

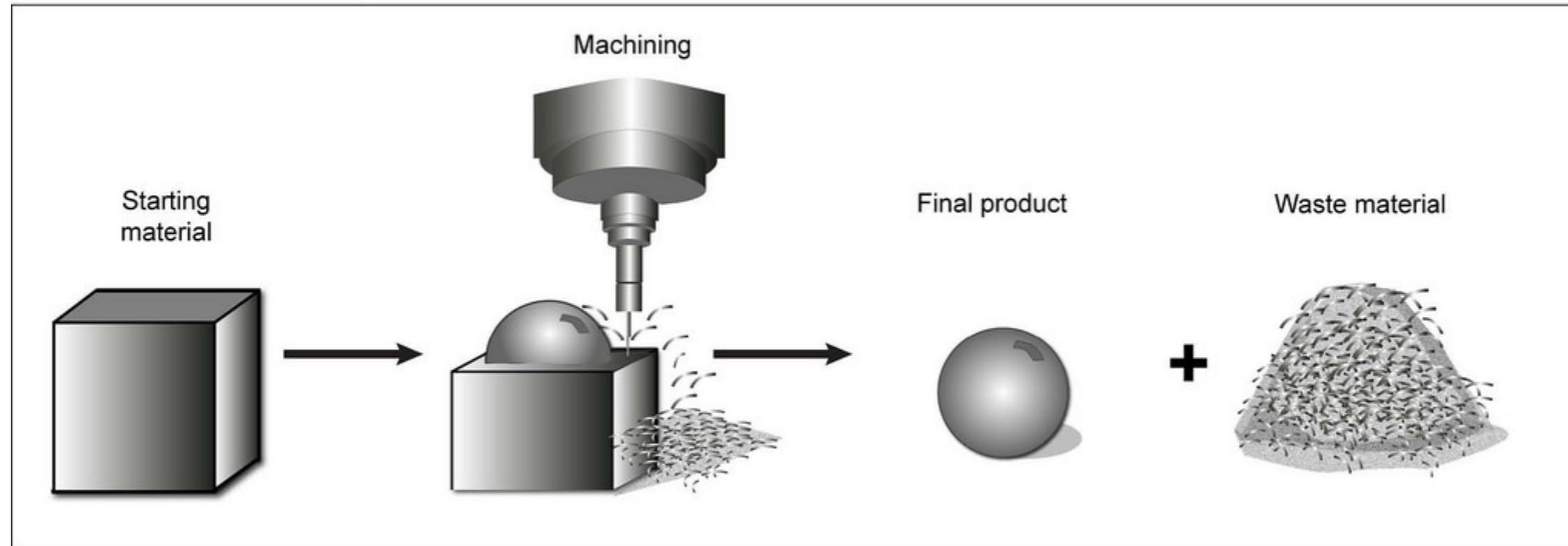
3D Printing

Bits to Atoms



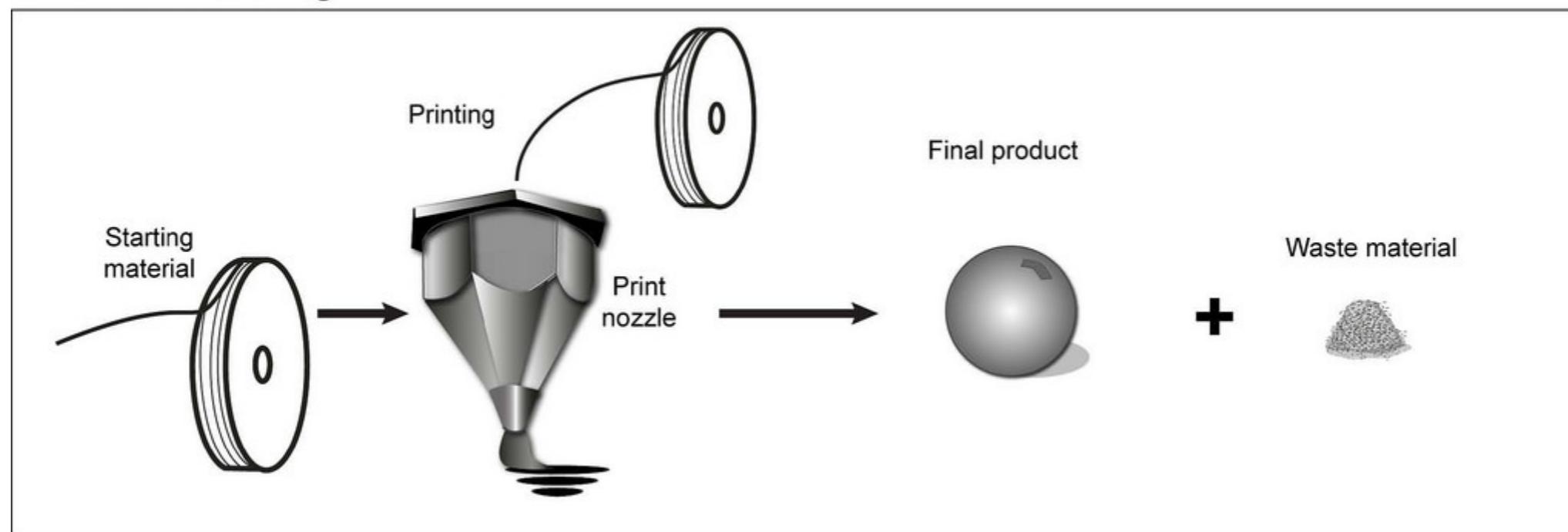
Additive vs. Subtractive

Subtractive manufacturing



3rd Industrial Revolution

Additive manufacturing



4th Industrial Revolution

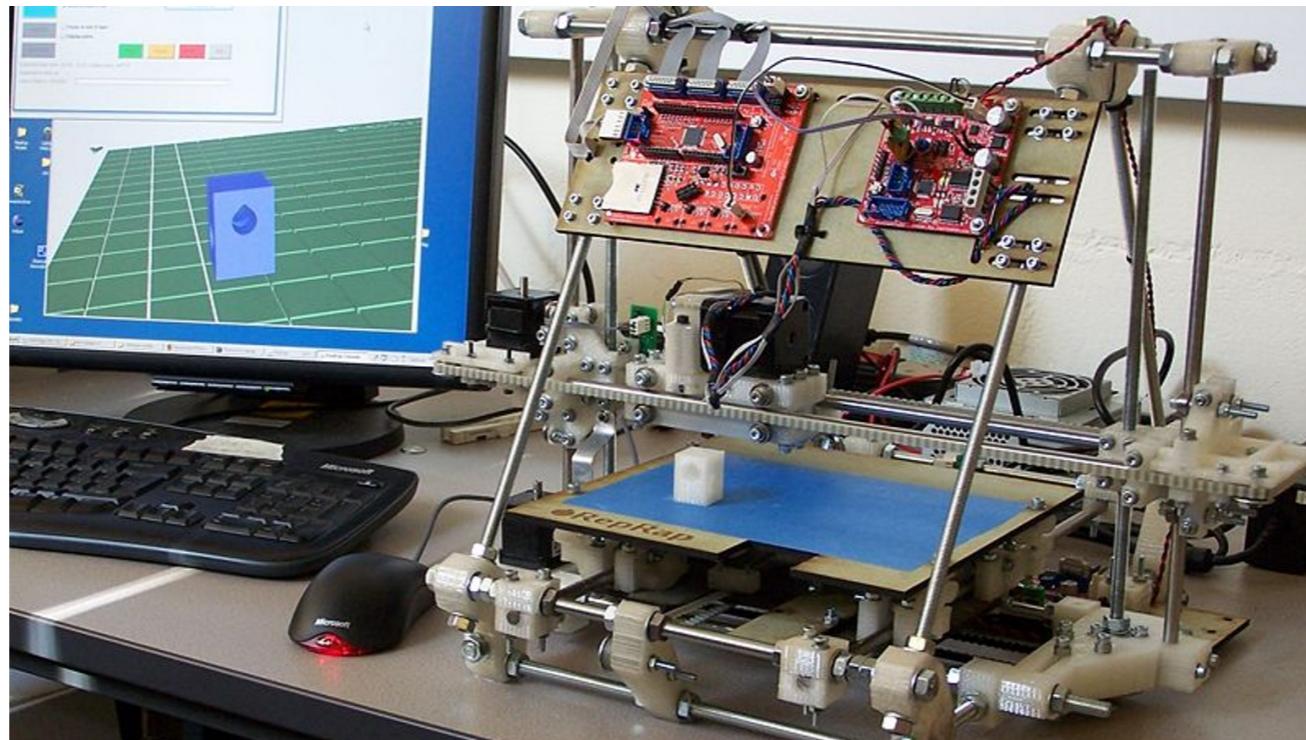
History

1980 - SLS method developed

1992 - SLA method developed

2005 - RepRap Project

- Open Source hardware
- Goal: a printer that could build itself.



How he started the worldwide 3D printing revolution: Adrian Bowyer
<https://www.youtube.com/watch?v=VV0Tjwq7Uc0>

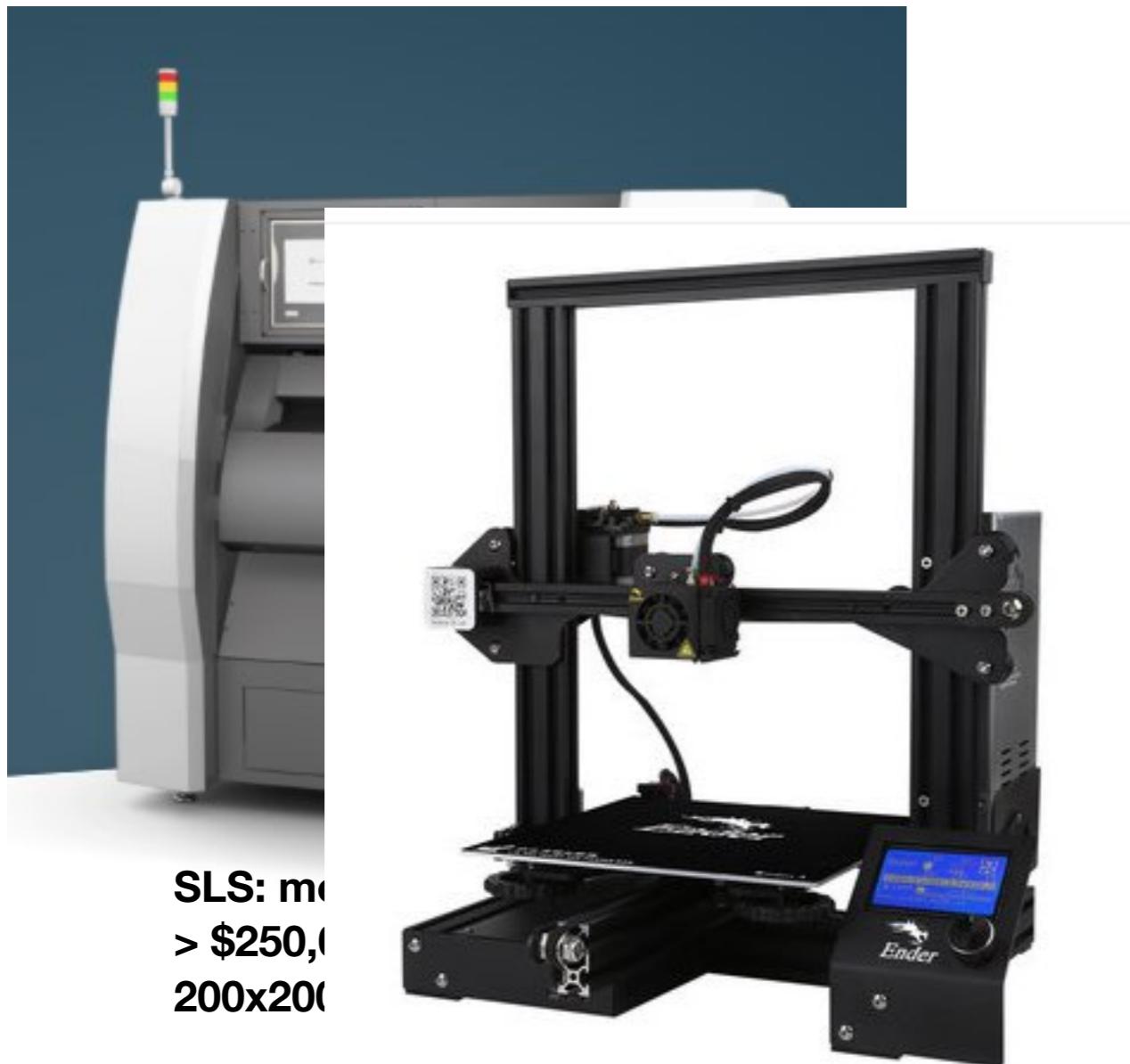
Early patent are expiring ==> an explosion of new products in all these technologies.

