

From 3D Printing and Personal Fabrication to Personal Design



Today

- Personal Fabrication: Concepts and tools
- Fab Labs
- Personal Design and HCI



The 3rd Digital Revolution?



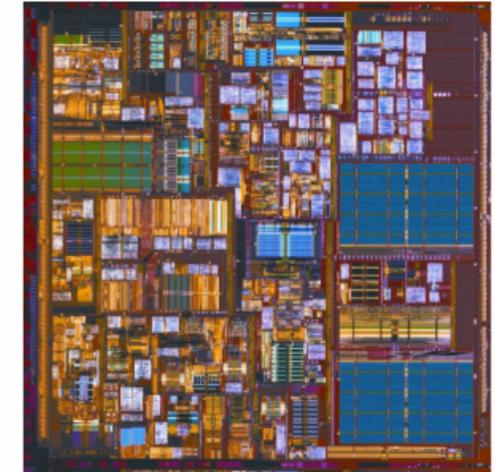
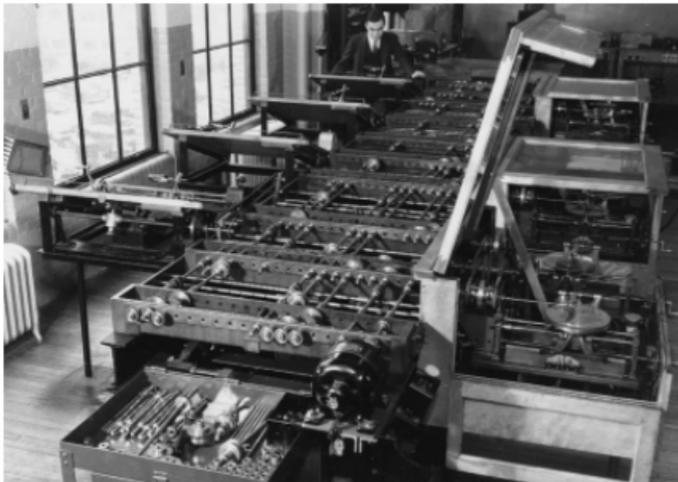
Digital Revolutions



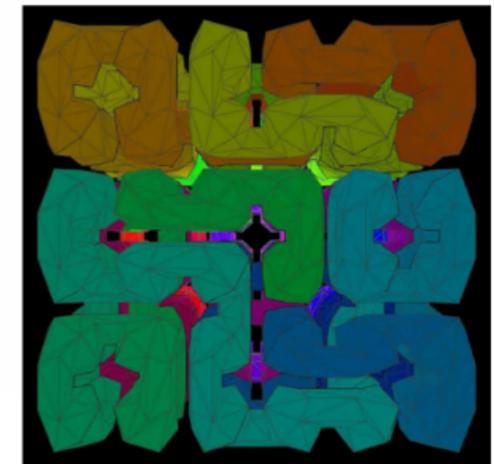
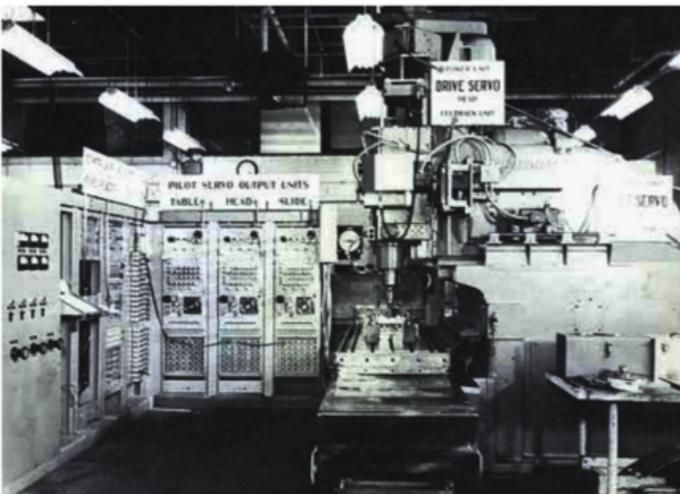
analog → digital communication
~1945



analog → digital computation
~1955

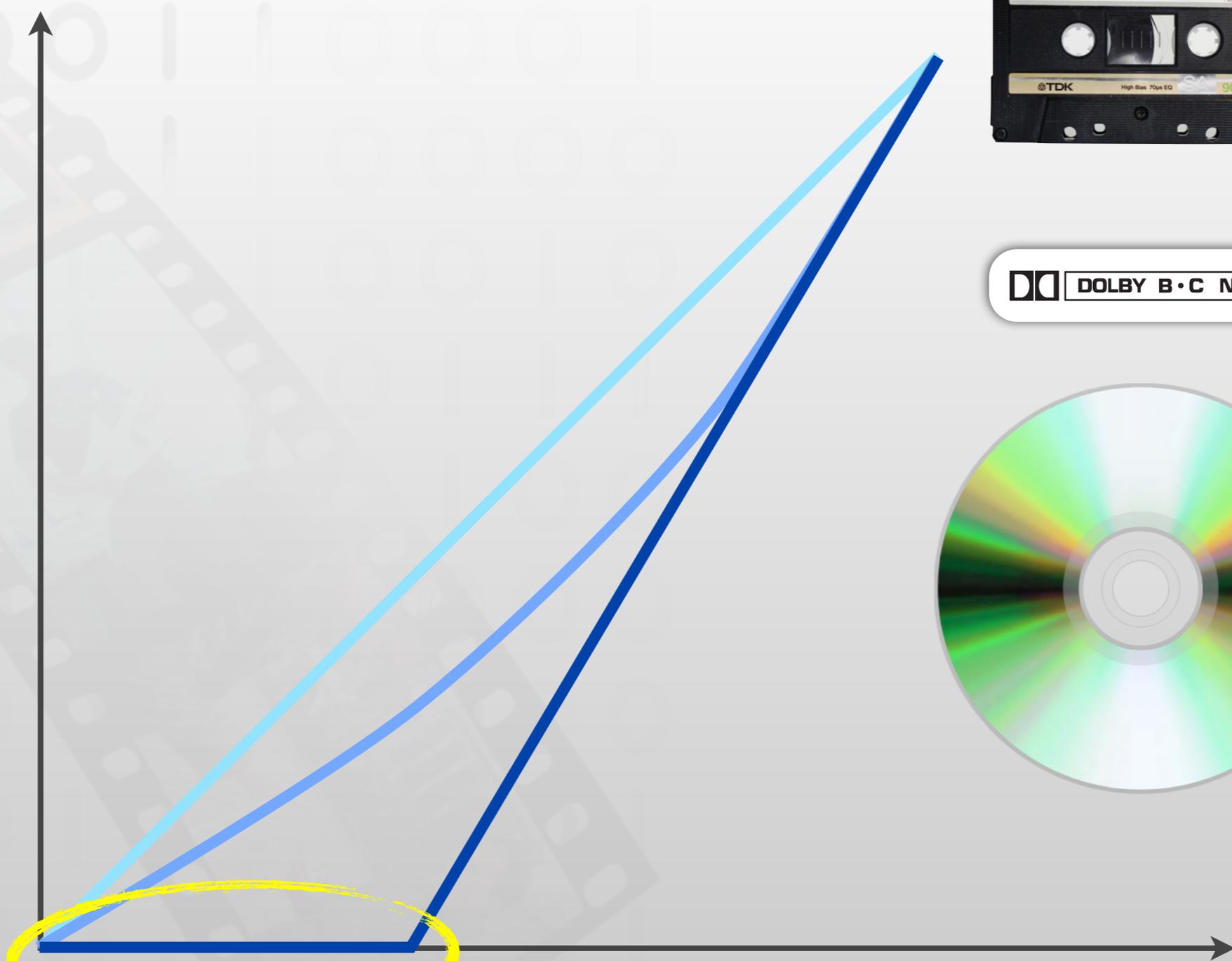


analog → digital fabrication
~2005

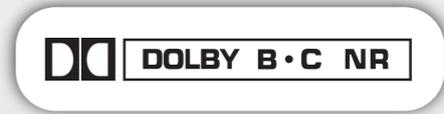




Errors



Analog



Analog+



Digital

After Gershenfeld 2010

Noise



lossless

fast

cheap

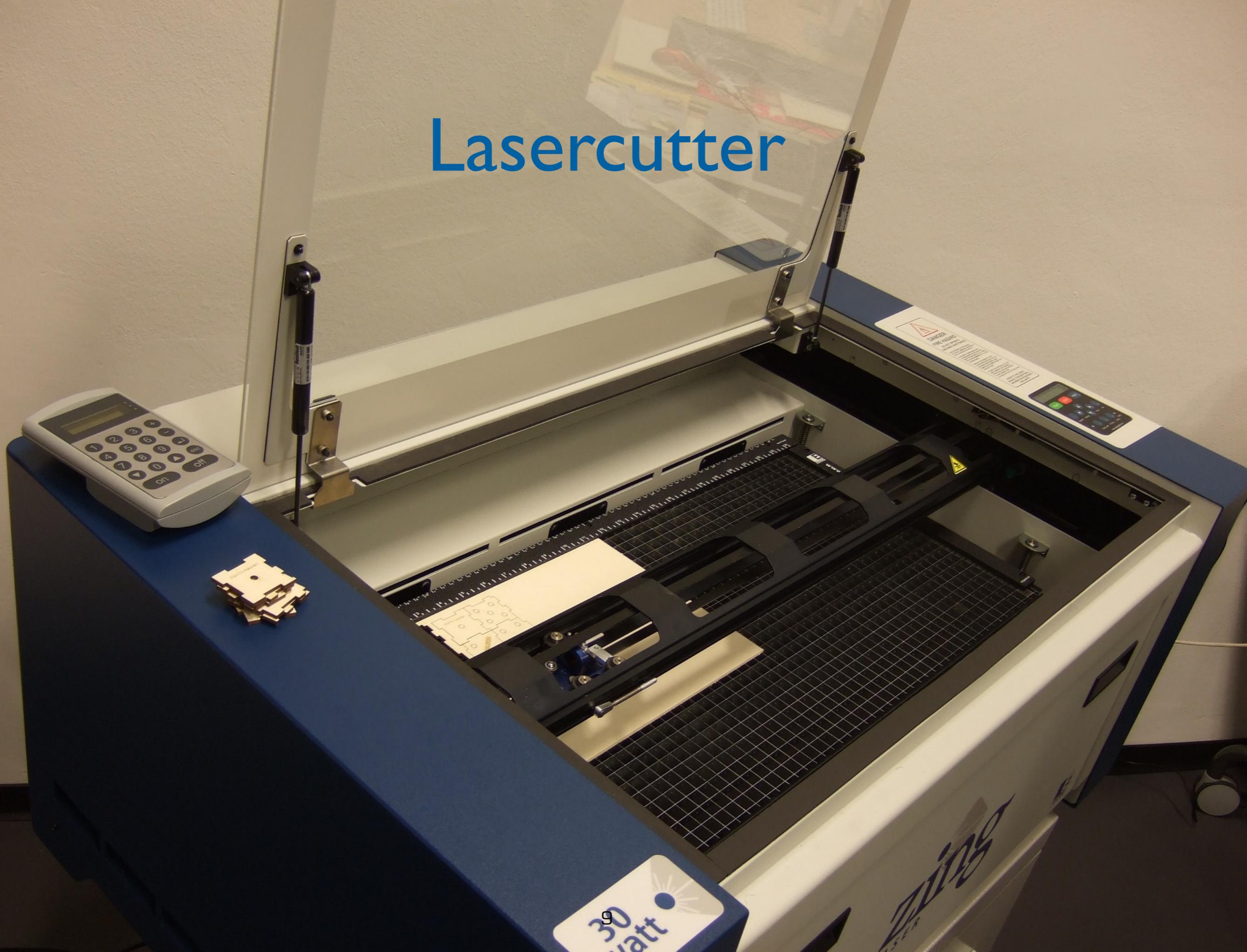


Personal Fabrication (Fabbing)

