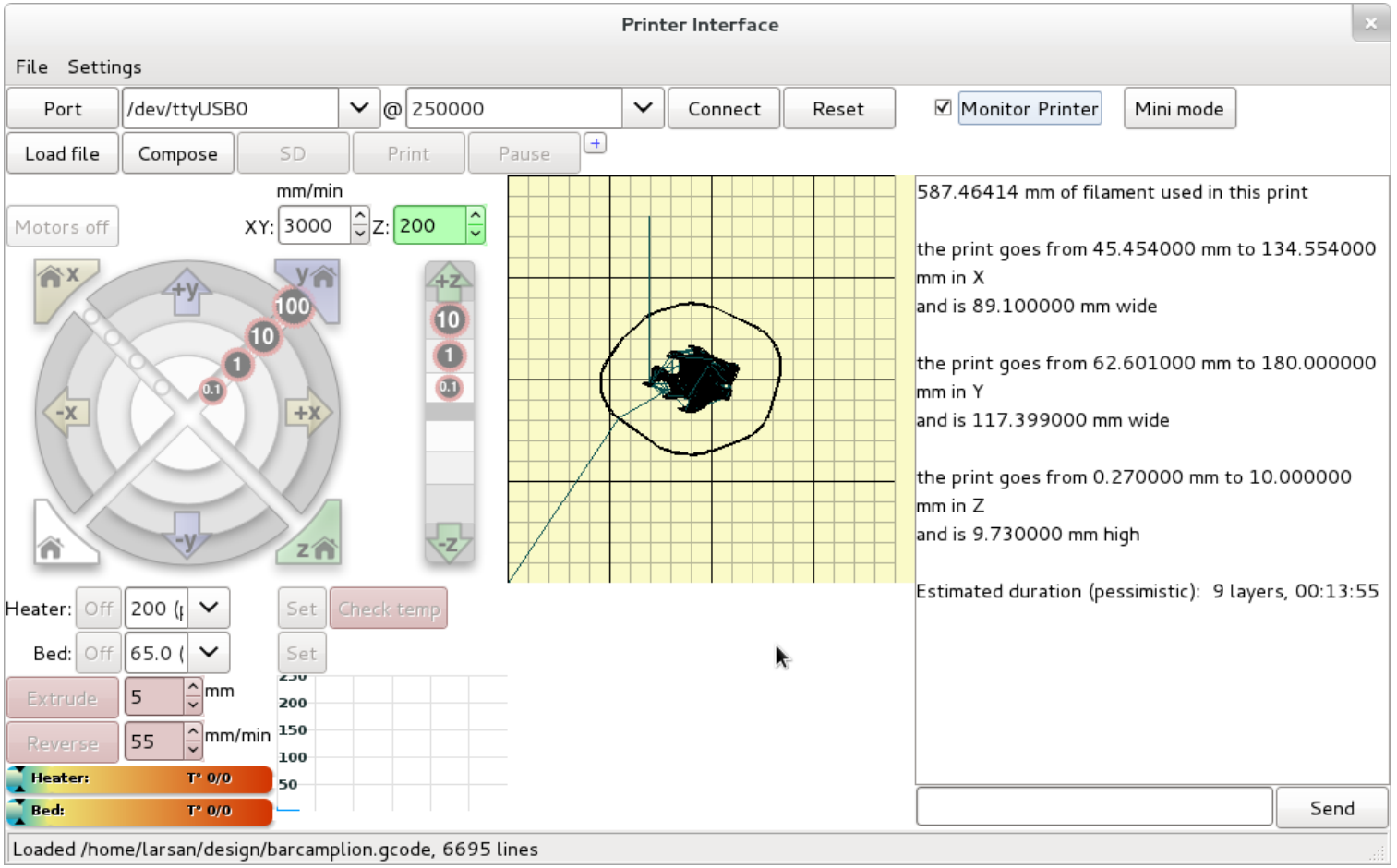
- Slic3r



Drucken: Drucken

Stratum 0

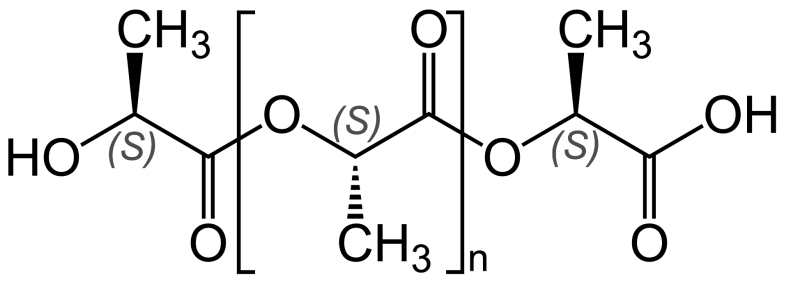
- Pronterface

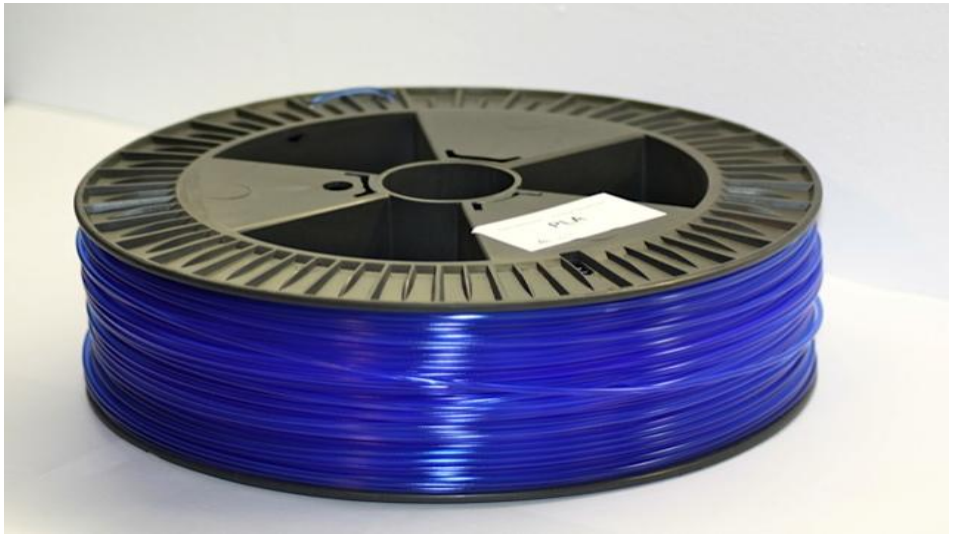


Material

PLA (Polylactide)

- verkettete Milchsäure
  - organisch