Price Spectrum



SLS: metals, ceramics
> \$250,000
200x200x330mm build envelope

Price Spectrum



Creality 3D® Ender-3 V-slot Prusa
Resume Function/MK10 Extruder 1

★★★★★ (526 Reviews) Product ID: 1278

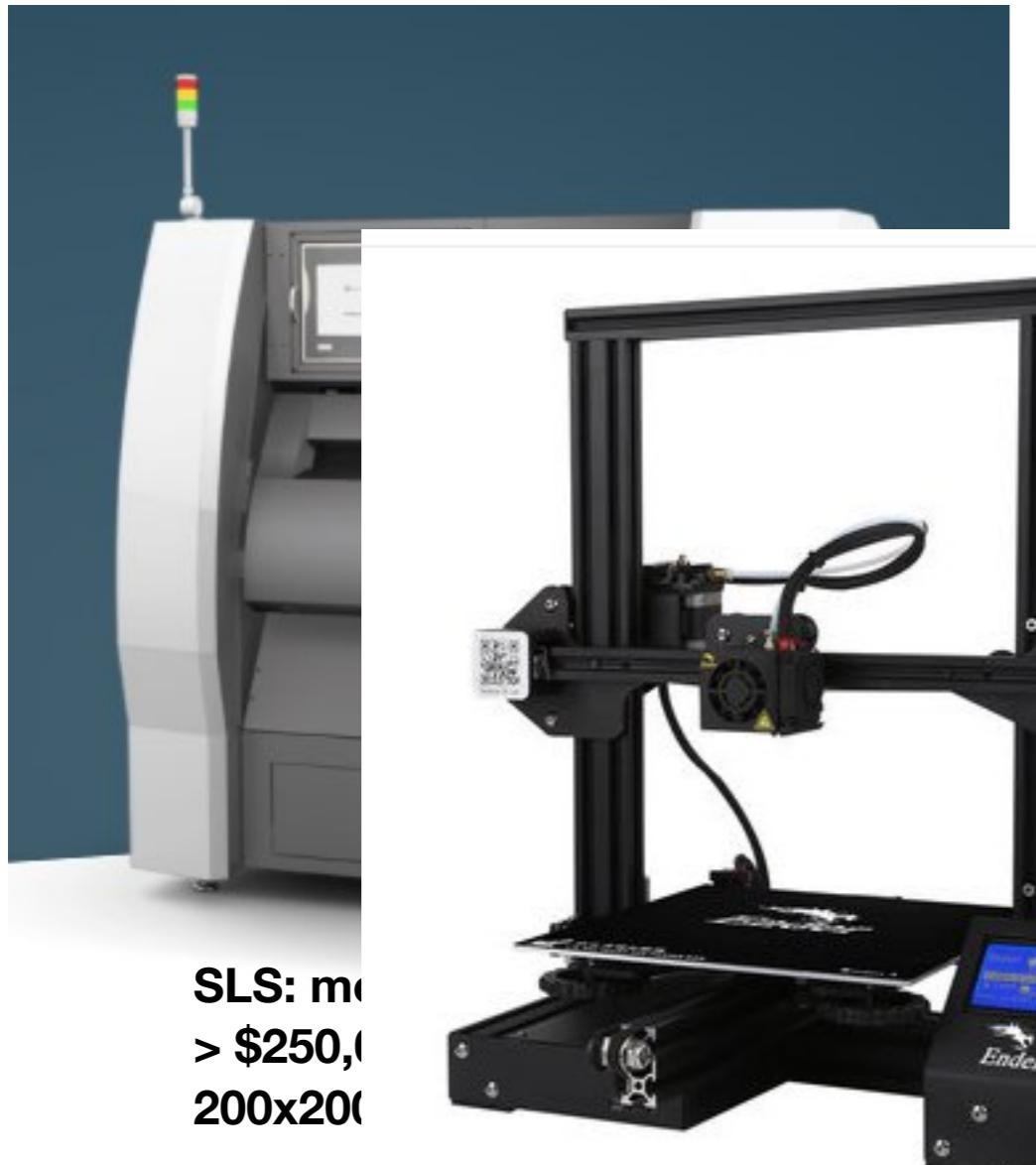
In stock, usually dispatched in 1 business day

Price: US\$ **179.99**

Shipping: **US\$6.14** to United States via UPS
2-8 business days

QTY:

Price Spectrum



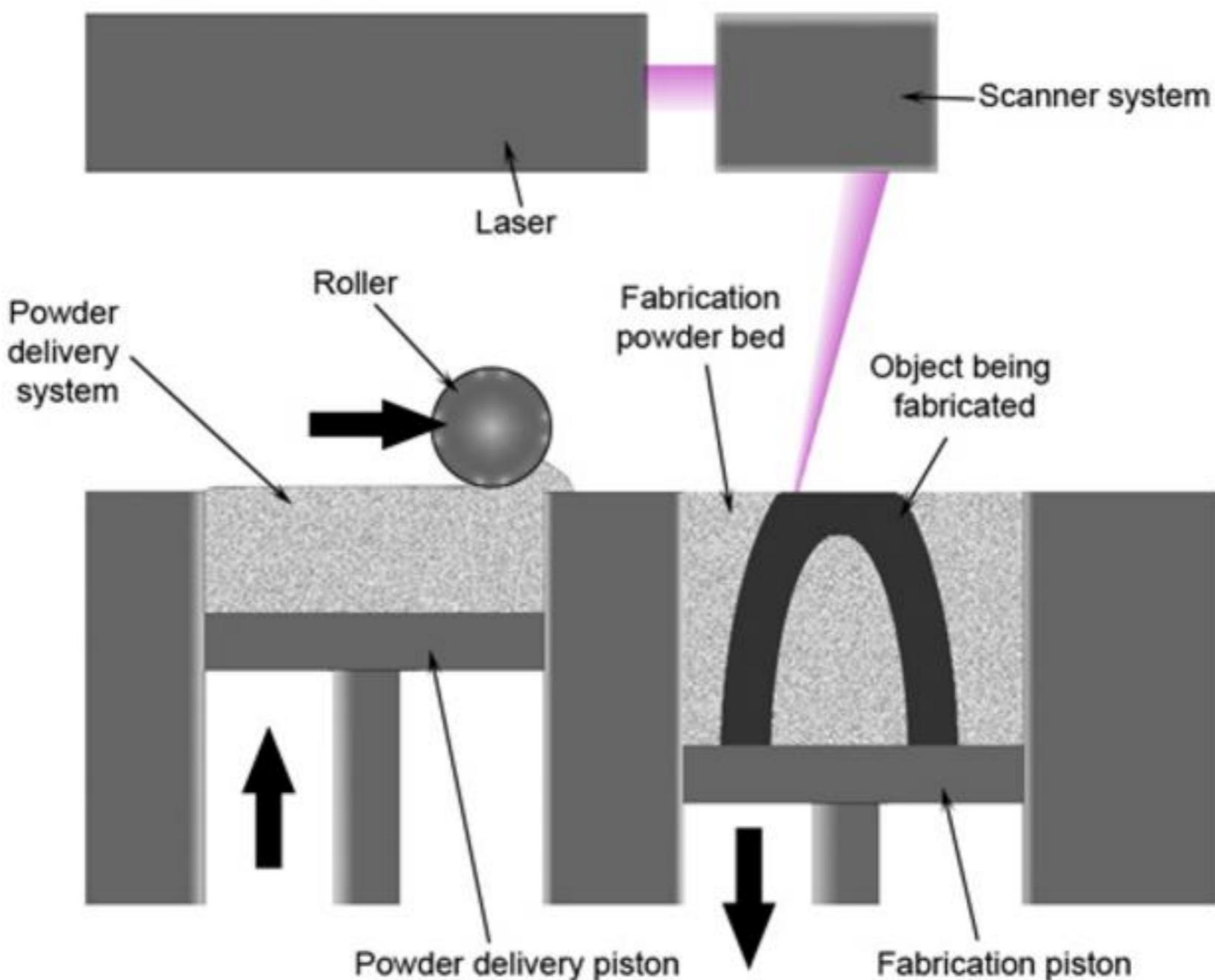
Prusa i3
\$1000 (\$750 kit)
210x210x250 build envelope
<https://www.youtube.com/watch?v=M73uIMDlvvk>

3D Printing Workflow



Selective Laser Sintering (SLS)

Selective Laser Sintering (SLS)