- Personal, digital fabrication of goods
- Personalizable to individual needs unlike mass-market products
- Largely missed by corporate world until now



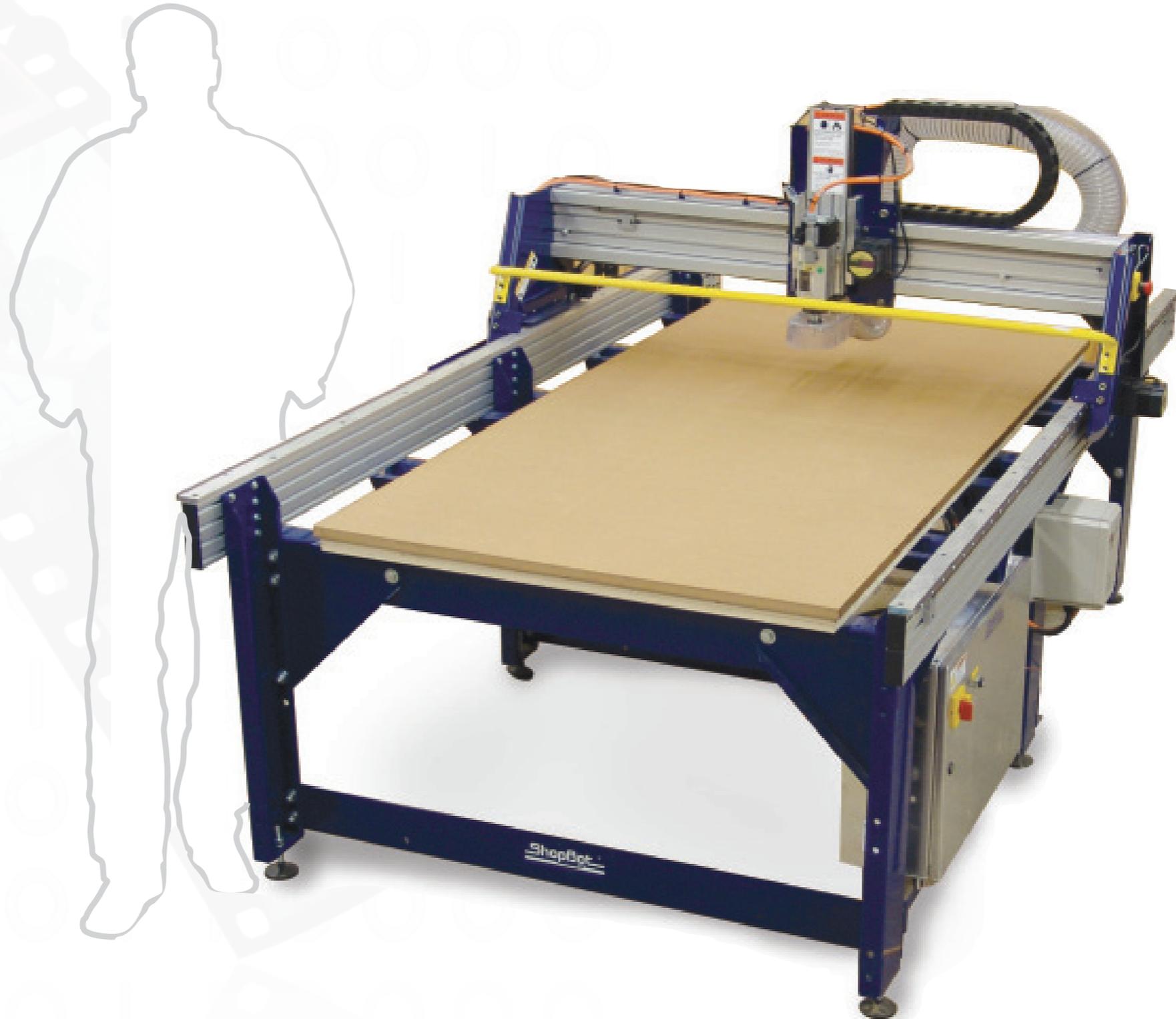
Lasercutter



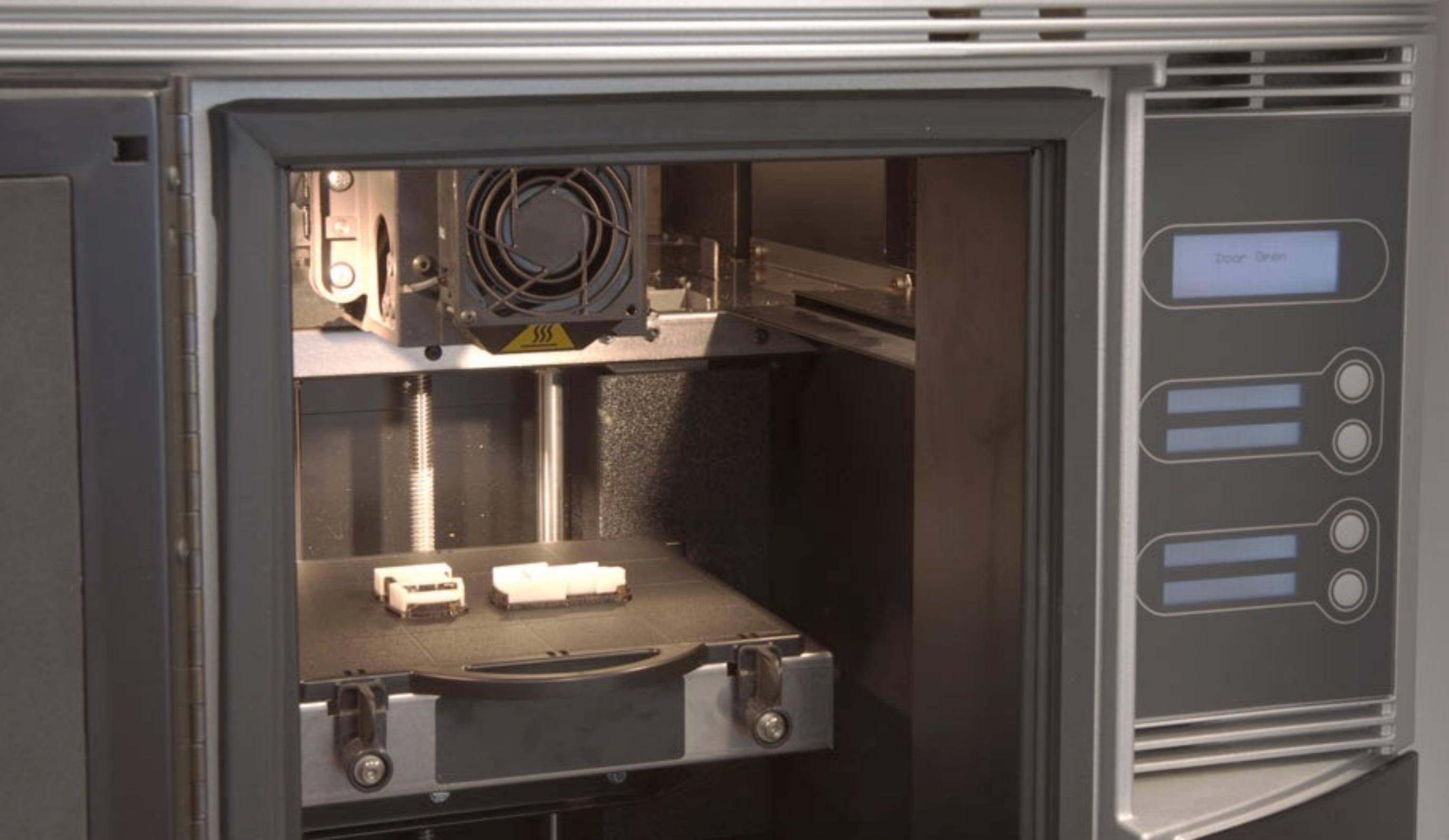