  - kompostierbar
- verformbar bei ~170-200°C
- aktuell bei uns genutztes Material



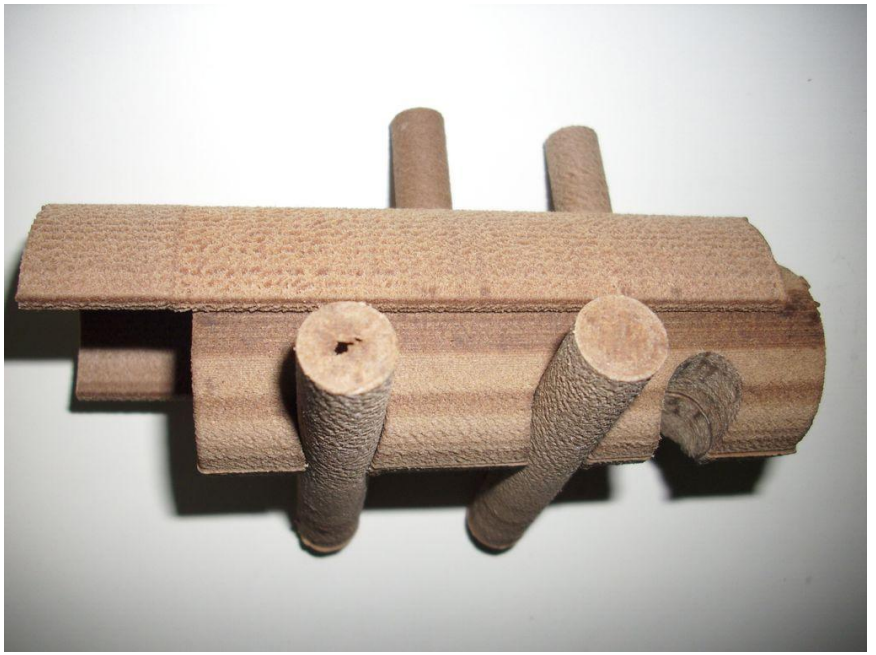


Source: https://grrf.de/de/catalog/pla-kunststoff-blau-transparent

Material

Andere Stoffe in Verbindung mit Trägermasse:

- Soft PLA
  - gummiartig
  - z. B. für Stempel geeignet
- Holz
  - „sieht aus und riecht wie Holz“
- Metal Clay
  - muss im Brennofen gebrannt werden

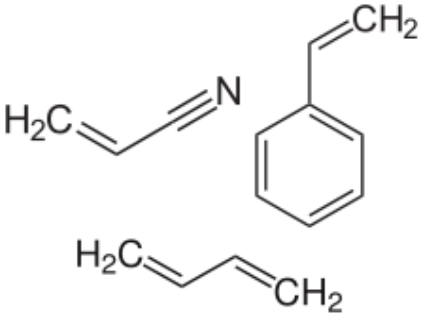


Source: https://grrf.de/de/catalog/spezial-material/druckbarer-holzdraht

Material

ABS (Acrylnitril-Butadien-Styrol)

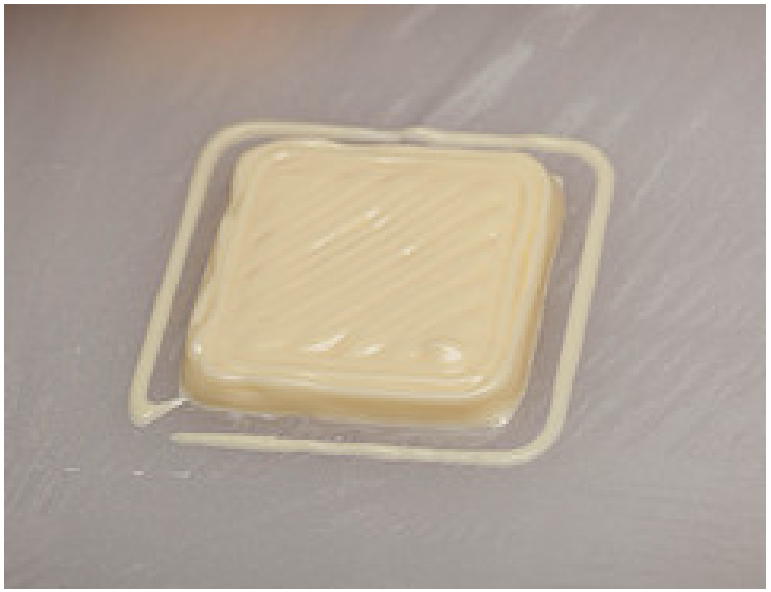
- verformbar bei ~230°C
- ursprünglich in der Industrie genutzt
- mehr Schwierigkeiten beim Druck
  - beheiztes Bett
  - anderer Extruder nötig
- weniger Umweltverträglichkeit



Schokolade?!

Stratum 0

- Schmelzpunkt: ~33.8°C
  - verschiedene Kristallstrukturen
- http://reprap.org/wiki/Chocolate_Extrusion



Drucktechniken

Stratum 0

- Alle gängigen: Schicht für Schicht.
- Filamentextruder
  - 1,75 oder 3 mm Filament
  - 0,35 mm Düse
  - Kosten: Drucker ab 400€, Filament ~20€/kg
- Stereolithografie
  - Aushärten eines Polymers mittels UV
  - Kosten: Drucker vierstellig, Fluid ~80€/l
- Sintern, etc...

Laaaaangweilig.