SLS Demo

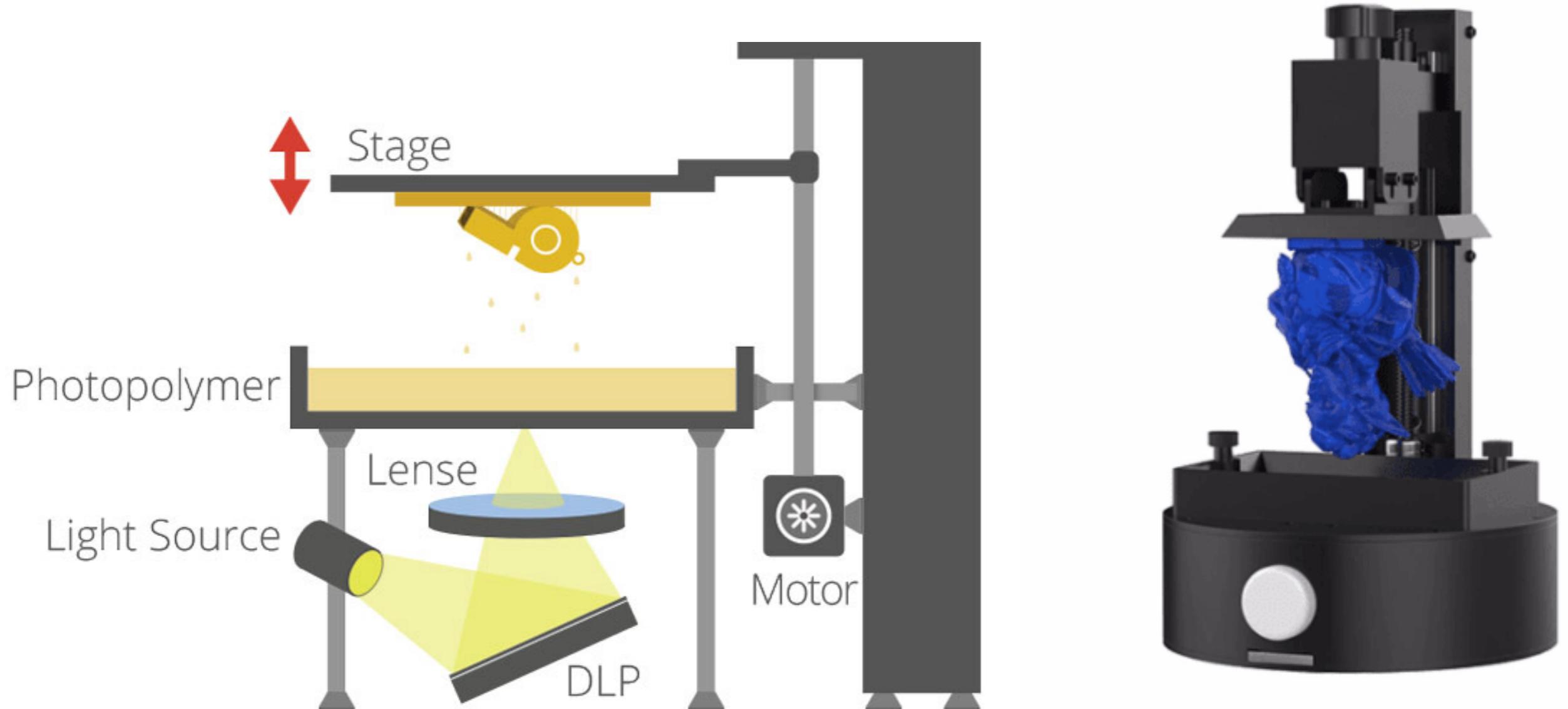


What is SLS 3D Printing? (Selective Laser Sintering)

<https://www.youtube.com/watch?v=xorCFh-9EWA>

Stereolithography (SLA)

Stereolithography (SLA)



SLA Demo – Carbon 3D

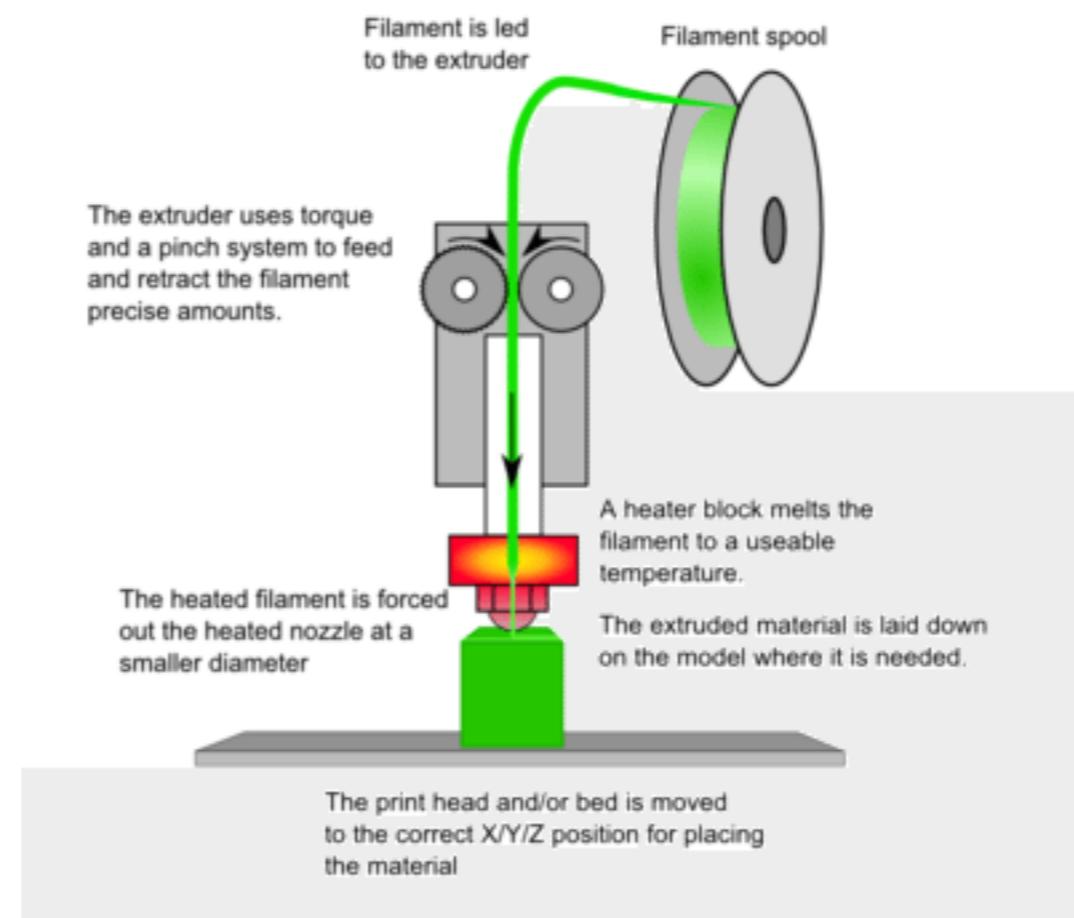


Carbon Demo

<https://www.youtube.com/watch?v=UpH1zhUQY0c>

Fused Deposition Modeling (FDM)

Fused Deposition Modeling (FDM)



FDM Demo

wildrosebuilds



#satisfying #3dprinting #timelapse

Satisfying 3D Print TimeLapse Compilation 7 (Prusa I3 Mk3 octopi)

<https://www.youtube.com/watch?v=Dss1yUHH-QY>

Ecosystem

thingiverse.com

- free models
- print them yourself

shapeways.com

- sell your designs
- high-end printers, exotic materials
- have them print it

3Dhubs.com

- Online manufacturing (CNC, print)
- Find a local shop
- Prototypes & small production runs

Applications

Medical

Medical

Prosthetic Limbs



Medical

Prosthetic Limbs



Custom Casts



Medical

Prosthetic Limbs



Custom Casts



\$50 vs. \$42,000

Medical

Prosthetic Limbs



Custom Casts



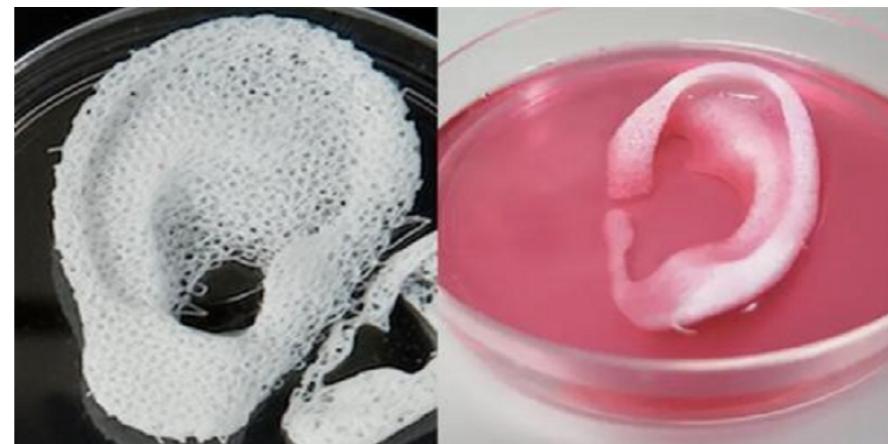
\$50 vs. \$42,000



Organs - “Bio-Printing”

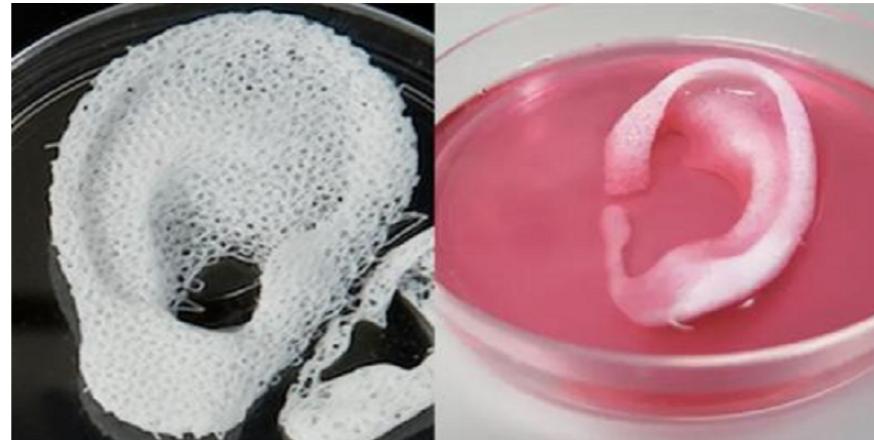
Organs - “Bio-Printing”