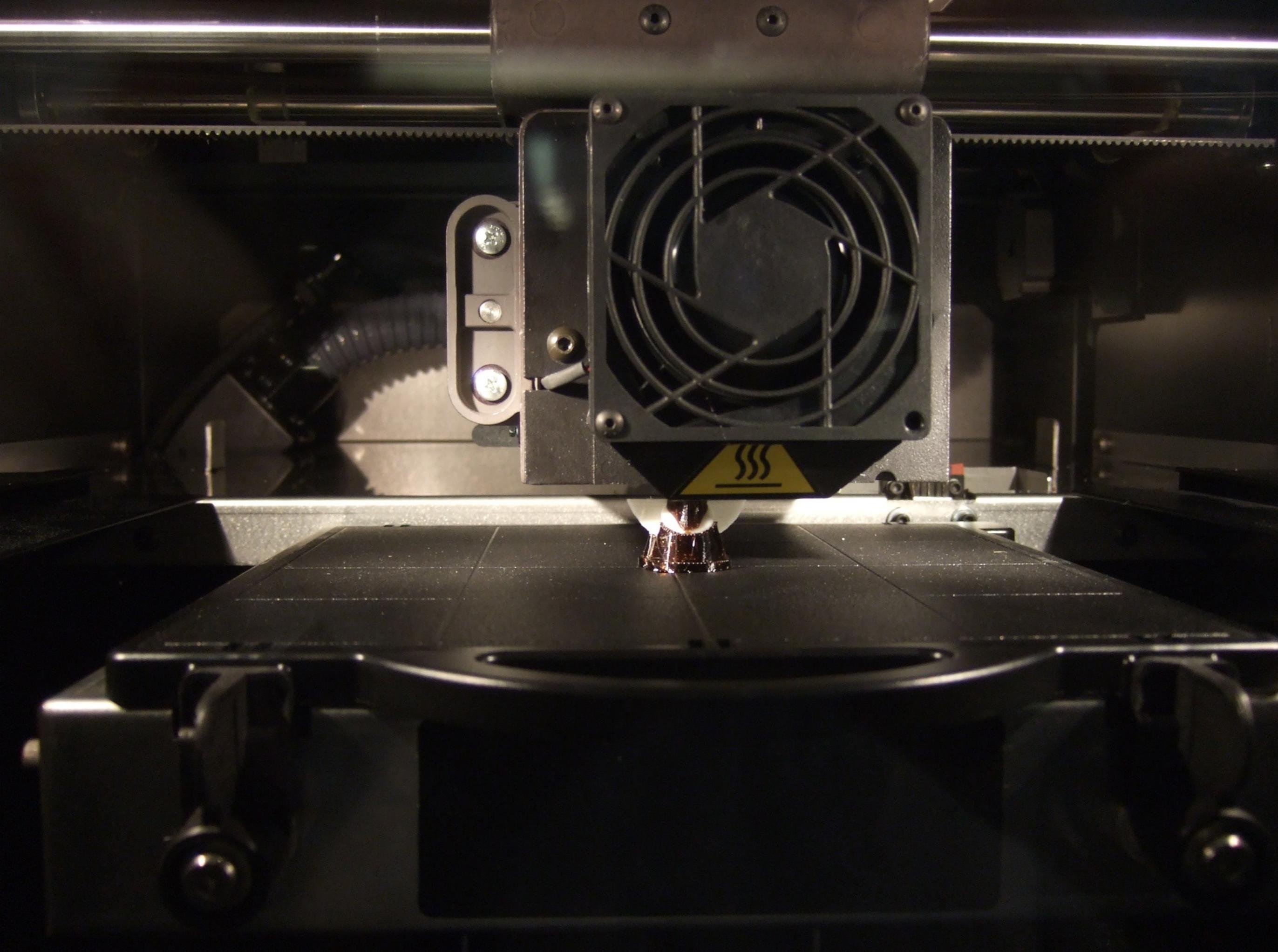
fablab.rwth-aachen.de

CNC Router

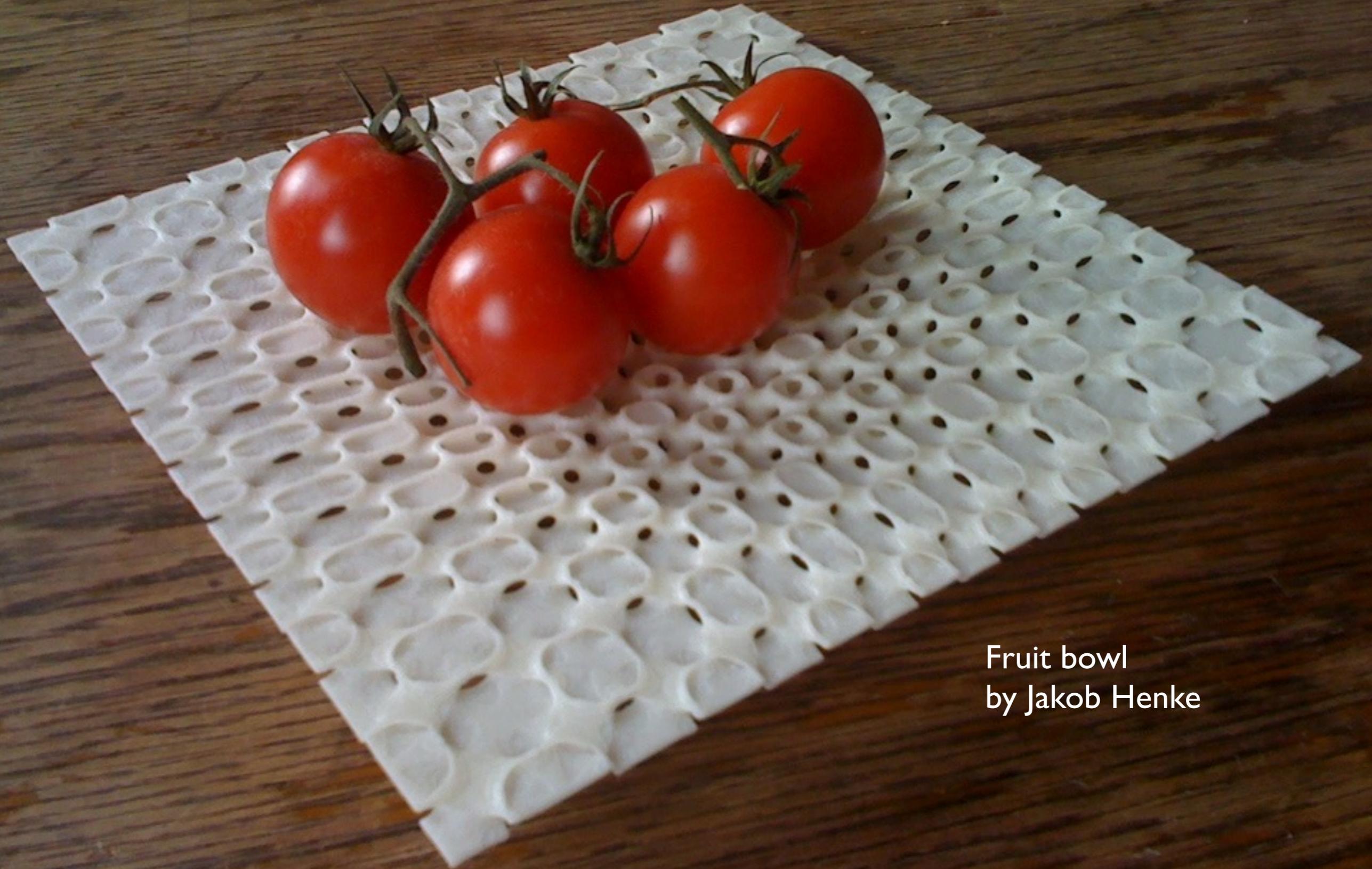


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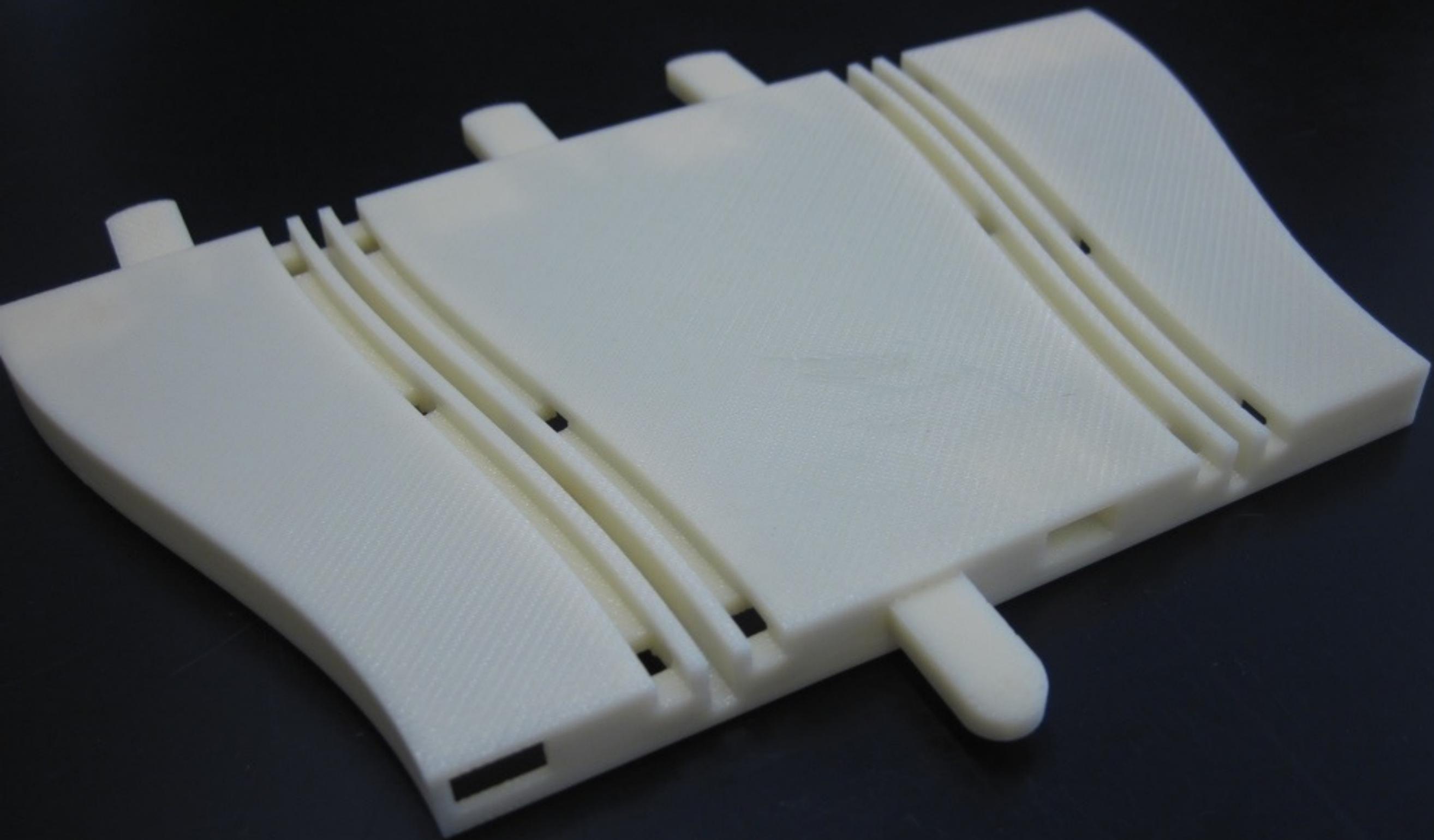