2005

Stratum 0

- Initiales Treffen
- Finanzielle Unterstützung

UNIVERSITY OF BATH

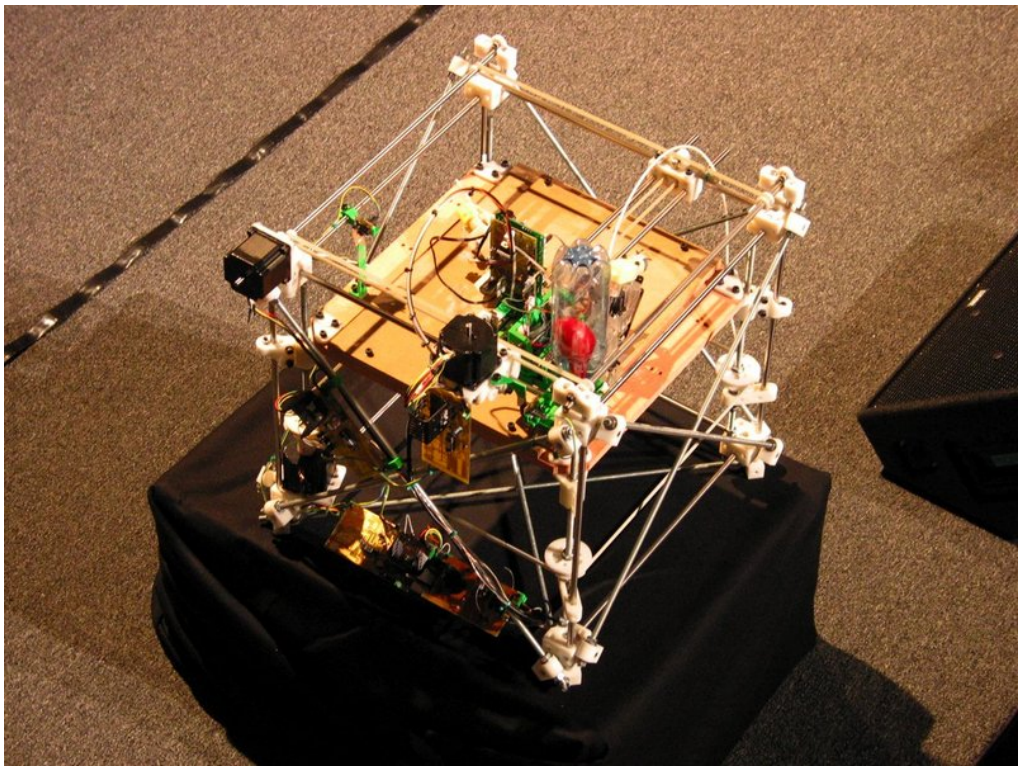
EPSRC

Engineering and Physical Sciences Research Council