“Bio-Ink” – each drop contains as few as 5 stem cells



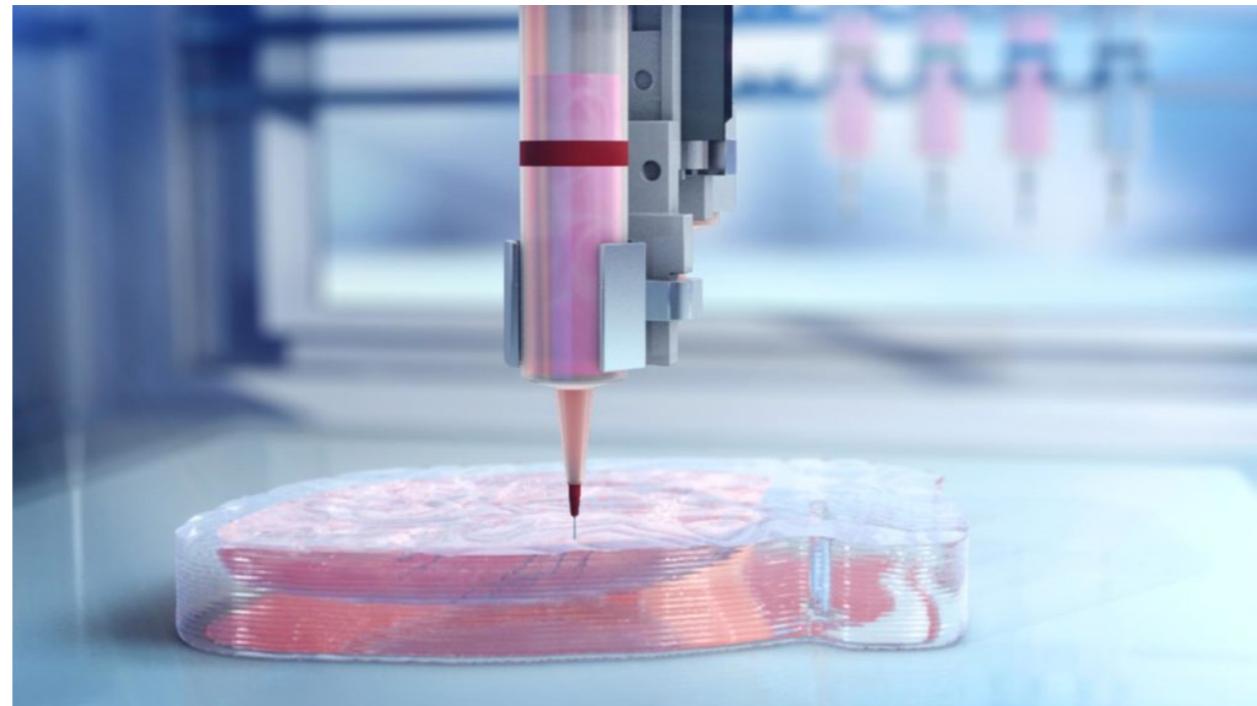
Organs - “Bio-Printing”

“Bio-Ink” – each drop contains as few as 5 stem cells



5 Most Promising 3D-printed Transplantable Organs

- Kidneys
- Liver
- Bones
- Heart
- Cornea



Organs - “Bio-Printing”

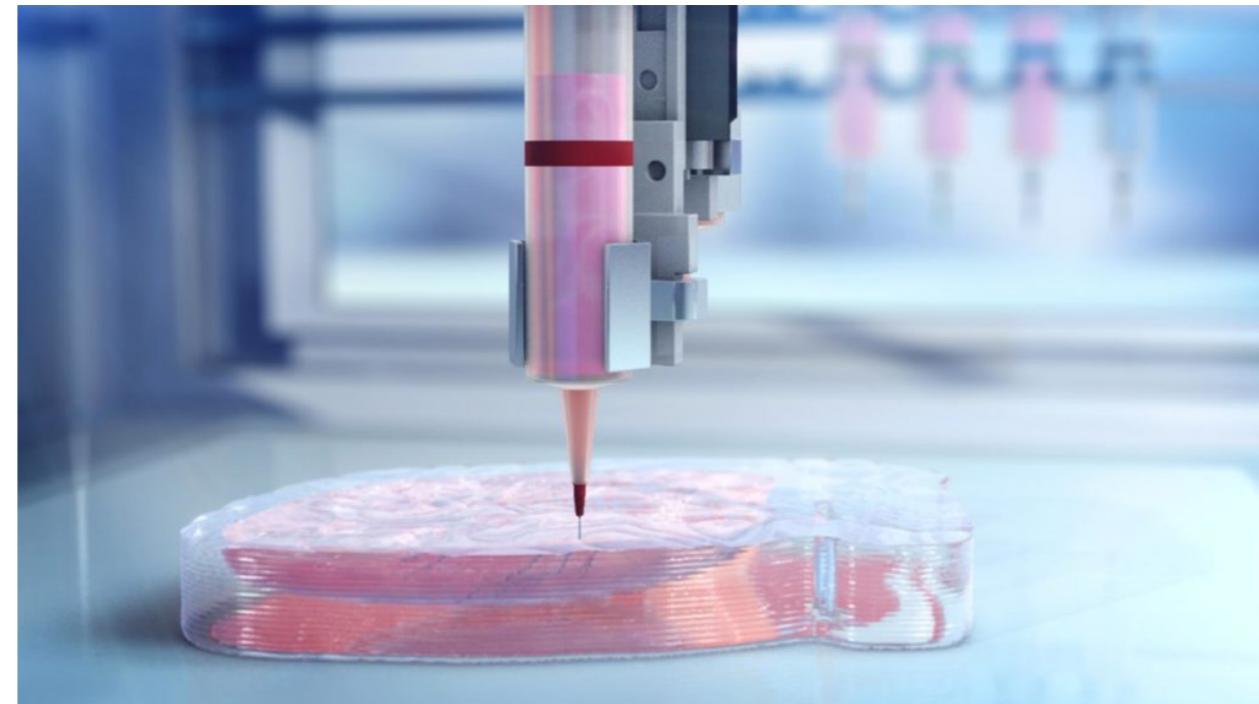
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5 Most Promising 3D-printed Transplantable Organs

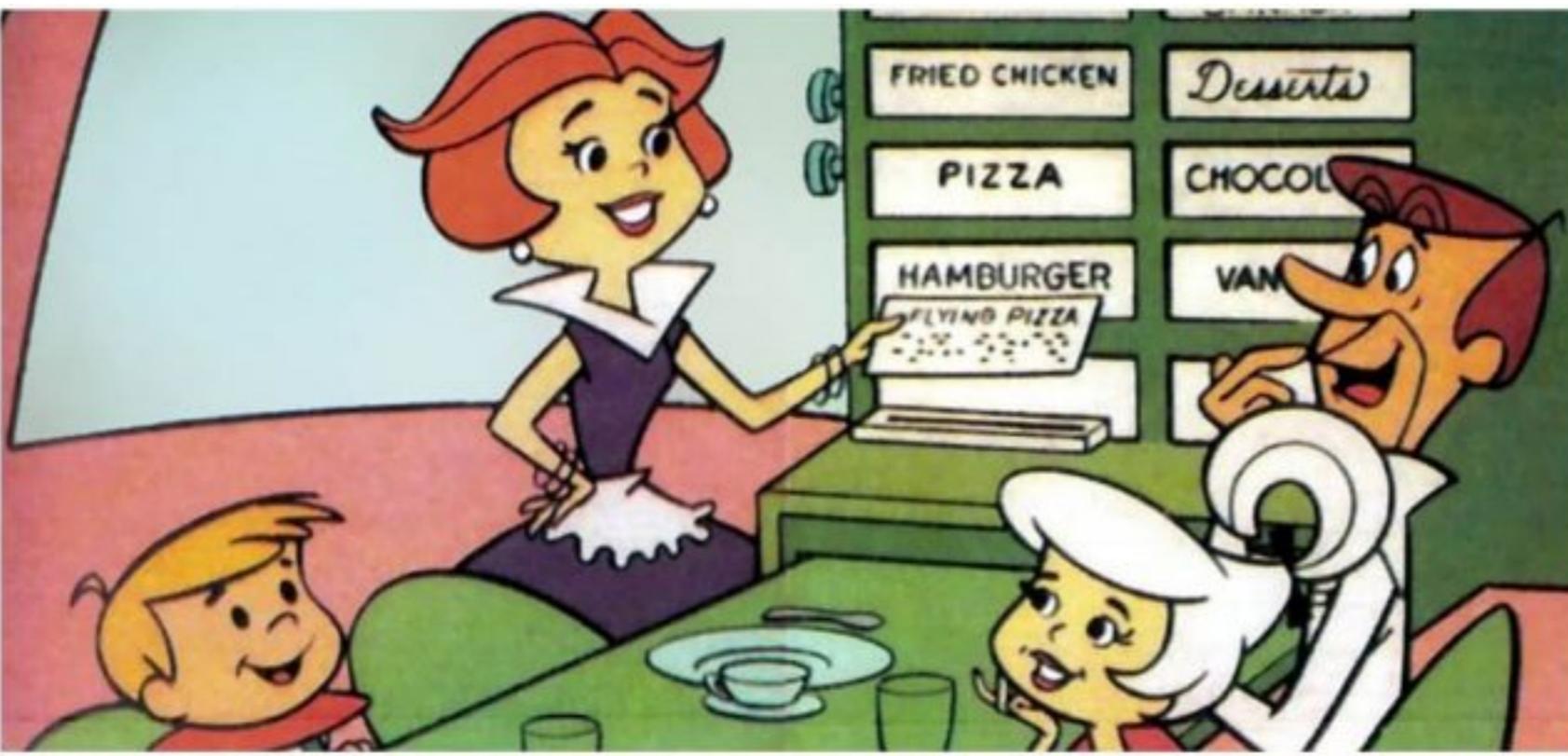
- Kidneys
- Liver
- Bones
- Heart
- Cornea

Will it solve the
organ shortage?



Food

Food



Food



Food



Food



“Made in Space”



A 3D printer flies on the International Space Station.

Applications: extravehicular activity (EVA) tools and repairs, stronger and more capable intravehicular (IVA) tools, spares, and repairs, and even satellite structure can be created on site, on-demand.



Mobility

Mobility



Mobility



Mobility



Housing

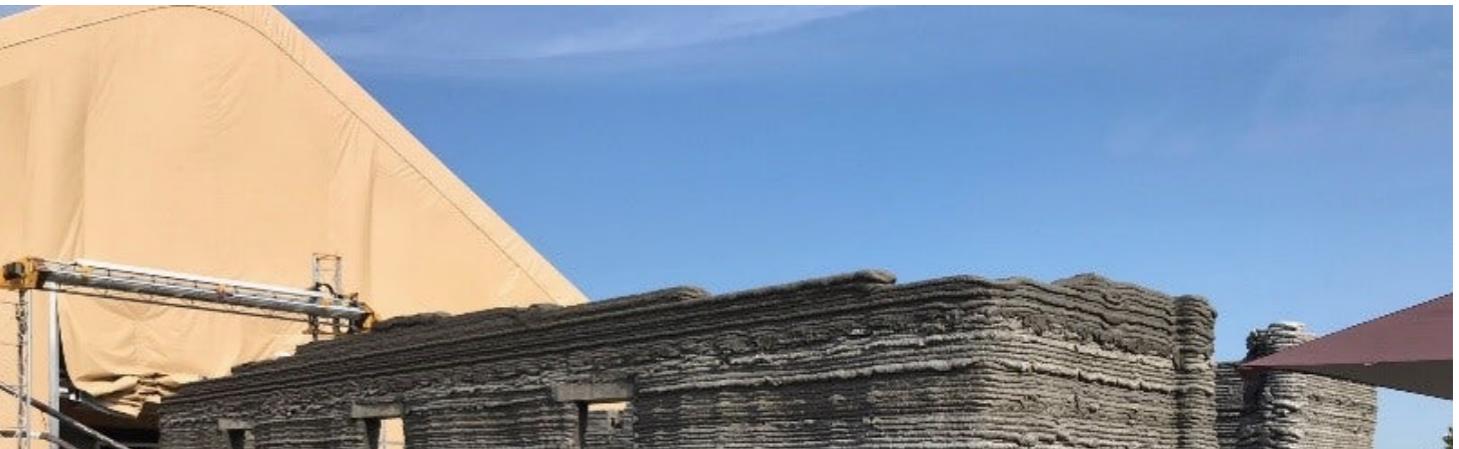
Housing



Housing



Housing



Weapons

"The Liberator"



<https://taskandpurpose.com/3d-printed-guns-defense-distributed/>

Materials

Plastics
Nylon
Carbon fiber
Ceramics
Metals
Concrete
Wood
Human Cells

<http://3dprintingfromscratch.com/common/3d-printer-filament-types-overview/>

4D Printing

A 3D print is made using soft, slightly elastic materials
==> the “ink”

That 3D-printed object can then harden into a variety of intricate ceramic shapes after being heated, stretched, magnetically stimulated, folded, or otherwise altered via the passage of time.