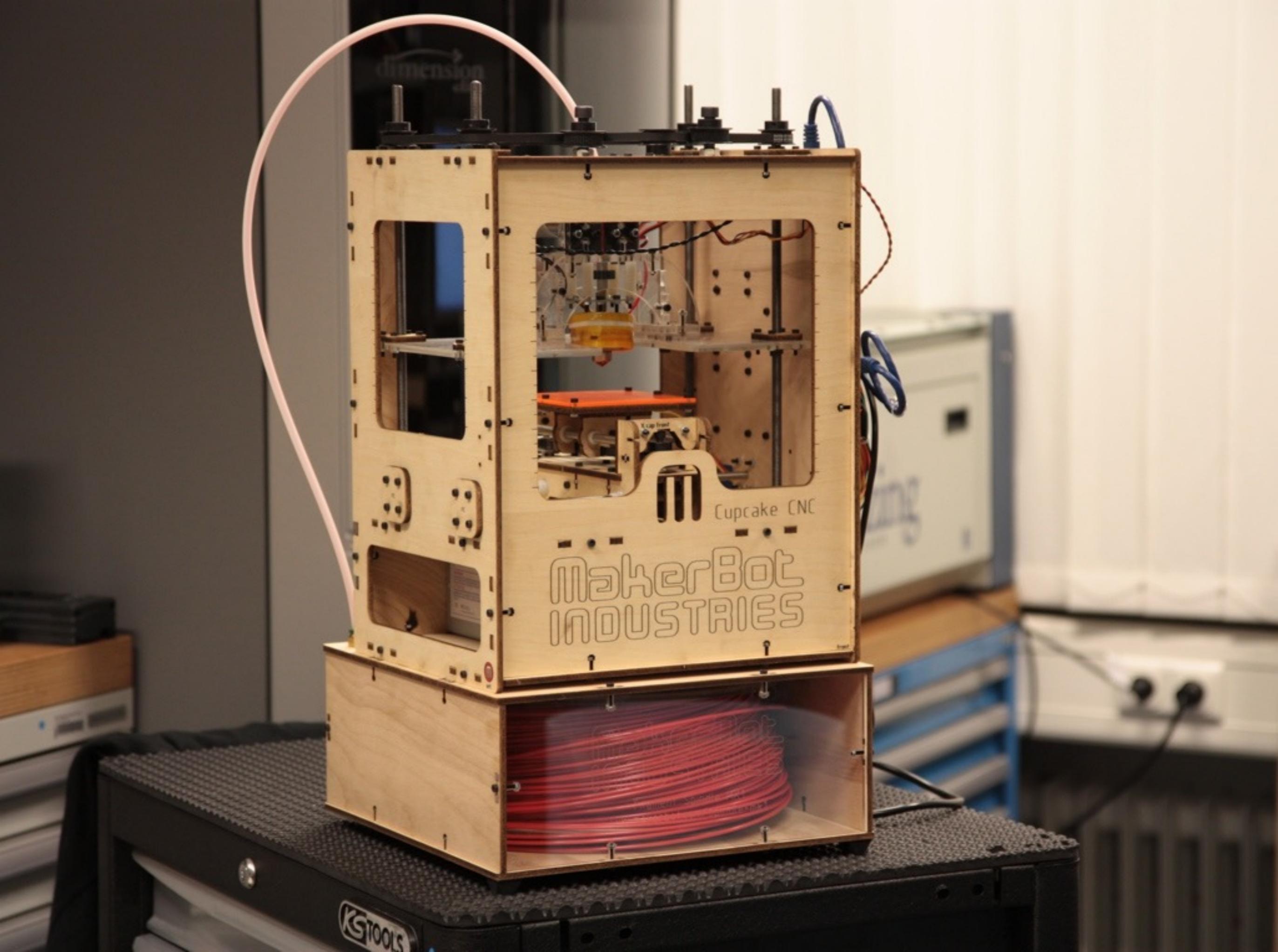






Fruit bowl
by Jakob Henke

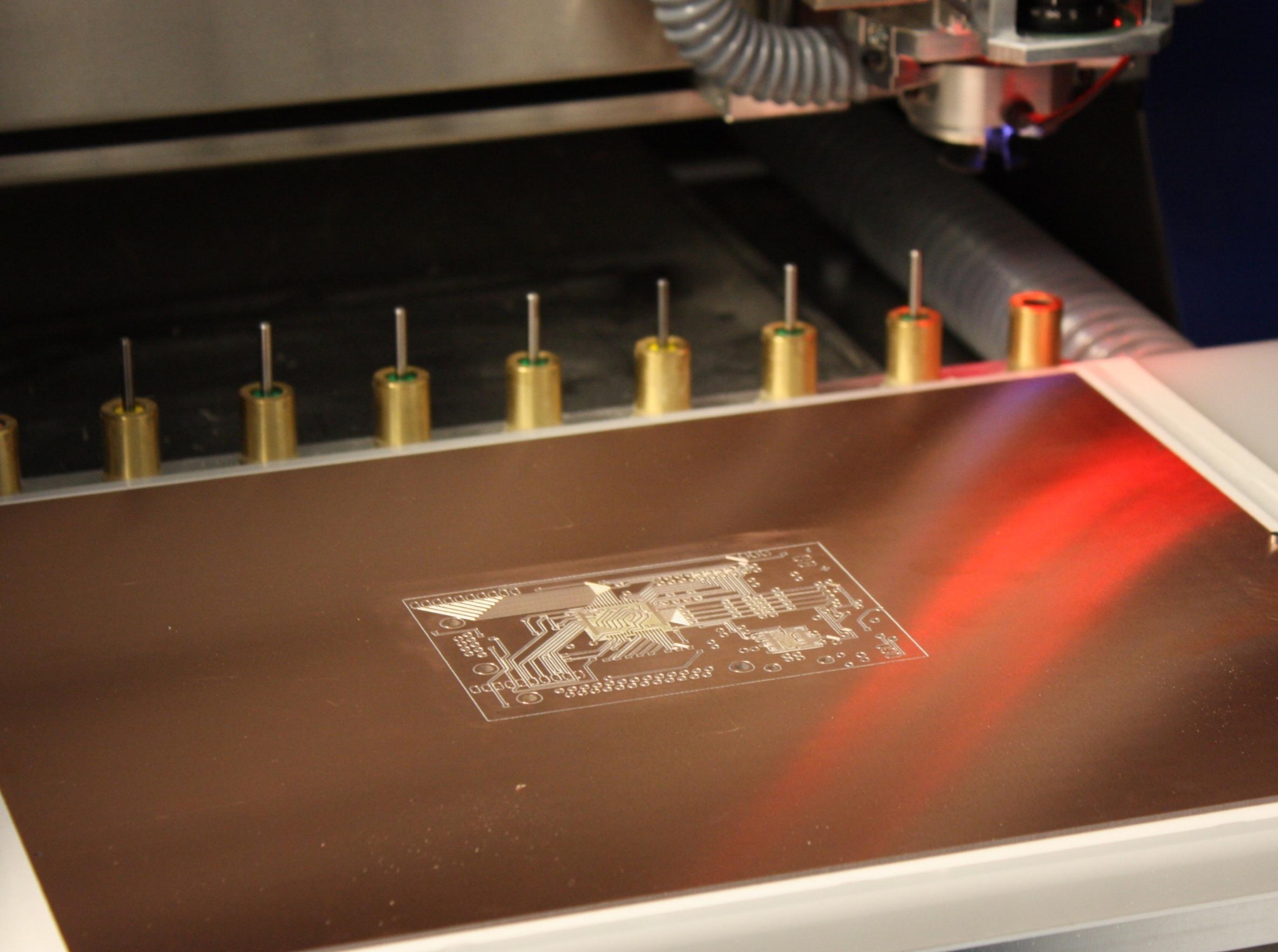


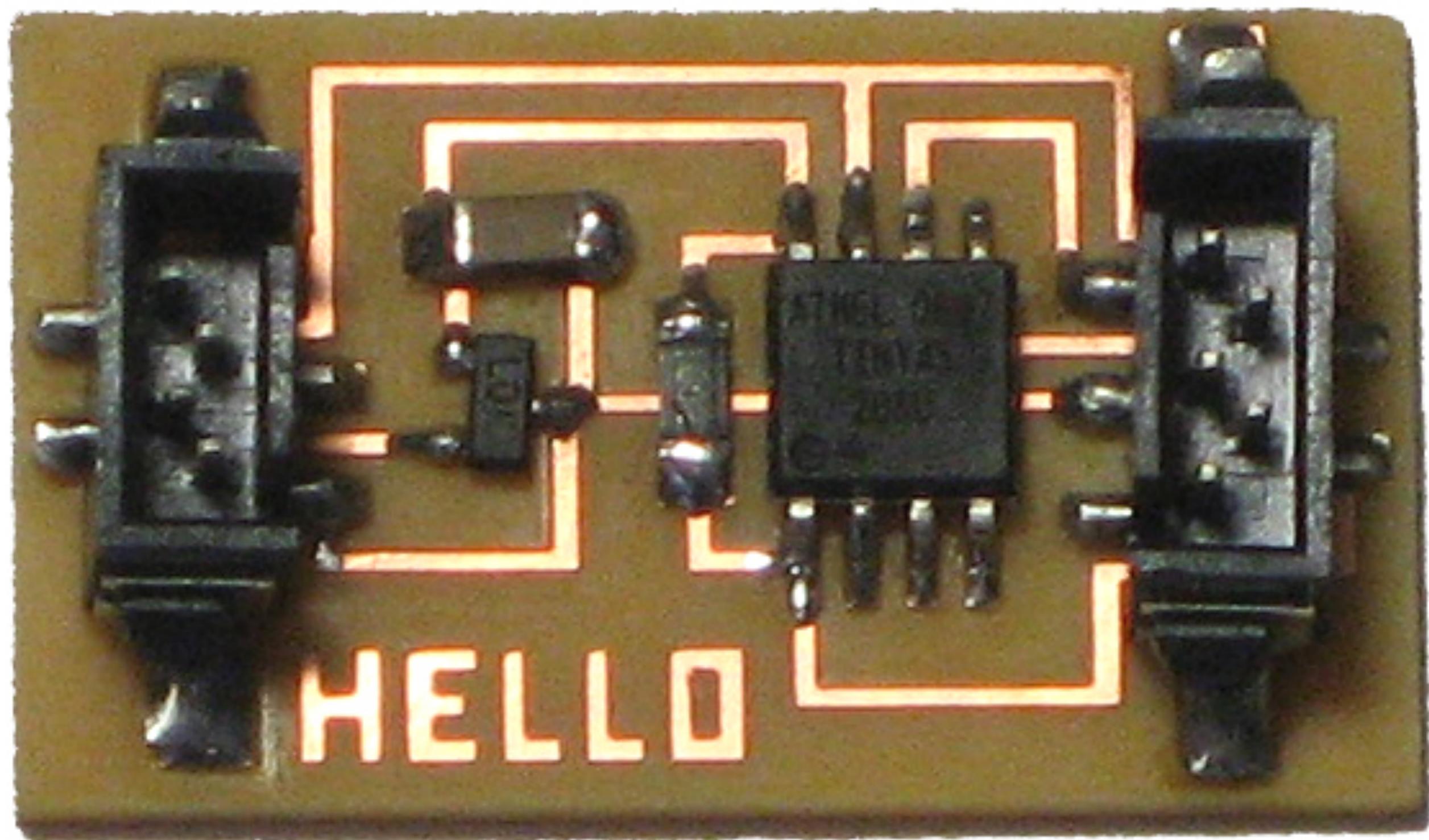


Cupcake CNC

MakerBot
INDUSTRIES

K&S TOOLS



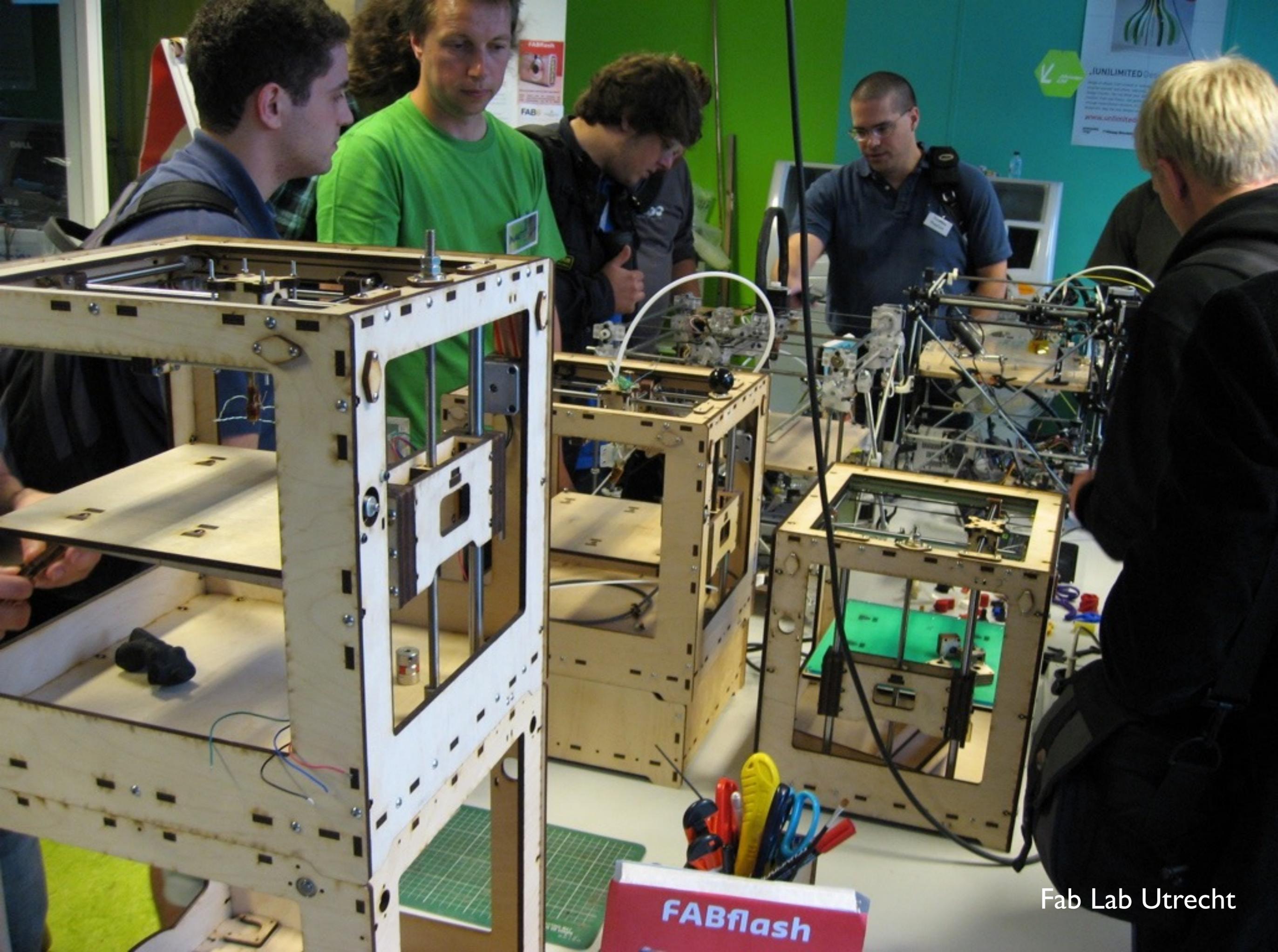


HELLO

Four Stages

- Fab 1.0: Expensive digital machines on dumb materials
- Fab 2.0: Easily replicated machines that make (MTM)
