

From 3D Printing and Personal Fabrication to Personal Design

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Media Computing Group
RWTH Aachen University

Summer term 2016

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



Midterm Exam Reminder

- Next week: **14.06.2016**
- Start at **10:15**
- Duration: **60 minutes**
- Room: **AH IV**
- More information tomorrow in the lab



Today

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



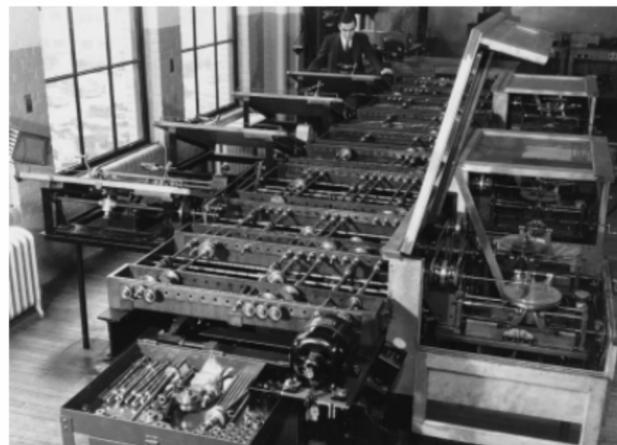
The 3rd Digital Revolution?



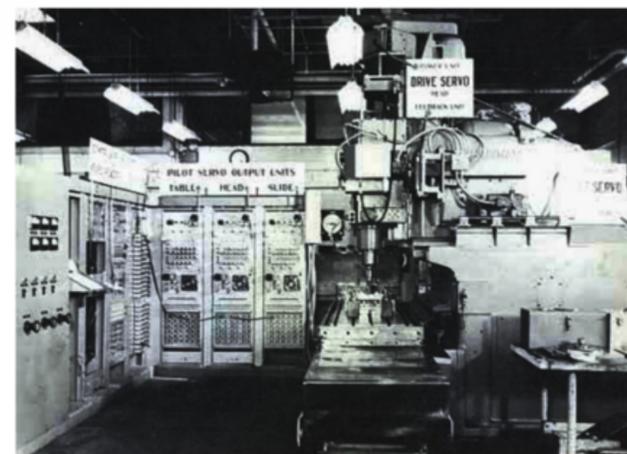
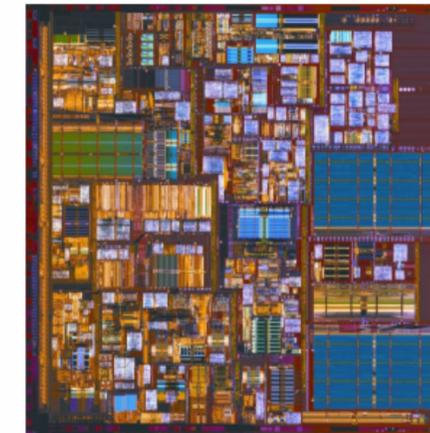
Digital Revolutions