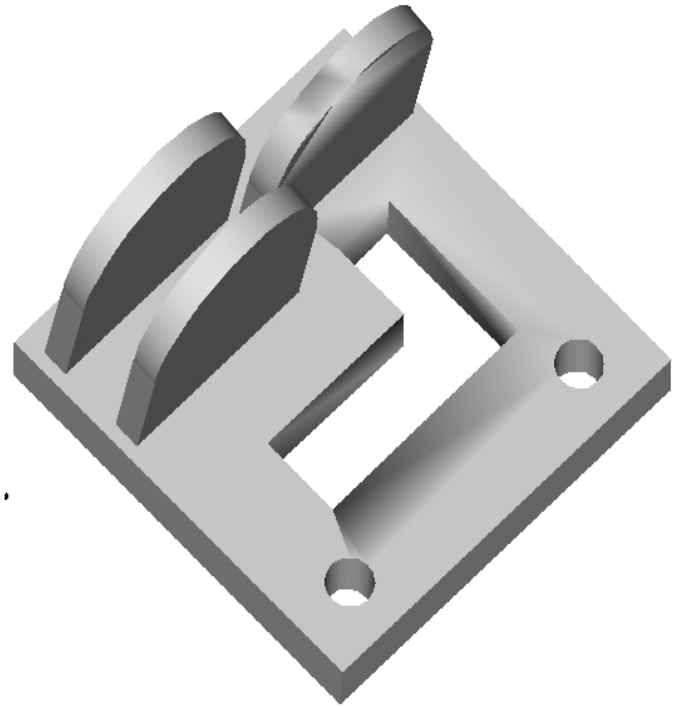
2006

Stratum 0

Beginn der eigenen Reproduktion

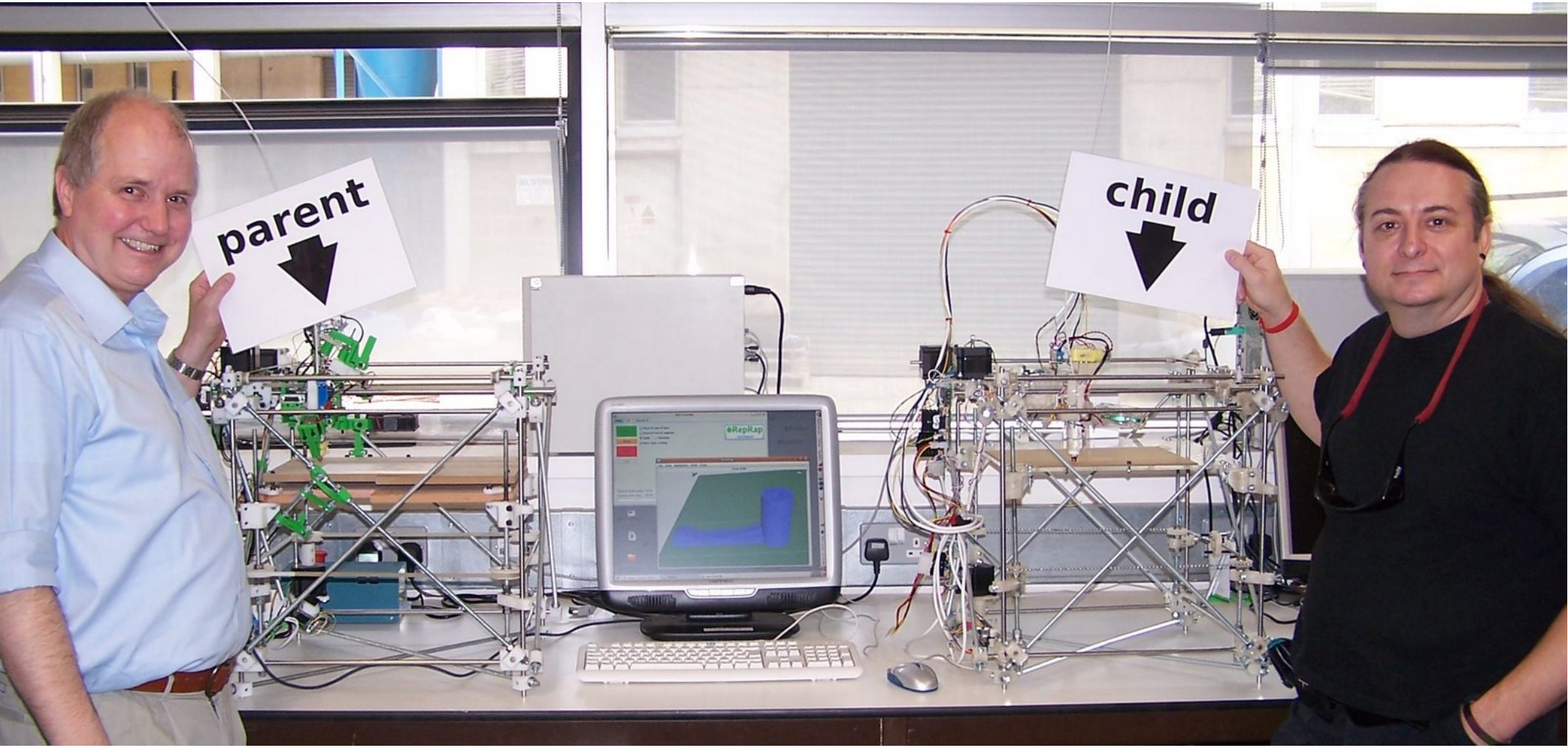


2008



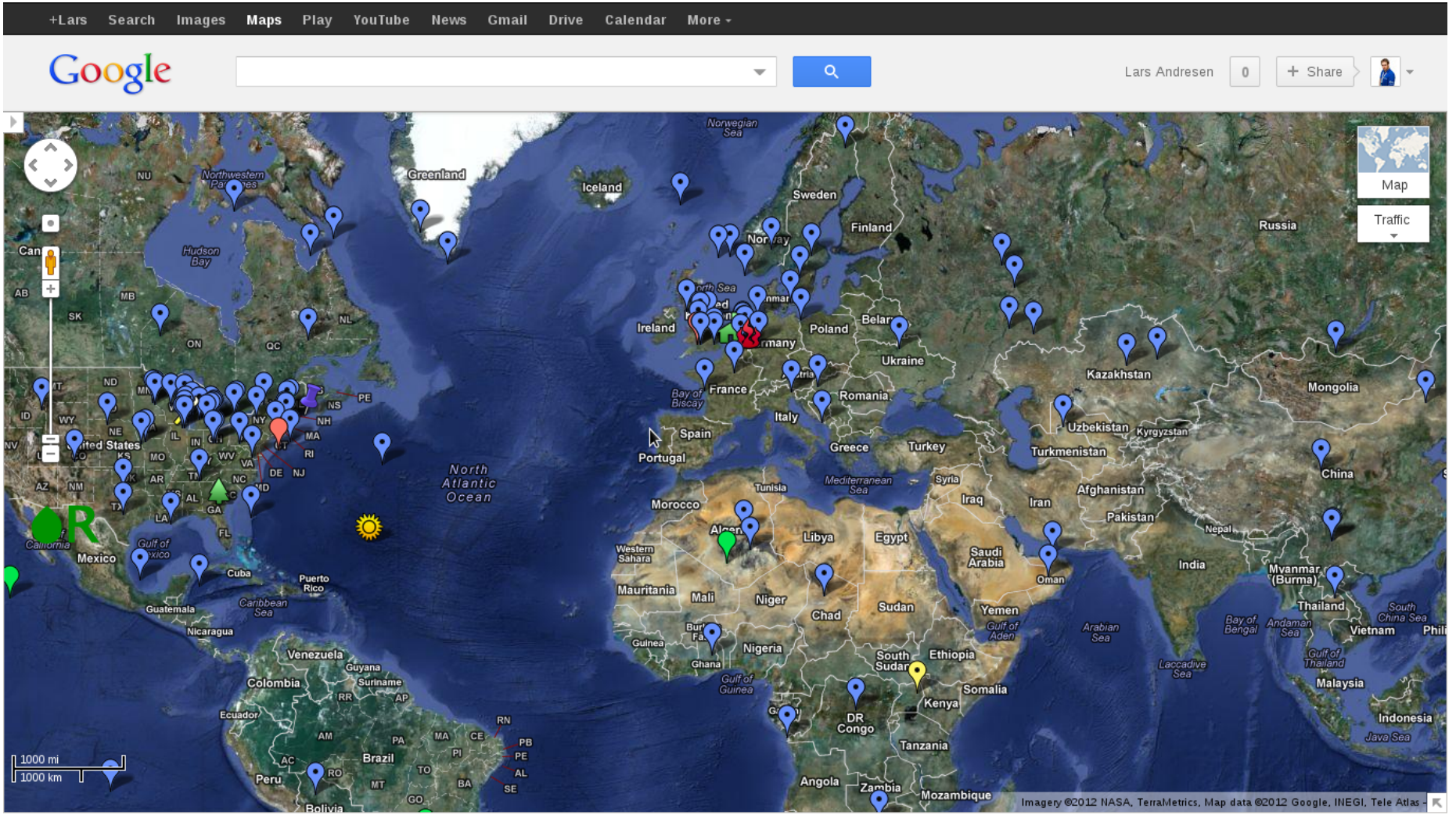