- Fab 3.0:, 4.0: Smart, self-arranging (replicating?) materials





FABflash

Fab Lab Utrecht



makeyourbot.org

Physical Literacy

- Correcting historical error (“liberal arts” excluded making stuff)
- Reunite arts and artisans, creator and consumer



Impact on Society



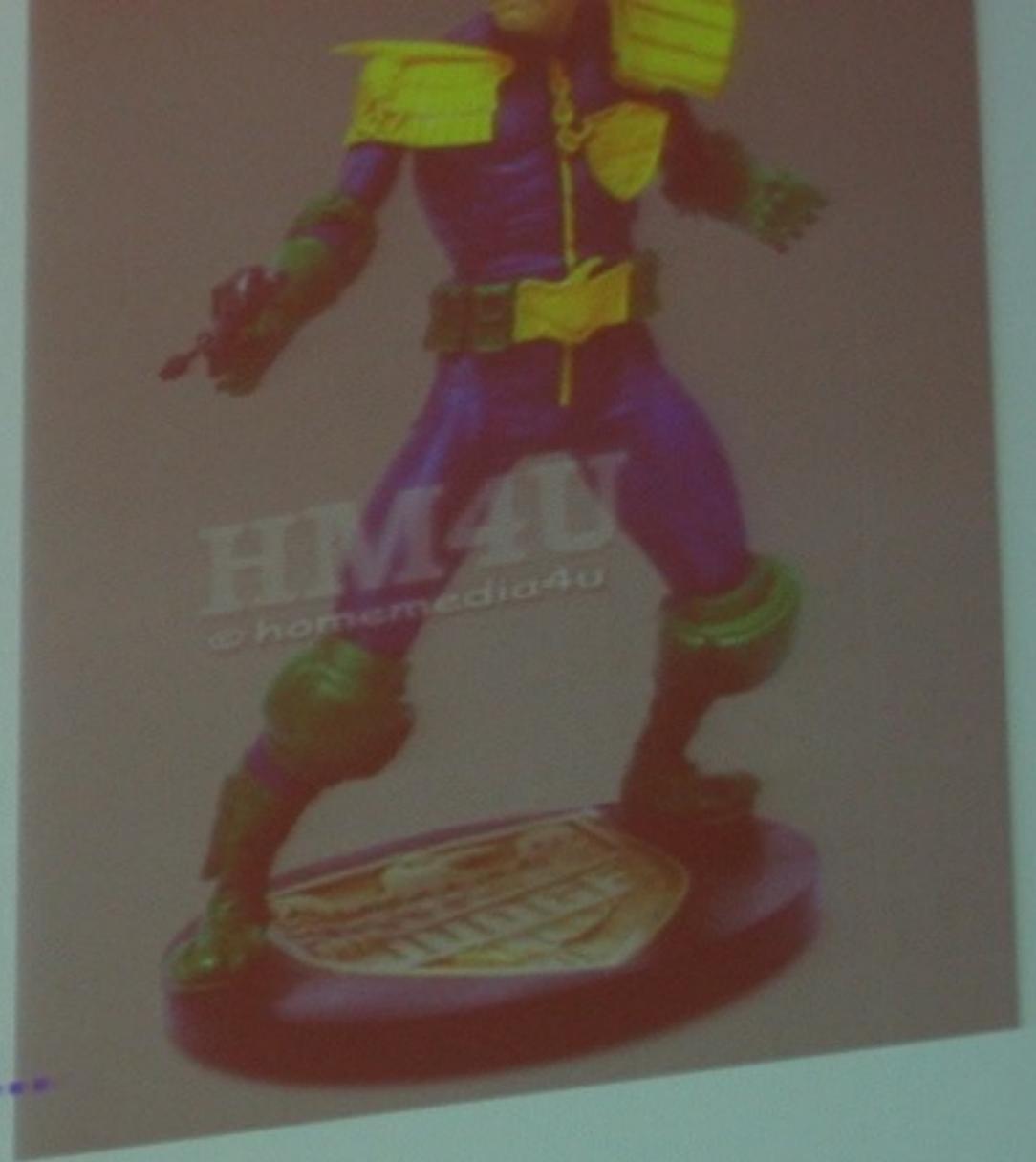
<http://www.bbc.co.uk/news/technology-22423883>