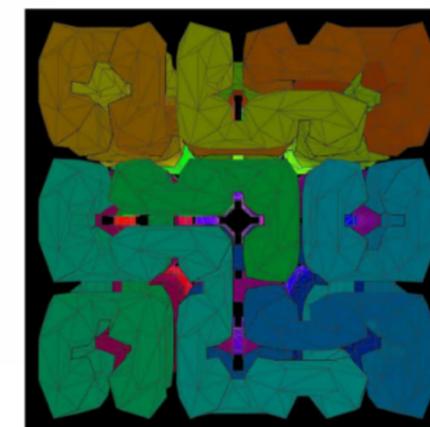
analog → digital communication
~1945



analog → digital computation
~1955

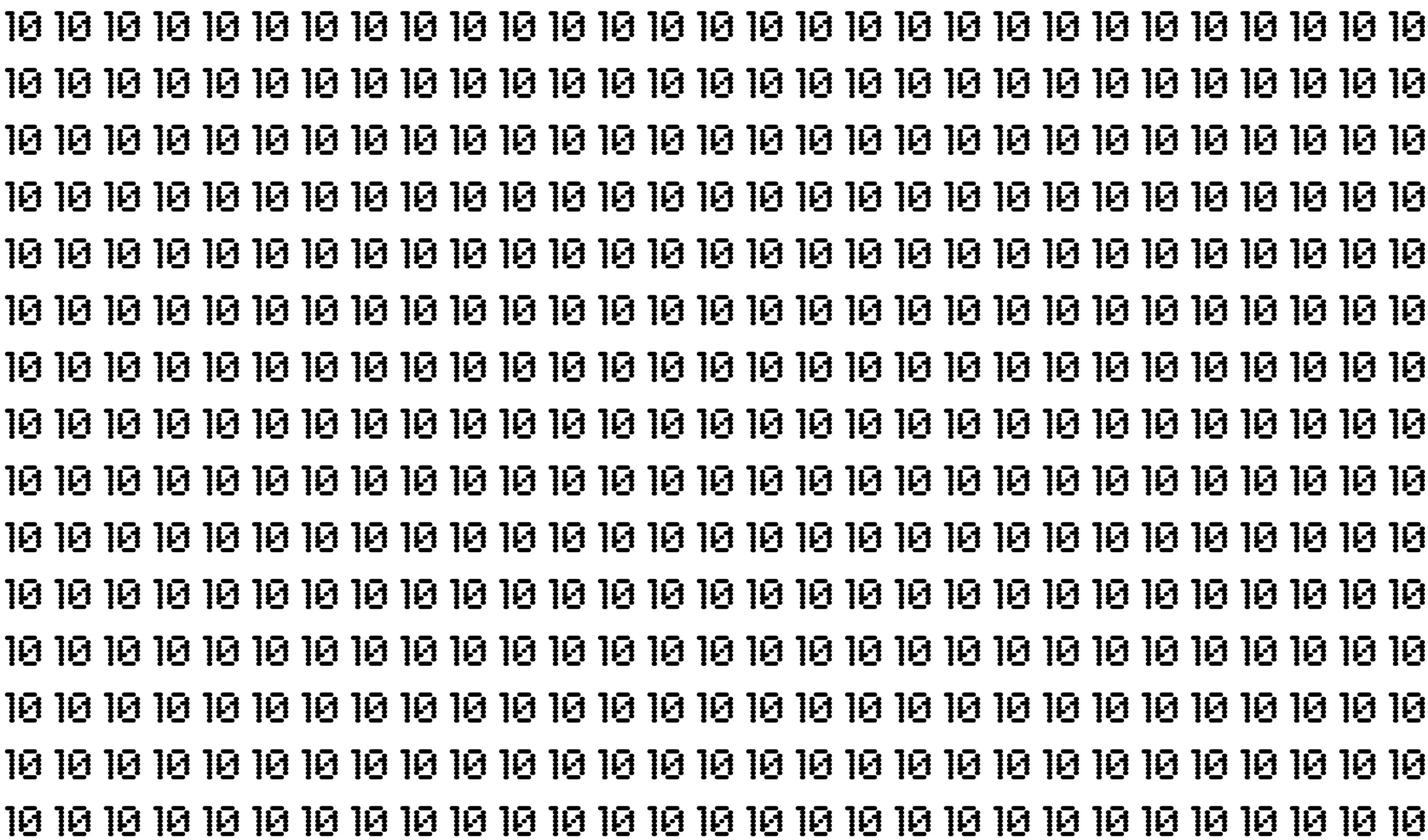


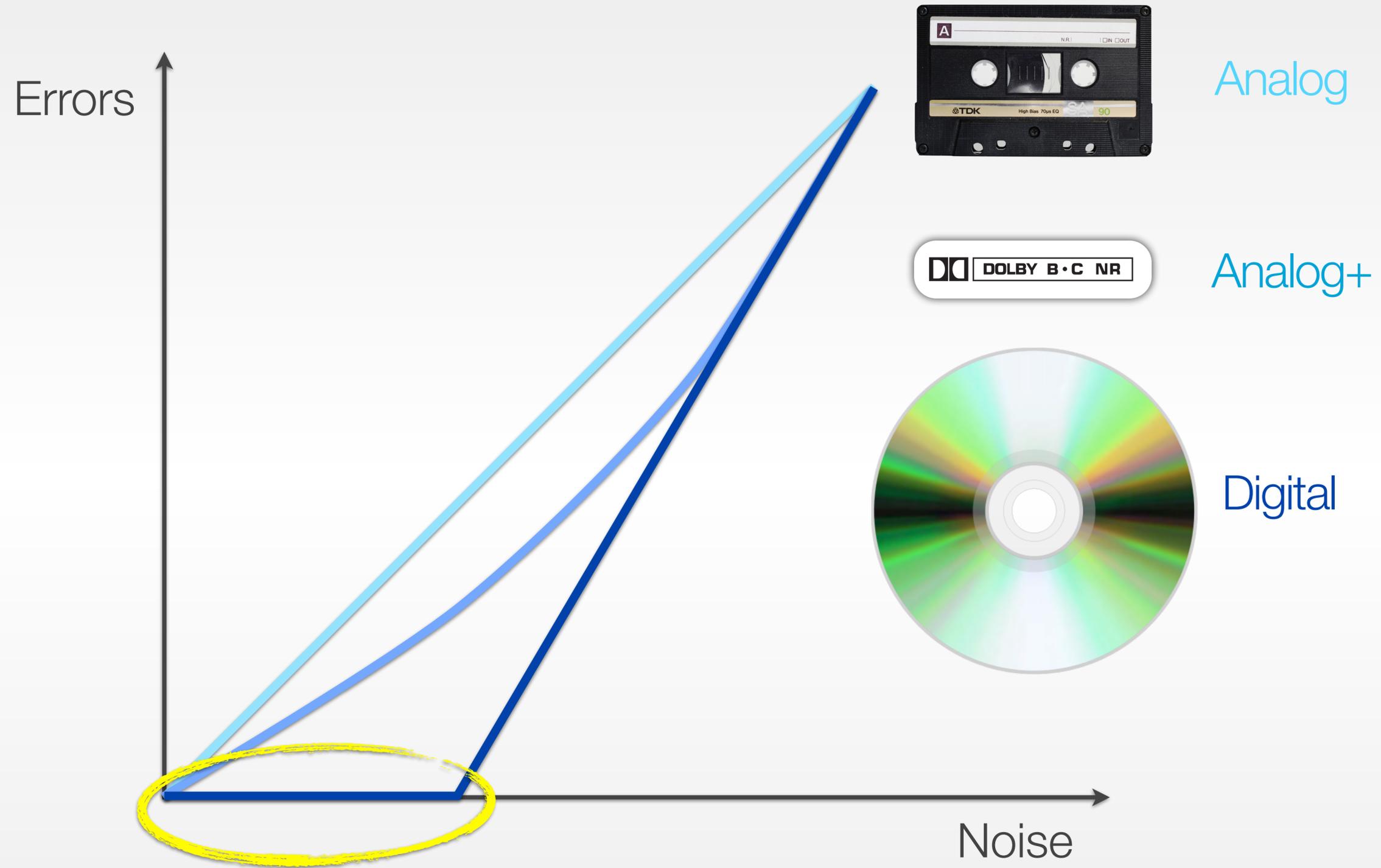
analog → digital fabrication
~2005



Source: Gershenfeld 2010