2008

Stratum 0



2008

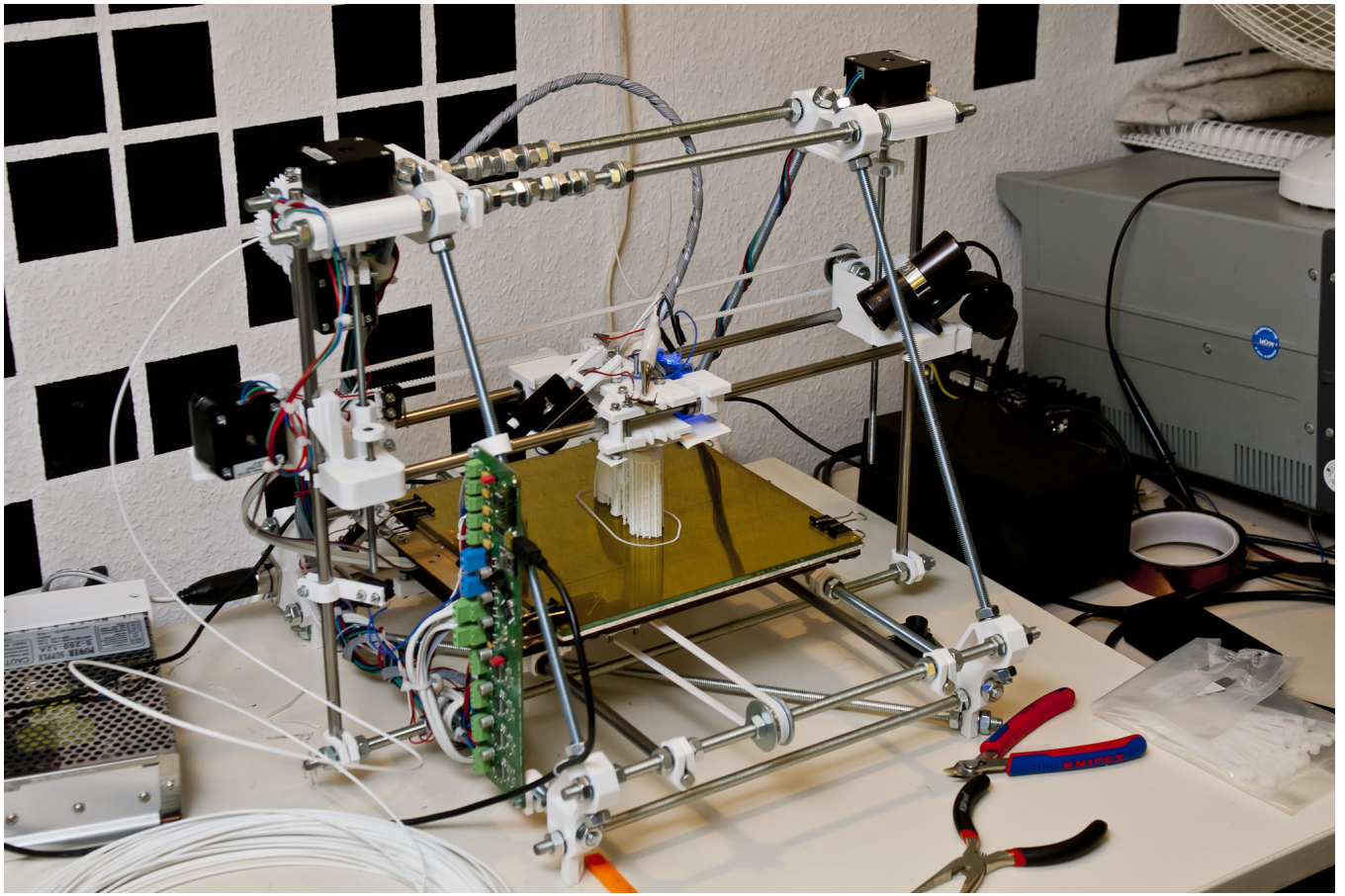
Stratum 0



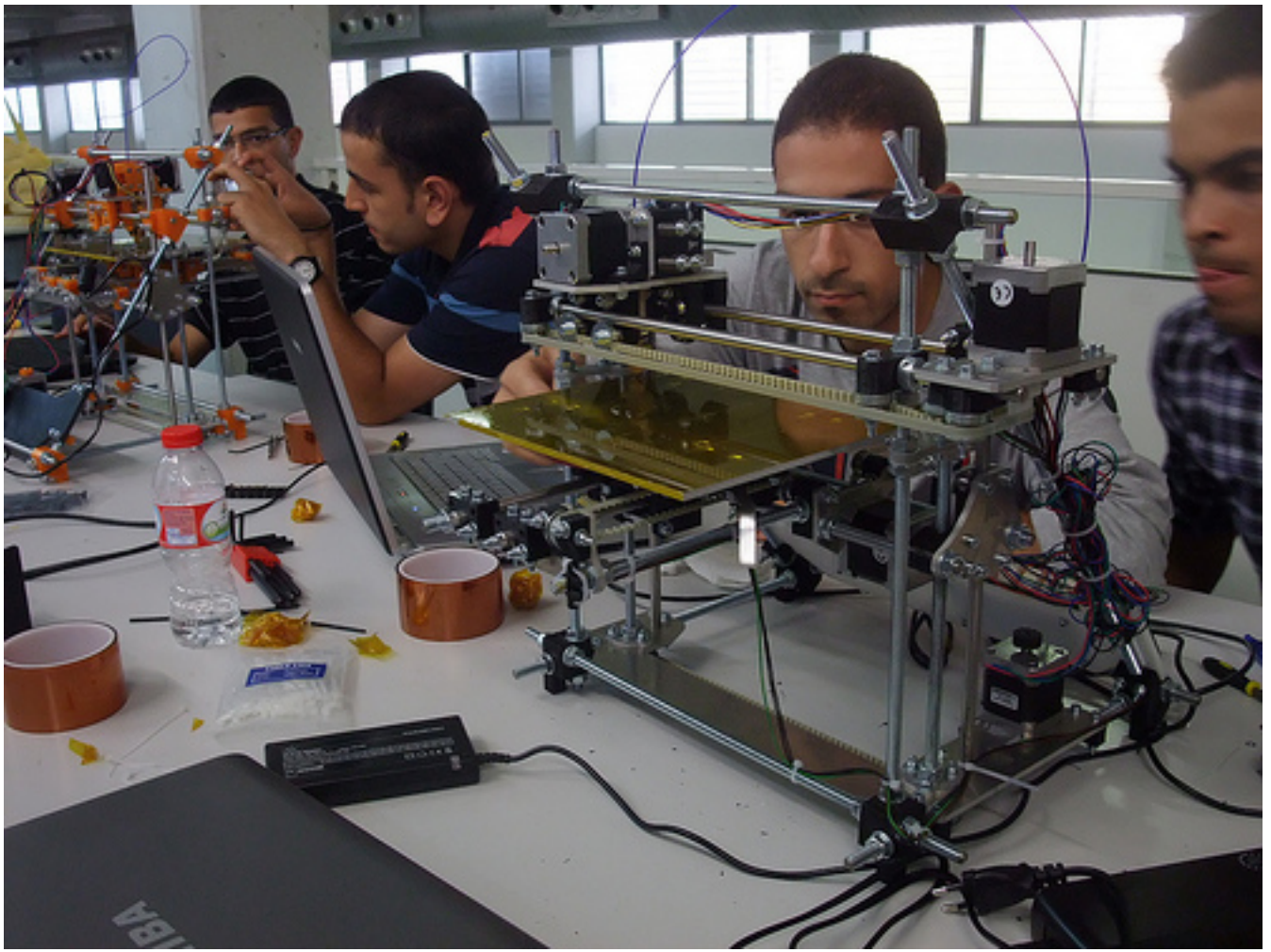
2009

Stratum 0

- neuer Drucker: RepRap Prusa Mendel (unser Modell)