Source: hackaday



The Law

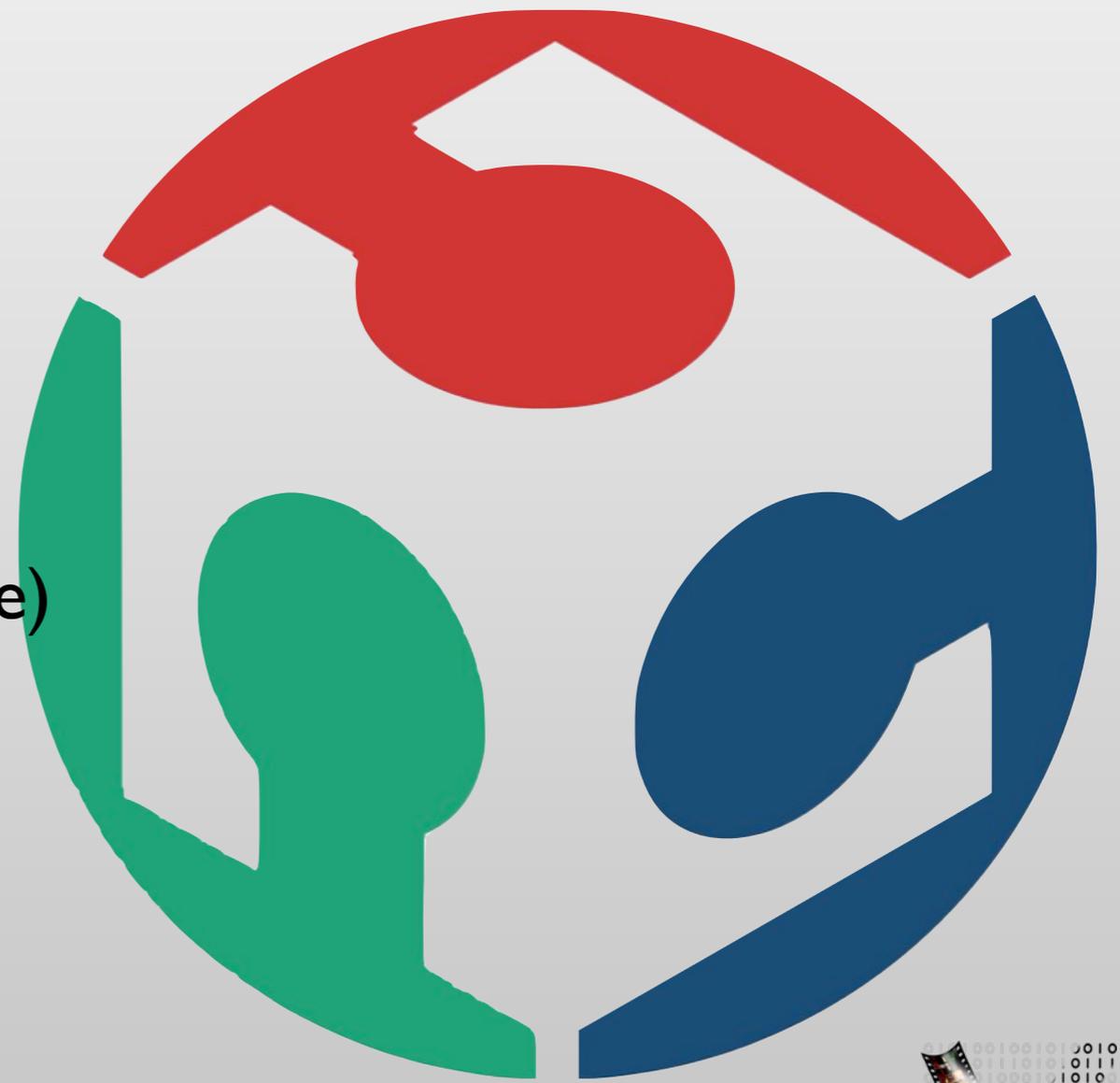
- 1 You can't infringe trademarks
- 2 You can't forge (pass off)
- 3 You can't make copyright figurines
- 4 You can't include copyright artwork
- 5 You can't **sell** patented items
- 6 You can pretty much do anything else...



S Bradshaw, A Bowyer and P Haufe, "The Intellectual Property Implications of Low-Cost 3D Printing", (2010) 7:1 SCRIPTed 5, <http://www.law.ed.ac.uk/ahrc/script-ed/vol7-1/bradshaw.asp>

Fab Labs

- Free, open access
- Teach “revolutionary” skills
- Community based
- 432 around the world (240 in Europe)
- Fab Lab Aachen: Germany’s first
- <http://fablab.rwth-aachen.de>