After Gershenfeld 2010



lossless

fast

cheap

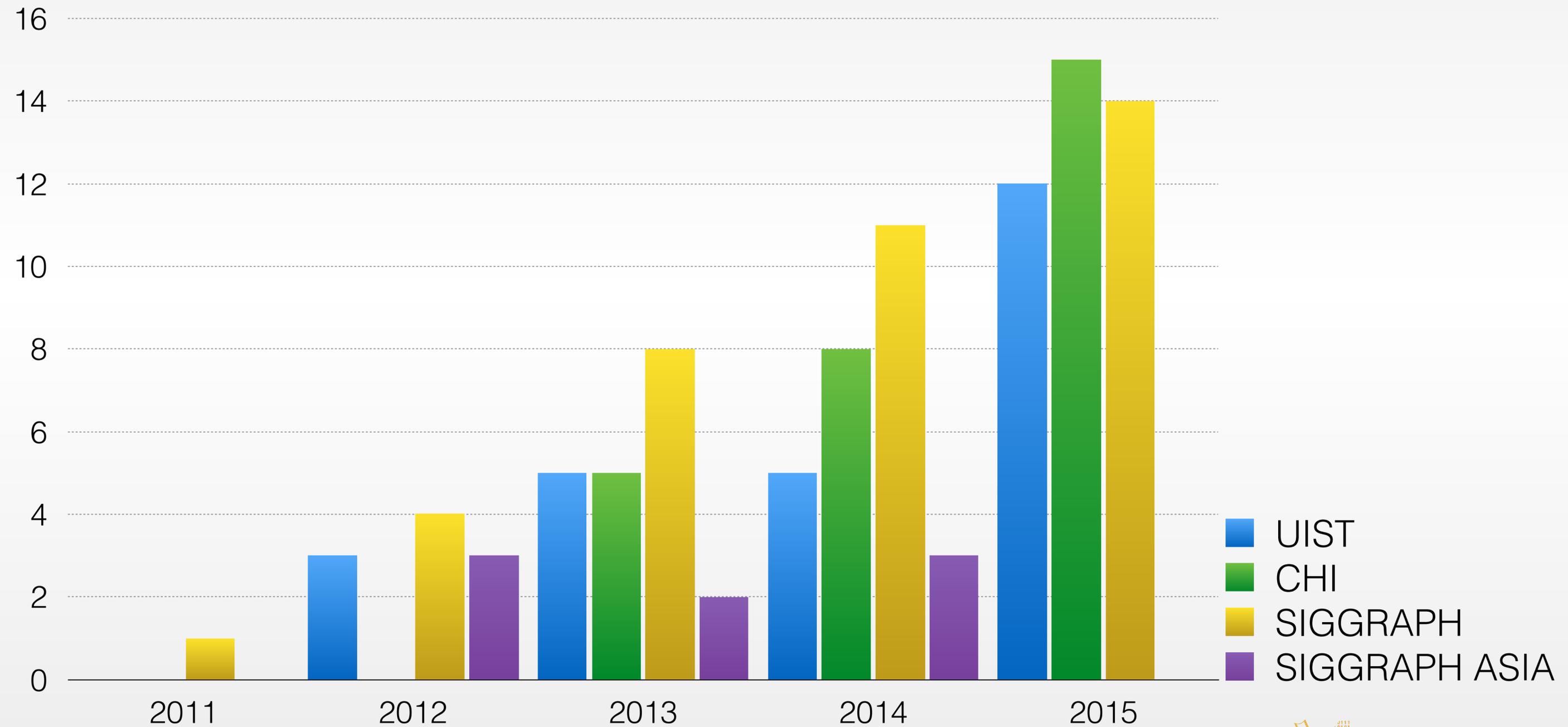


Personal Fabrication (Fabbing)