Still a research area

Why do *I* have a 3D printer?

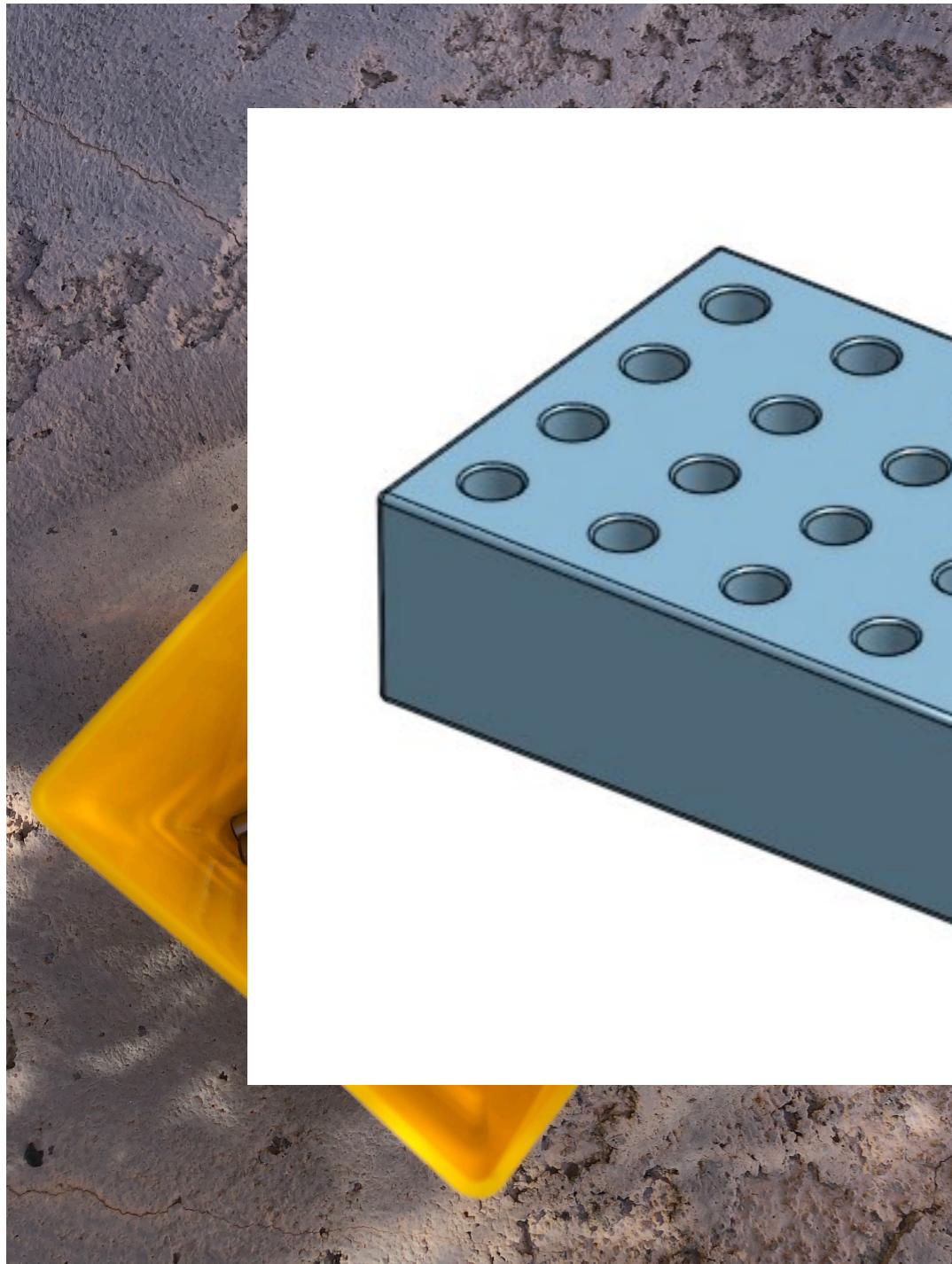
Why do *I* have a 3D printer?

I Build Stuff!

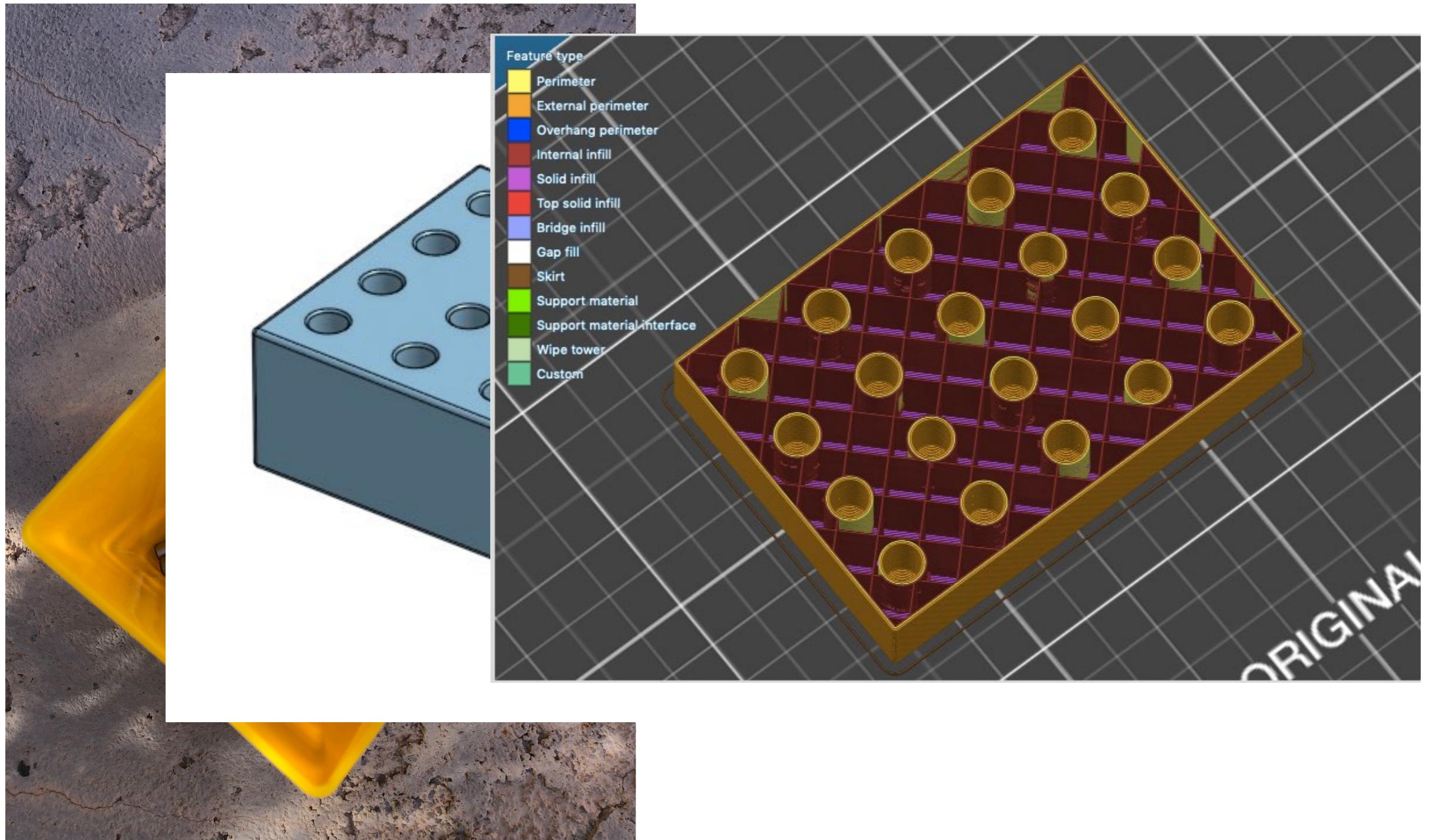
“I can do better than this mess...”



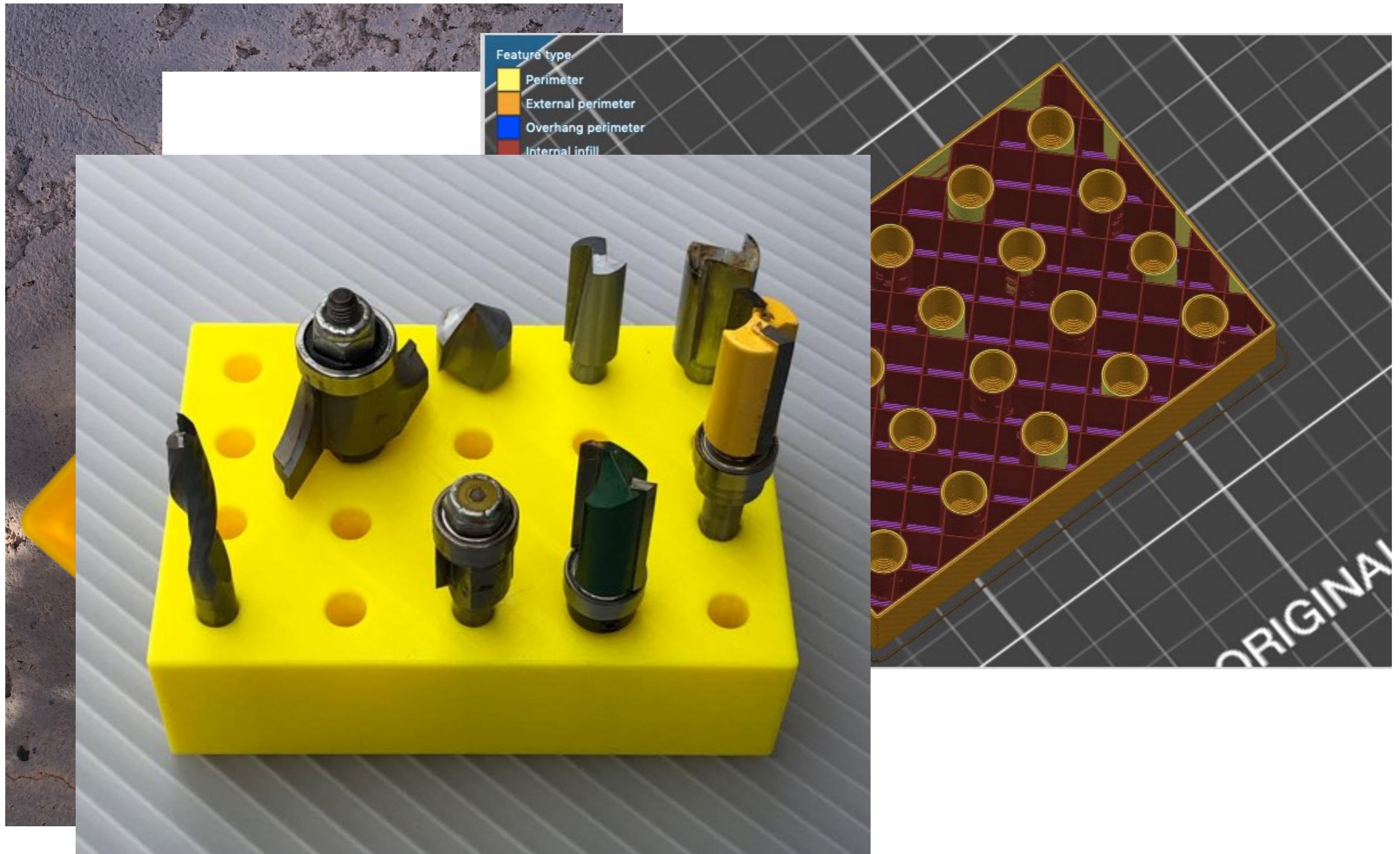
“I can do better than this mess...”