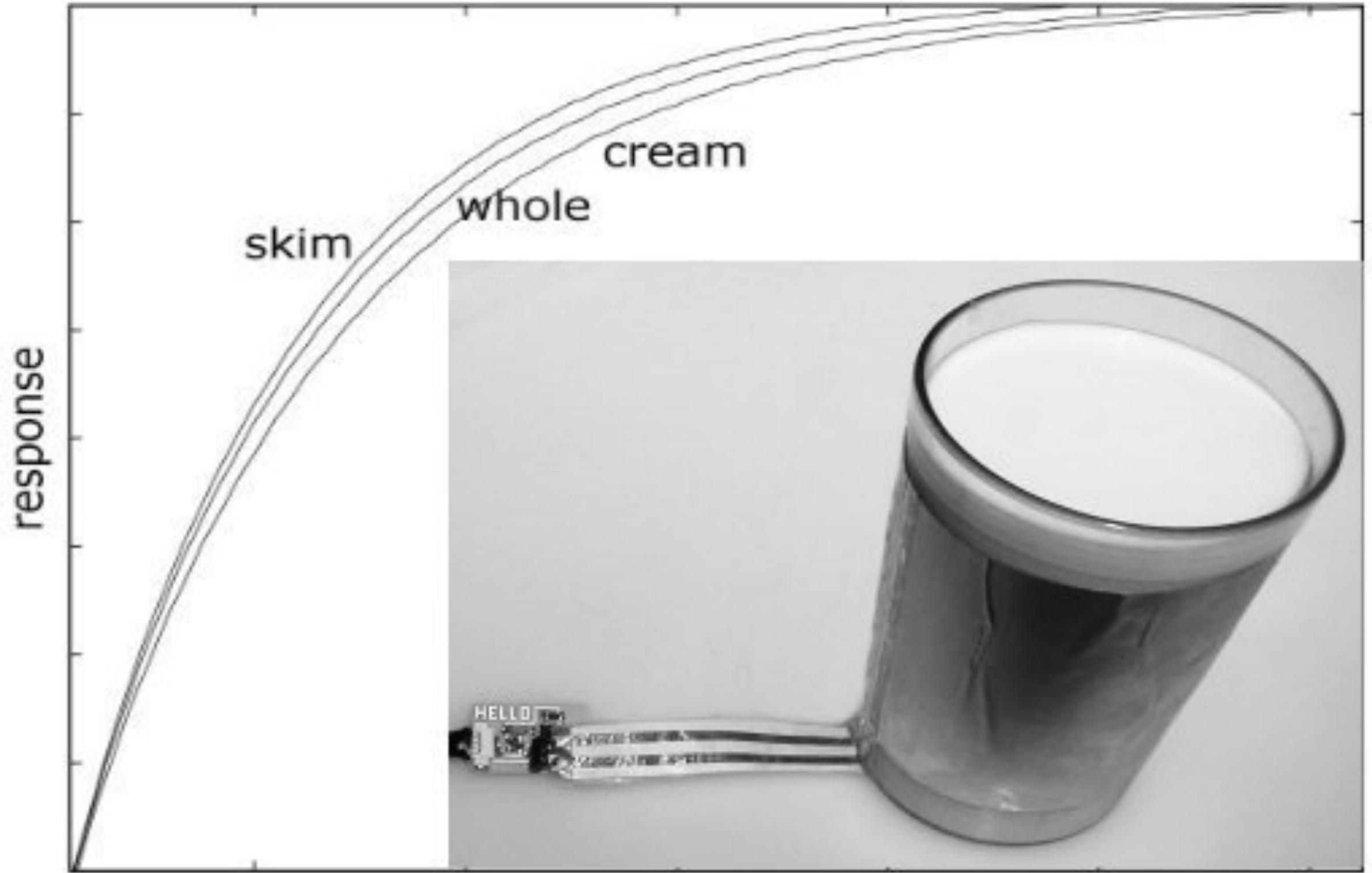


we make things
no war



Fab Lab Afghanistan







FABLABHOUSE

IaaC | CBA | Fab Lab

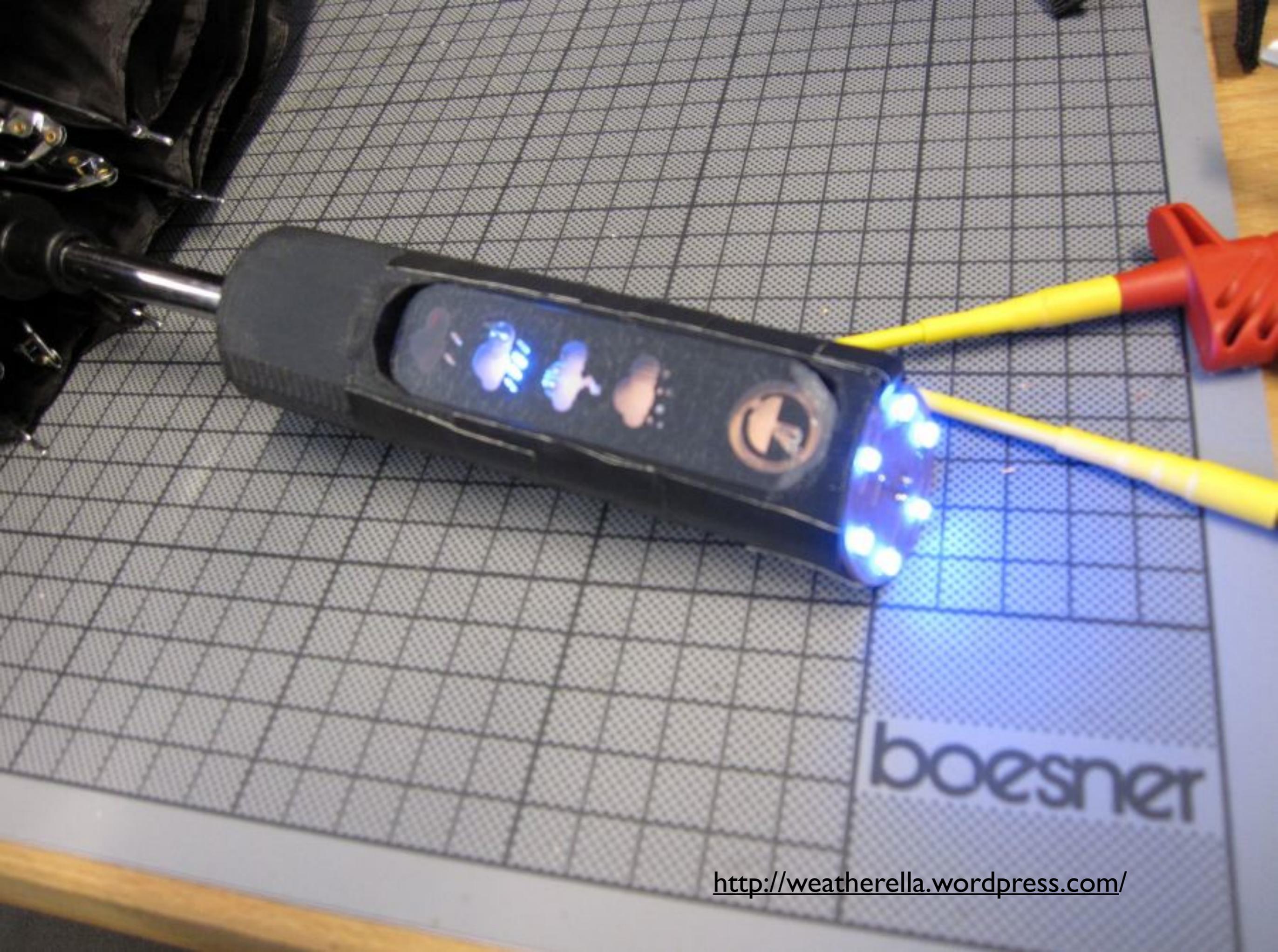
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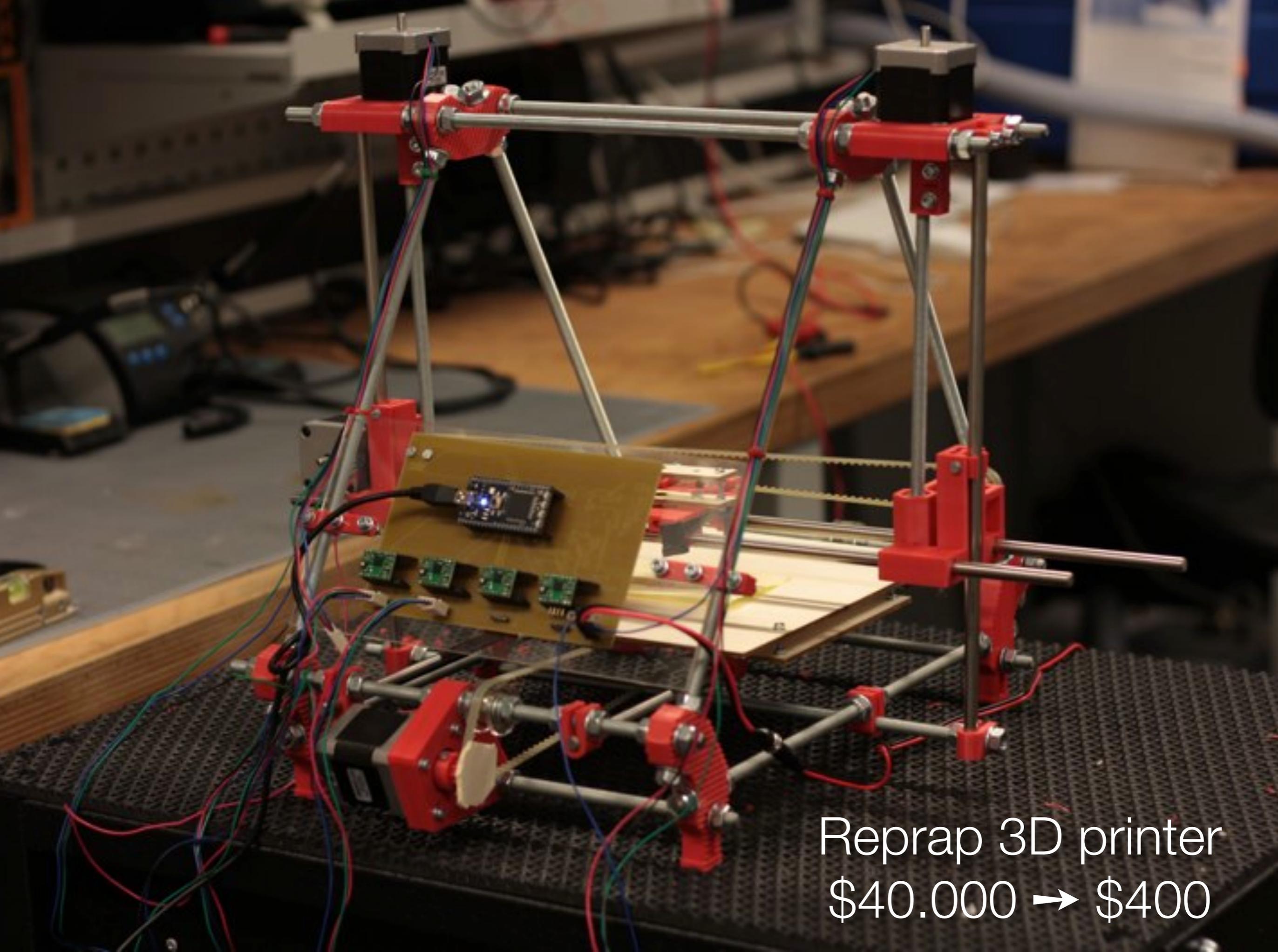
Personal Fabrication *Enables* New HCI Design/Research/Teaching Practices





Personal Fabrication *Requires* New User Interfaces

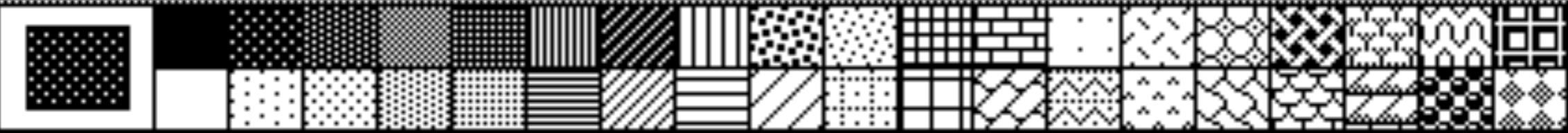
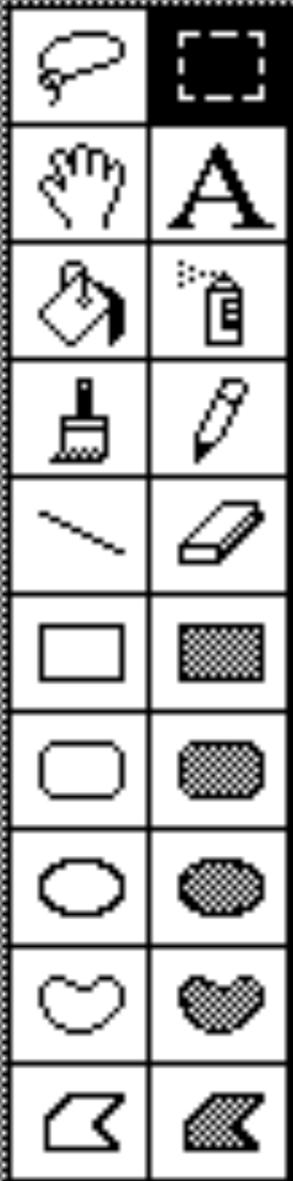




Reprap 3D printer
\$40.000 → \$400



Altair: \$397 (1975)



<http://www.thingiverse.com/thing:1005>

a MakerBot Industries website

THINGIVERSE

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Thingiverse is a place to share digital designs that can be made into real, physical objects. Let's create a better universe, together!

[UPLOAD A THING](#)

FEATURED

Lego Compatible Disc Buttons

Created by [clothbot](#)

Created on Sep 13, 2009

Featured on Sep 14, 2009

How do you make a great idea like Makerbot-printable (clothing) buttons better?

Why, make them Lego Compatible! Naturally.

Update 2009/10/04: In the design files, the knobs are 5mm in diameter. I remeasured my source Lego disc after getting back some Shapeways test prints and the Lego knobs are actually closer to 4.8mm in diameter. I lucked out with my MakerBot-printed buttons; shrinkage brought them down to about 4.9mm in diameter. The Shapeways printed versions are more accurate, 5.00mm diameter, +/- 0.05mm. There's enough give in the plastic materials for them to still fit 'regulation size' lego blocks, but the metal one was simply too wide a diameter.

Update 2009/11/07: I've been playing around with OpenSCAD (<http://www.openscad.org/>) and came up with the attached DiscButton_20091107 variation. I even added bottom "sockets" to this variation. It's almost too easy when it's all code!

Disclaimer: LEGO is a trademark of the LEGO Group and these explorations are in no way associated with LEGO Group. Heck! The files are CC-licensed; nothing to stop them embracing and extending it themselves if they so chose! ;-)

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DiscButton.stl
 2 mb / 361 downloads / 2 years ago

Instructions
 0. Download the STL. It prints four buttons.

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[The 3D Printer](#)

Make awesome stuff.

Flat is boring. Capture your world in 3D with free Autodesk 123D apps.

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123D

Design stuff you really want to make, send it straight to a 3D printer.

123D Catch

Automatically convert ordinary photos into extraordinary 3D models.

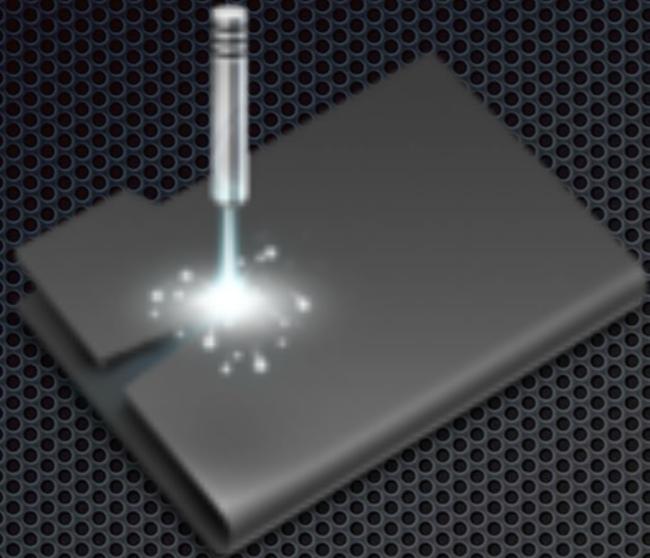
123D Sculpt

Shape and paint digital clay into amazing 3D sculptures on your iPad.

123D Make

Transform 3D models into a pattern for assembling real artful creations.