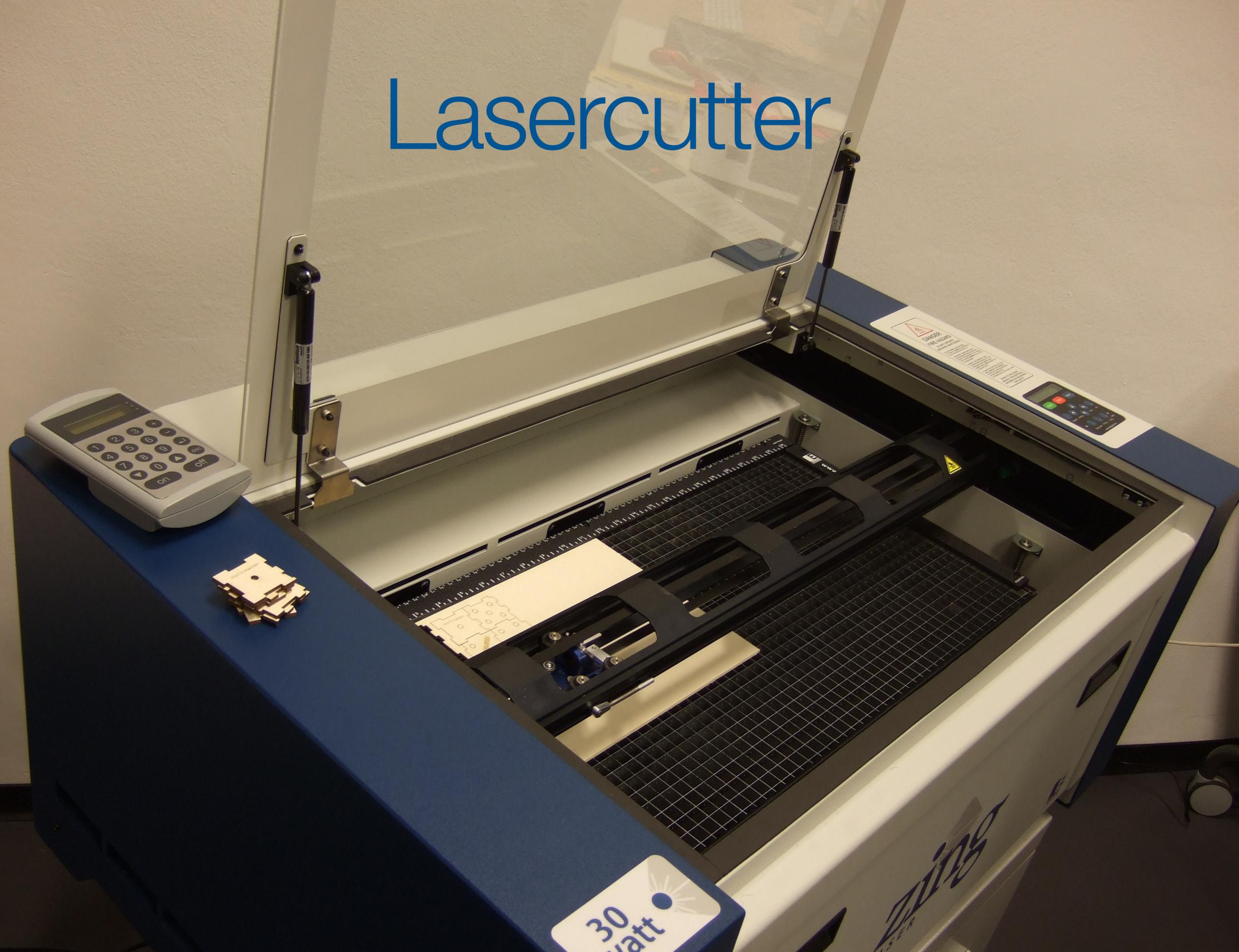
- Personal, digital fabrication of goods
- Personalizable to individual needs unlike mass-market products
- Largely missed by corporate world until now