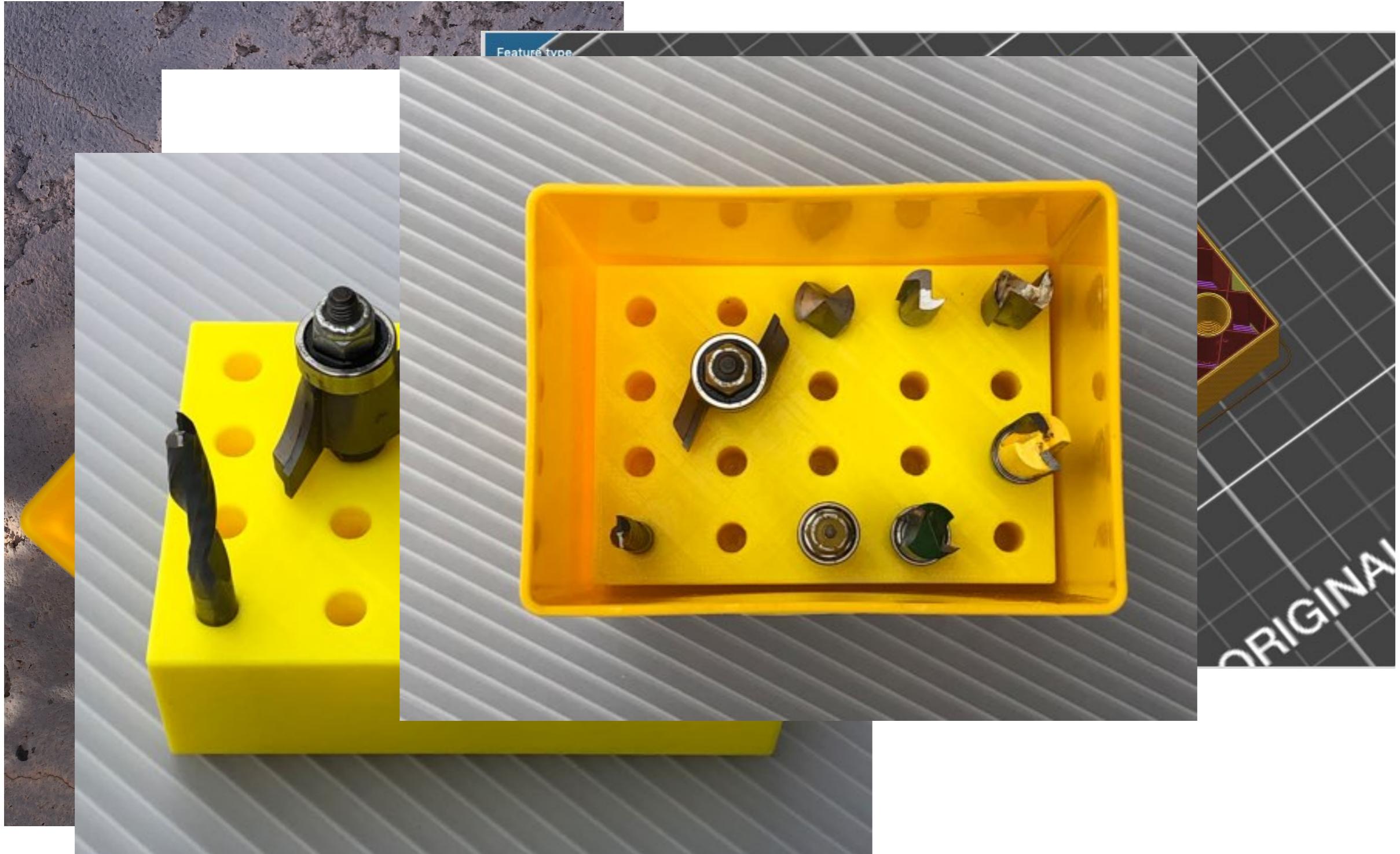
“I can do better than this mess...”



“I can do better than this mess...”



“I can do better than this mess...”



Personal Design Examples

Personal Design Examples



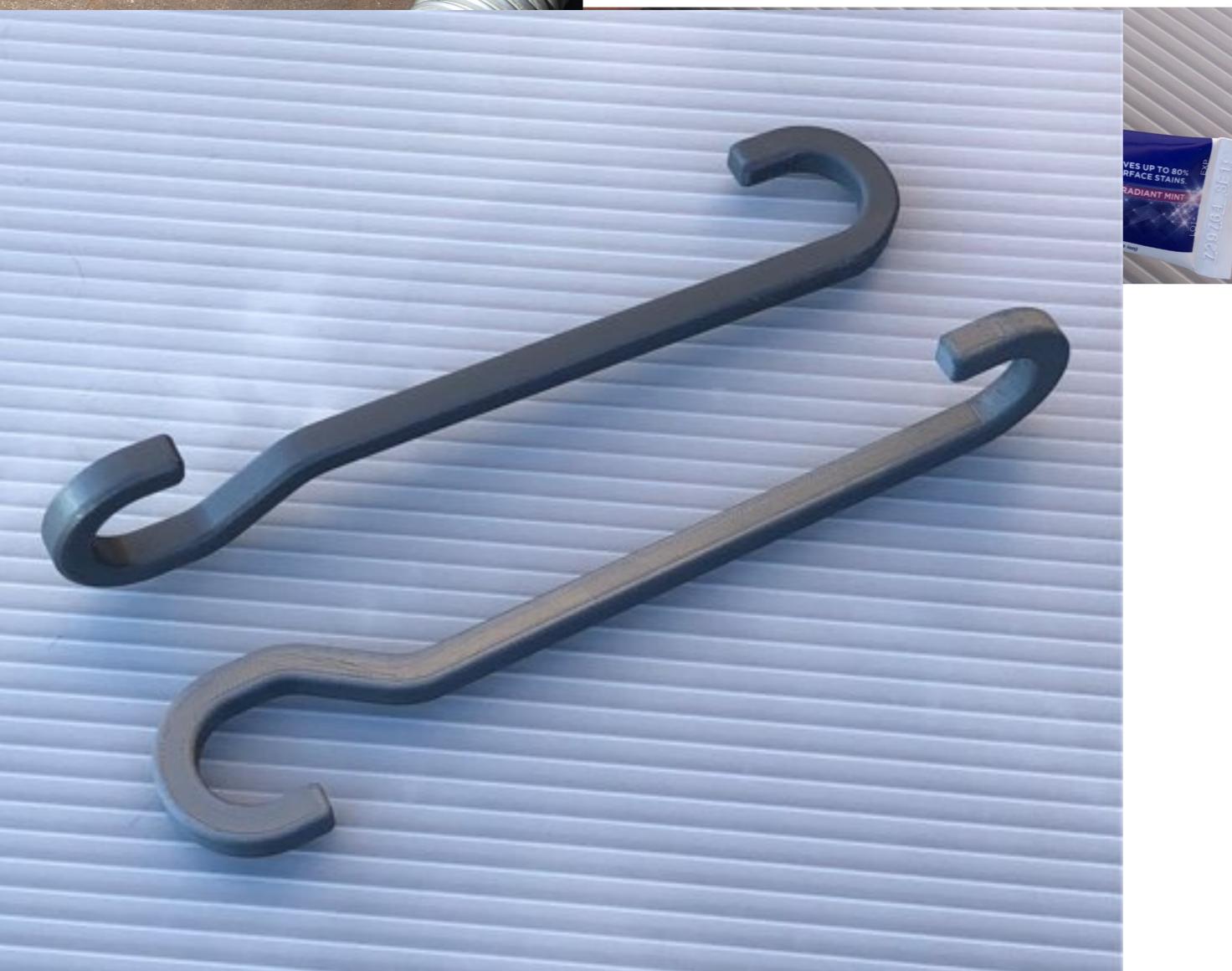
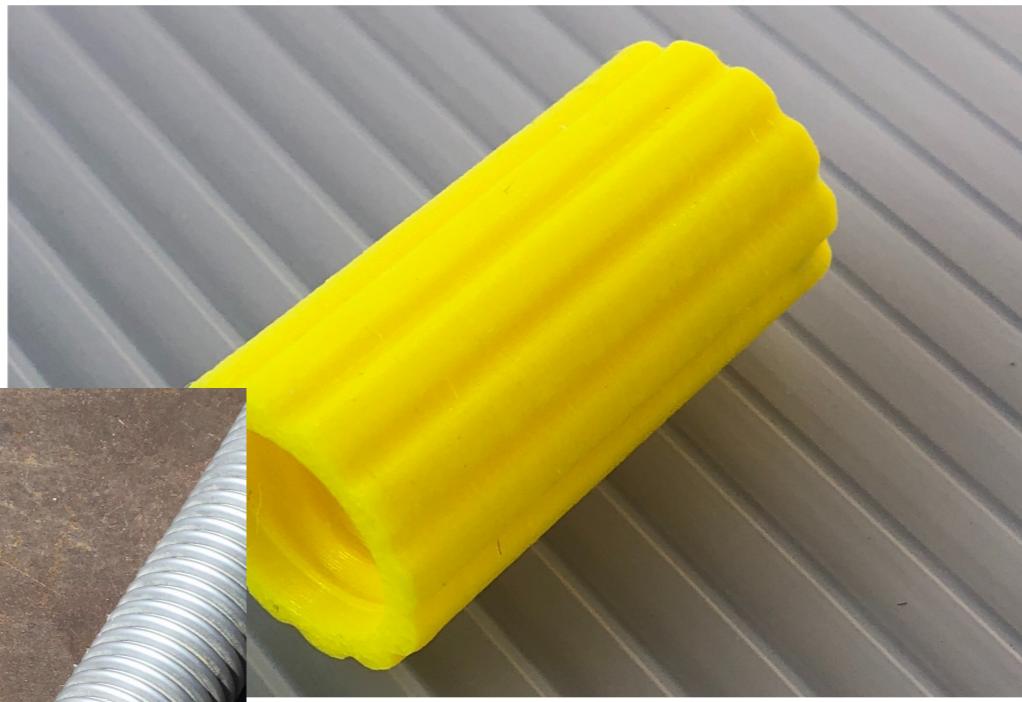
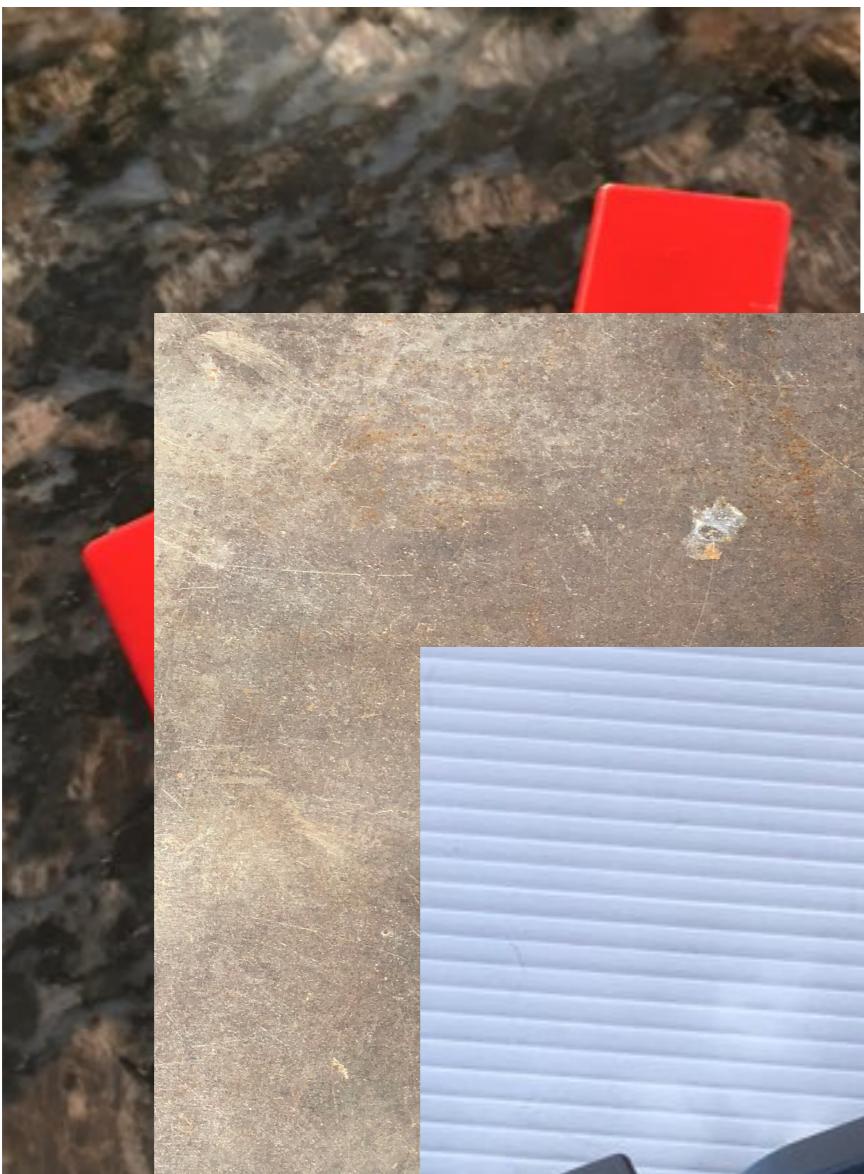
Personal Design Examples