VisiCut



- The VisiCalc of LaserCutting
- Open-source, free
- <http://hci.rwth-aachen.de/visicut>

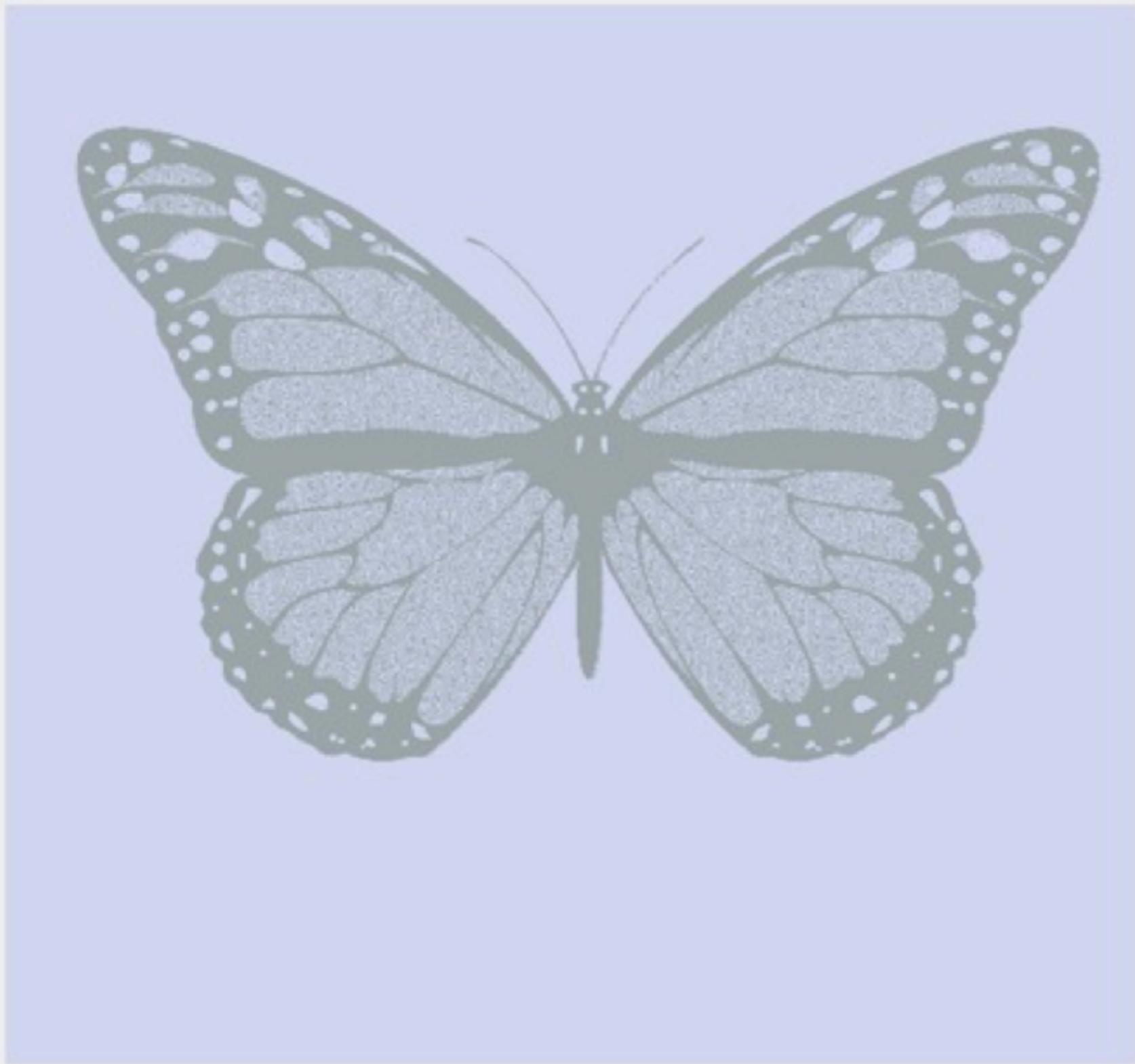
Full Preview

Cutting Preview

Zoom: 517

Capture Foto

Preview



Laser Cutter



Epilog ZING @
Fablab



Material



Acrylic Glass



Total Height

3.0 mm

Dimensions

600 x 300 mm

Mapping

Engrave



Custom

Estimated Time:

00:08:10

Calculate

Execute

FabScan (RWTH)

hci.rwth-aachen.de/fabscan



\$ 110

FabScan

<http://hci.rwth-aachen.de/fabscan>

hci.rwth-aachen.de/fabscan



Jan Borchers, RWTH Aachen University: Personal Design



FRONT: Sketching Furniture (2007)

Cassius Lamp
(AEC '09)





Sketch Chair
(Greg Saul, 2010)

Food

Furniture

Consumer
electronics

(Copyrighted)
Toys

Weapons

WHAT?

Replacement parts

Prosthetics

Art

Small-market gadgets



3D Scan

AI, Assistants, Templates

CAD

Crowdsourcing

HOW?

Parameterization

Download/Query

Gesture

Touch&Haptics



Personal Design vs. Personal Fabrication

	Local Design	Outsourced Design
Local Fabrication	AutoCAD +RepRap	Thingiverse
Outsourced Fabrication	Shapeways	Traditional



HCI Research Topics

- Tools for HCI Research
 - Examples: SLAP, Madgets, Pneumatic Displays (CHI 2009)
- Software for Fabrication
 - 123D Make (Autodesk)
 - SketchChair.cc (Igarashi)
- New Interactions for Fabrication (beyond CAD)
 - FreeD
 - Constructables



D-Coil: A Hands-on Approach to Digital 3D Models Design

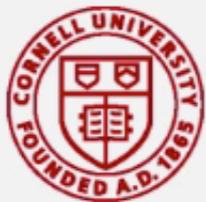
- Huaishu Peng, Amit Zoran, and François V Guimbretière, CHI 2015
- Handheld actuated extruder device knows 3D model, uses wax coiling to bring tangibility to the design



D-Coil: A Hands-on Approach to Digital 3D Models Design

Huashu Peng¹
Amit Zoran²
François Guimbretière¹

¹ Cornell University
² The Hebrew University of Jerusalem

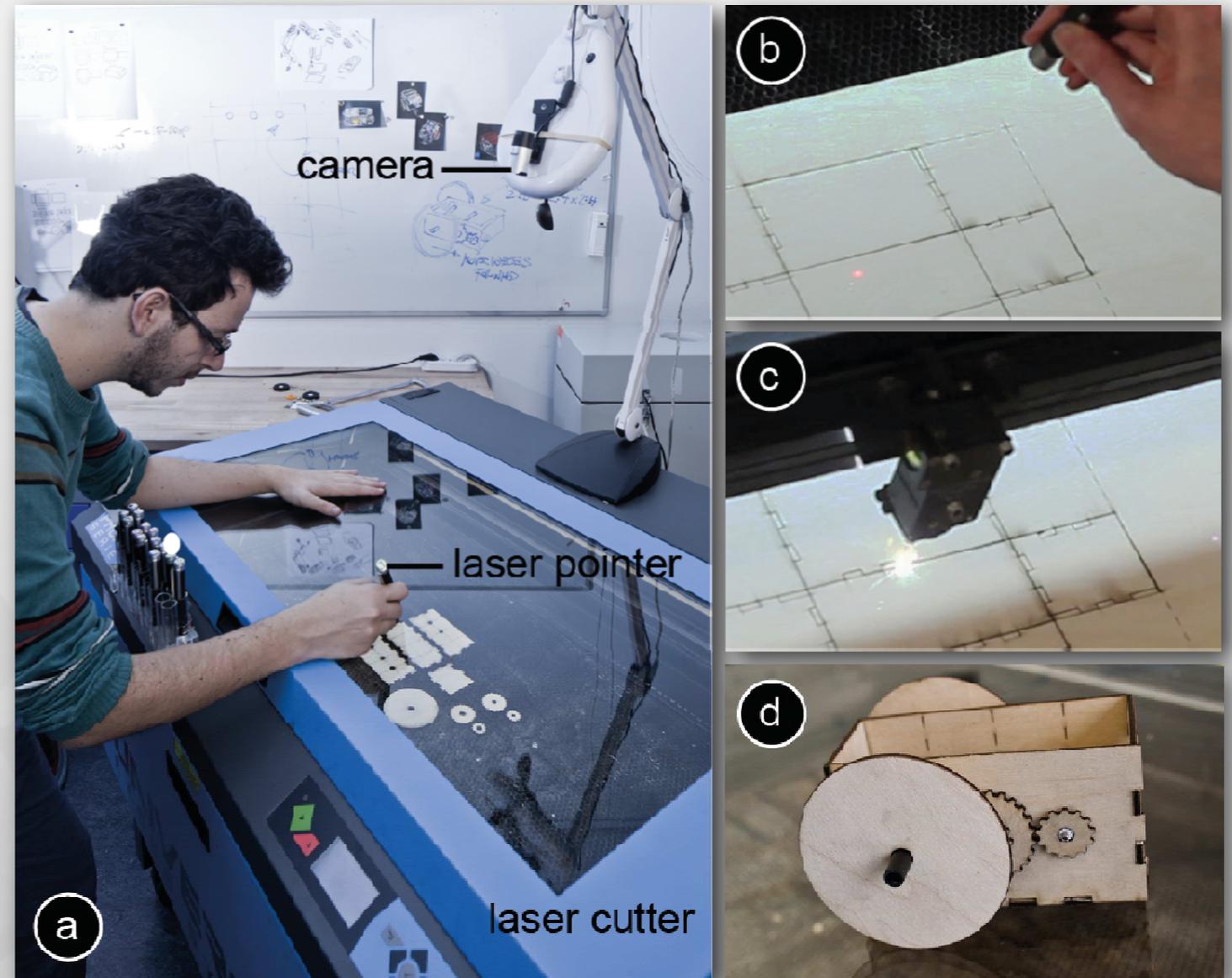


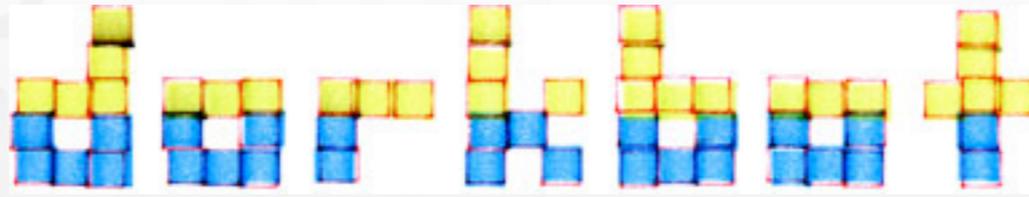
האוניברסיטה העברית בירושלים
The Hebrew University of Jerusalem



Interactive Construction

- Stefanie Mueller et al. (HPI), UIST 2012 (youtu.be/8g3LaF9oVFY)
- Use laser pointers to draw on material, lasercutter cuts interactively





- “People doing strange things with electricity”
- International network of people doing interactive art and electronic hacks
- We launched the Aachen dorkbot chapter in 2009
- Meetings every 3rd Wed of the month, here (room 2222)
- dorkbot.de



Tomorrow
19:00-23:00
Room 2222