aktuell



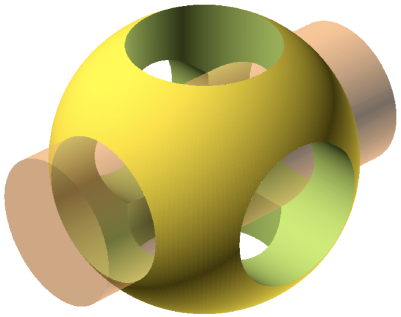
- ca. 30.000 Drucker

Software: GPL-lizenziert

Stratum 0

Slic3r.org

Reprap.org



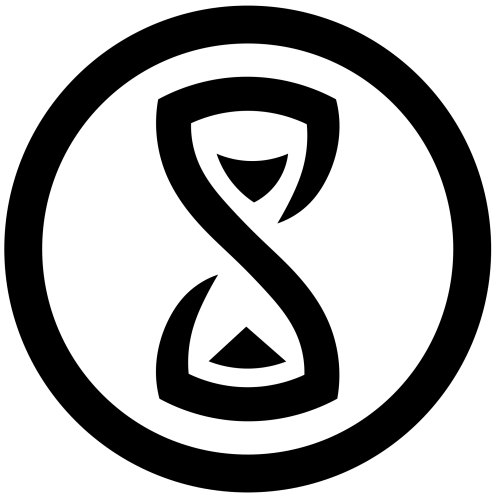
Openscad.org

Blender.org

Fragen?

https://stratum0.org/wiki/BarCamp_Braunschweig_2012

Twitter: @stratum0
IRC: #stratum0 @ freenode.net
https://stratum0.org



Stratum 0