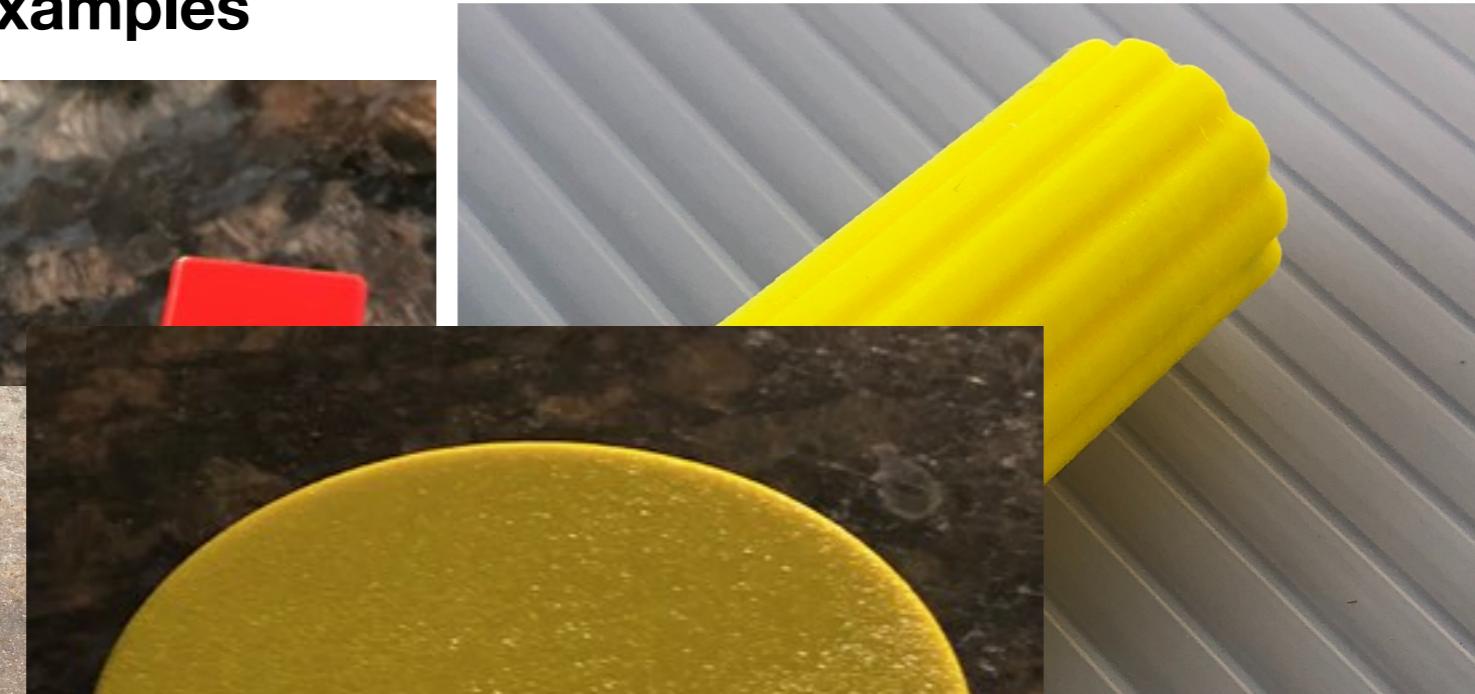
Personal Design Examples



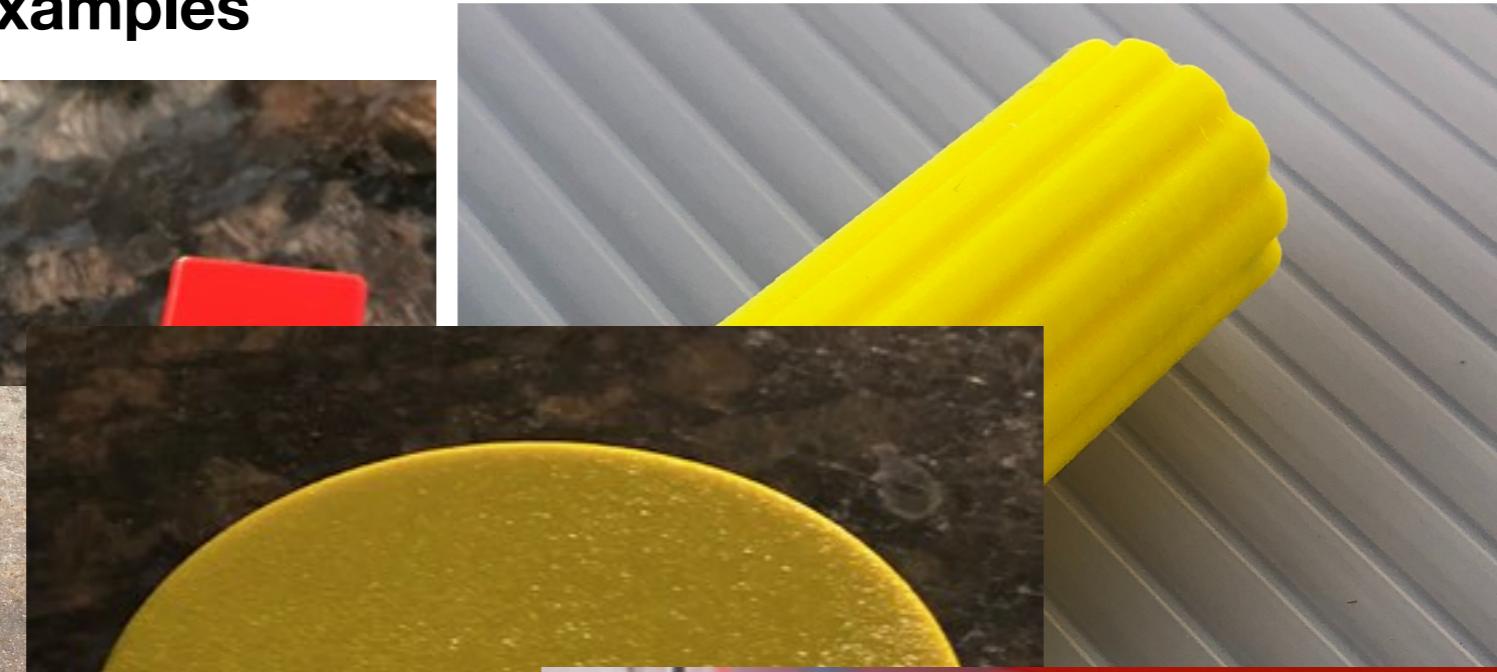
Personal Design Examples



Personal Design Examples



Personal Design Examples



Personal Design Examples

Personal Design Examples



Personal Design Examples



Personal Design Examples



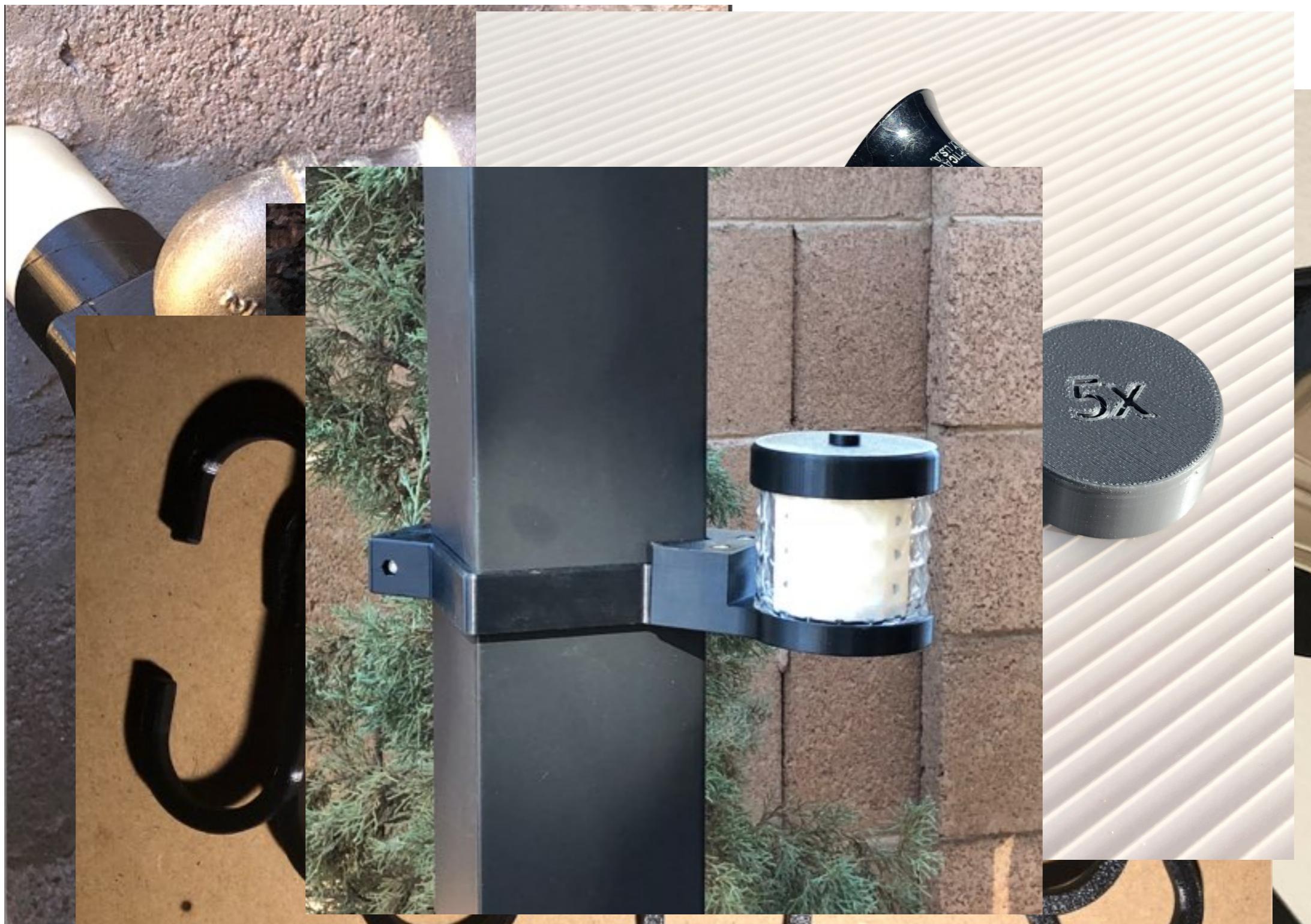
Personal Design Examples



Personal Design Examples

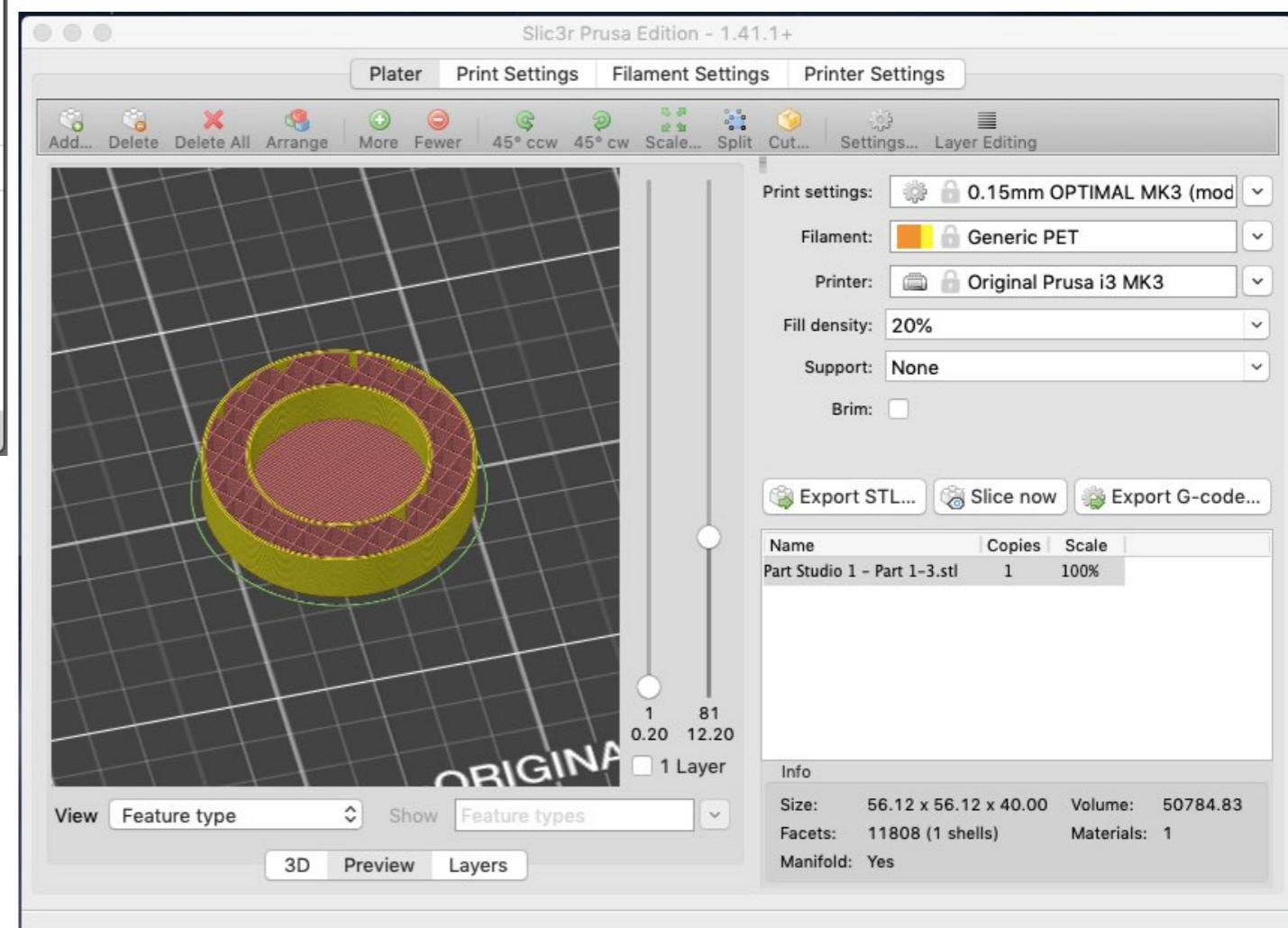
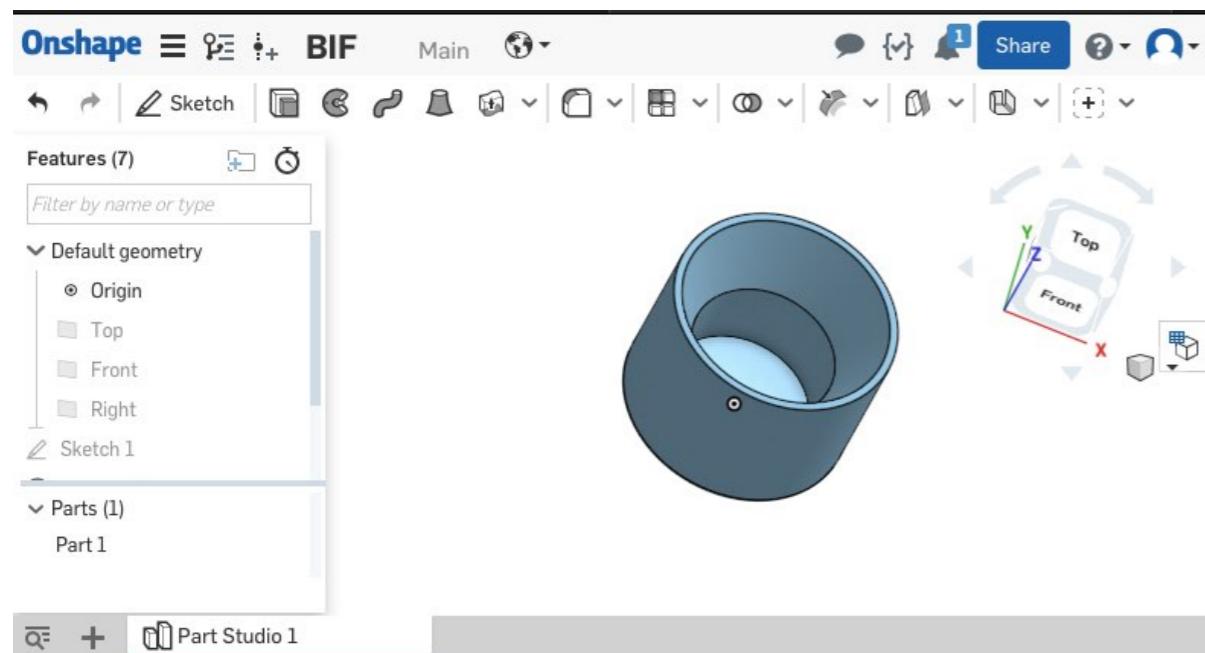


Personal Design Examples



Example Design

In this live 5 minute demo, we fired up a CAD application (onshape.com), created a very simple 3D model, exported the model as an STL file, then imported that STL file into a “slicer” application (slic3r.org) to prepare it for printing.



Live Print

During the presentation, the Prusa i3 MK3 printer was busy printing a simple kitchen “device”; a chip bag clip.

It should be noted that an FDM 3D printer takes a LONG time to print anything useful. Our simple, tiny bag clip took 45 minutes to print. Many of the objects I’ve printed take 6 to 10 hours (or more) to print. One can hardly become a “manufacturer” at those rates, but it’s a great tool for solving problems around the home.