Publication Development



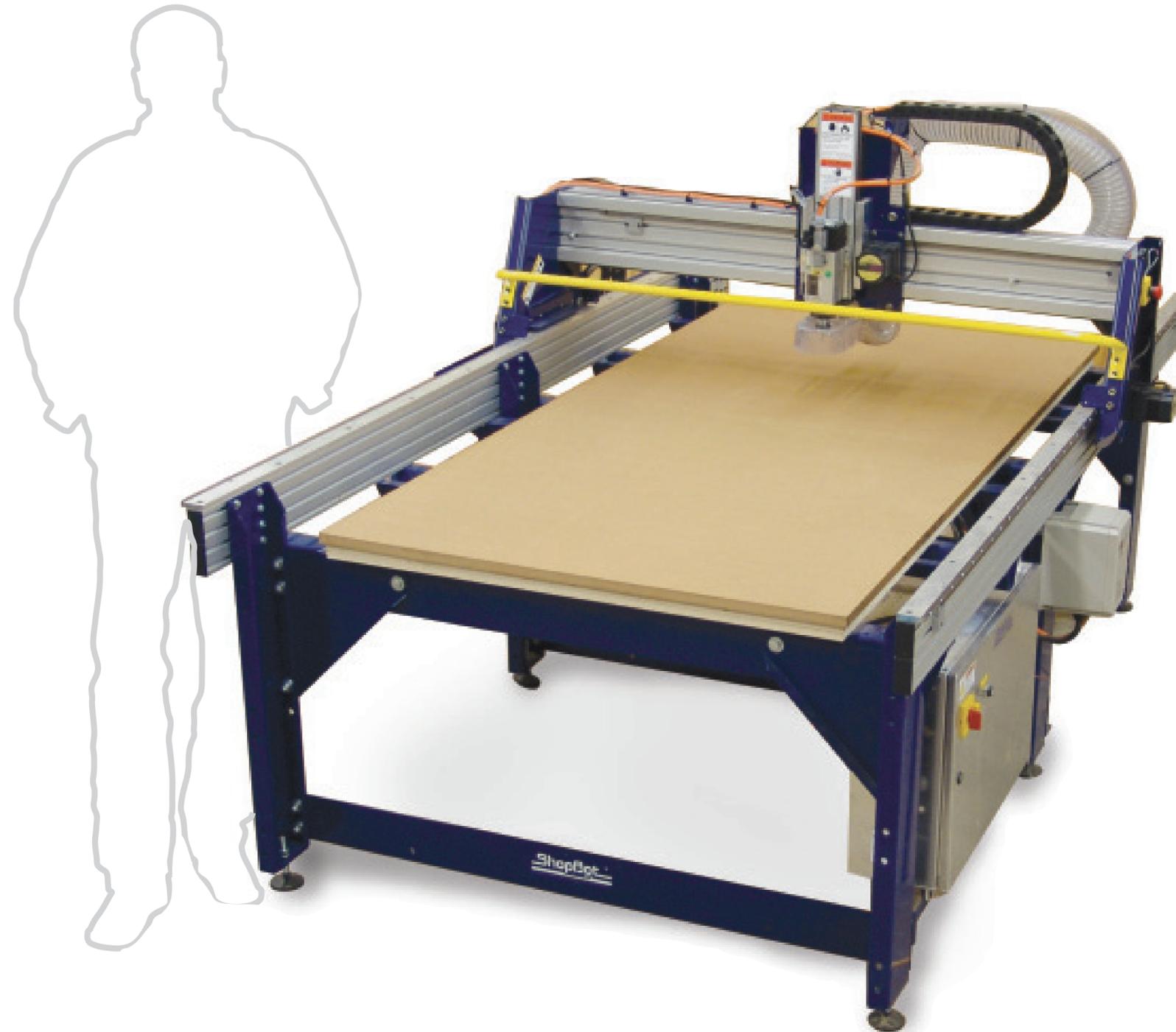
Lasercutter



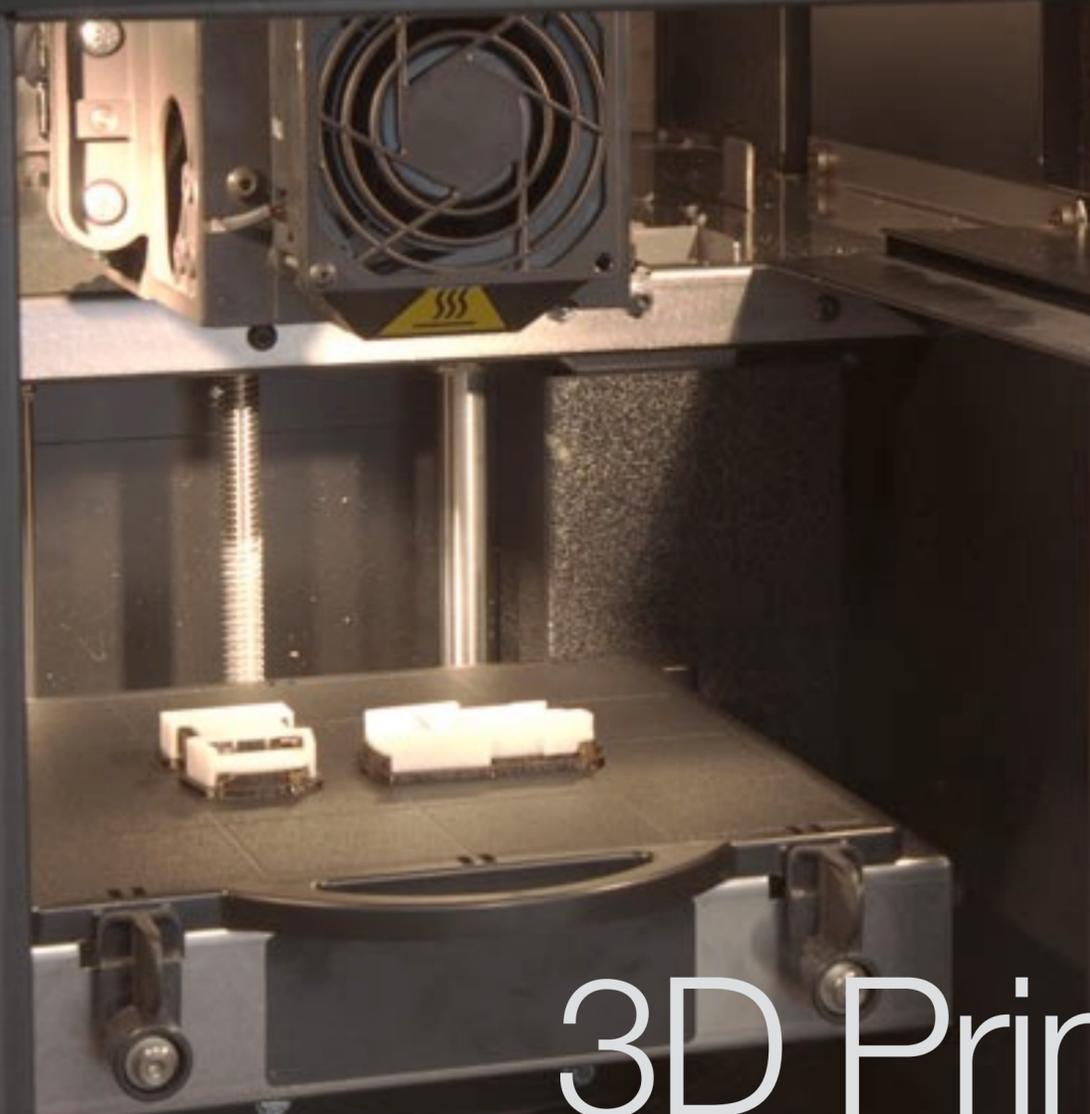


fablab.rwth-aachen.de

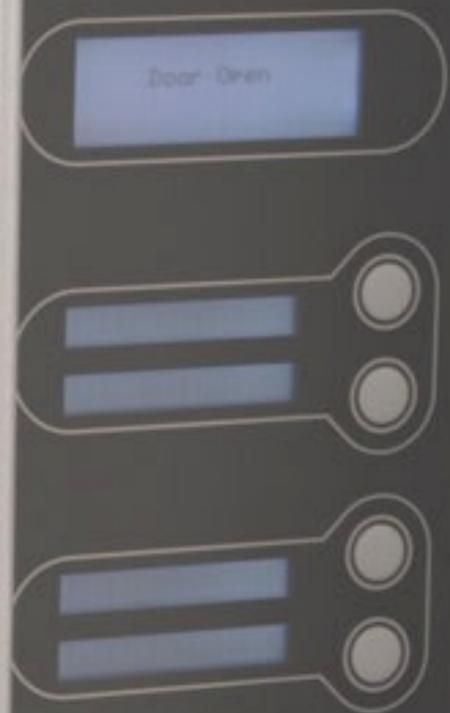
CNC Router

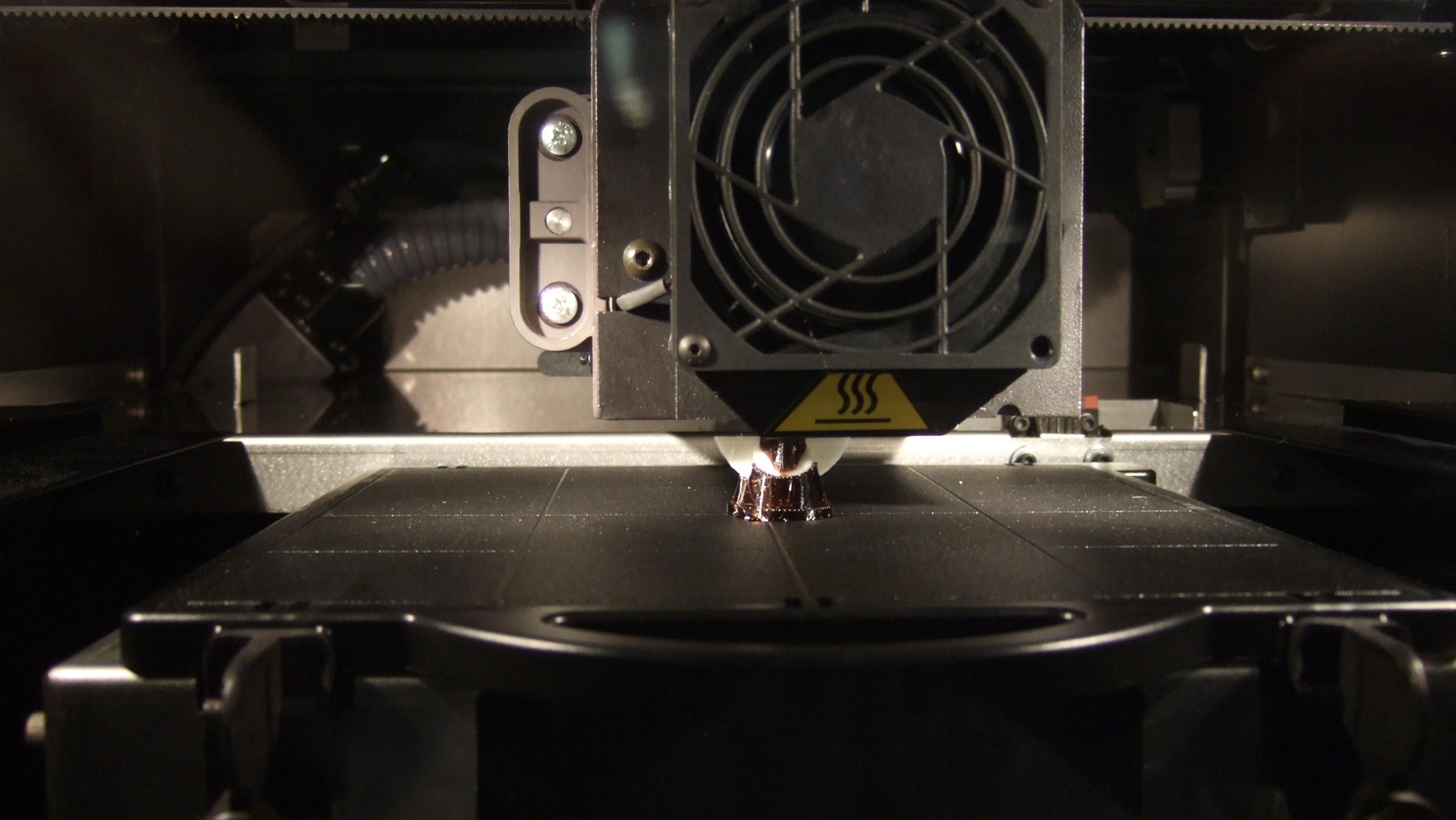


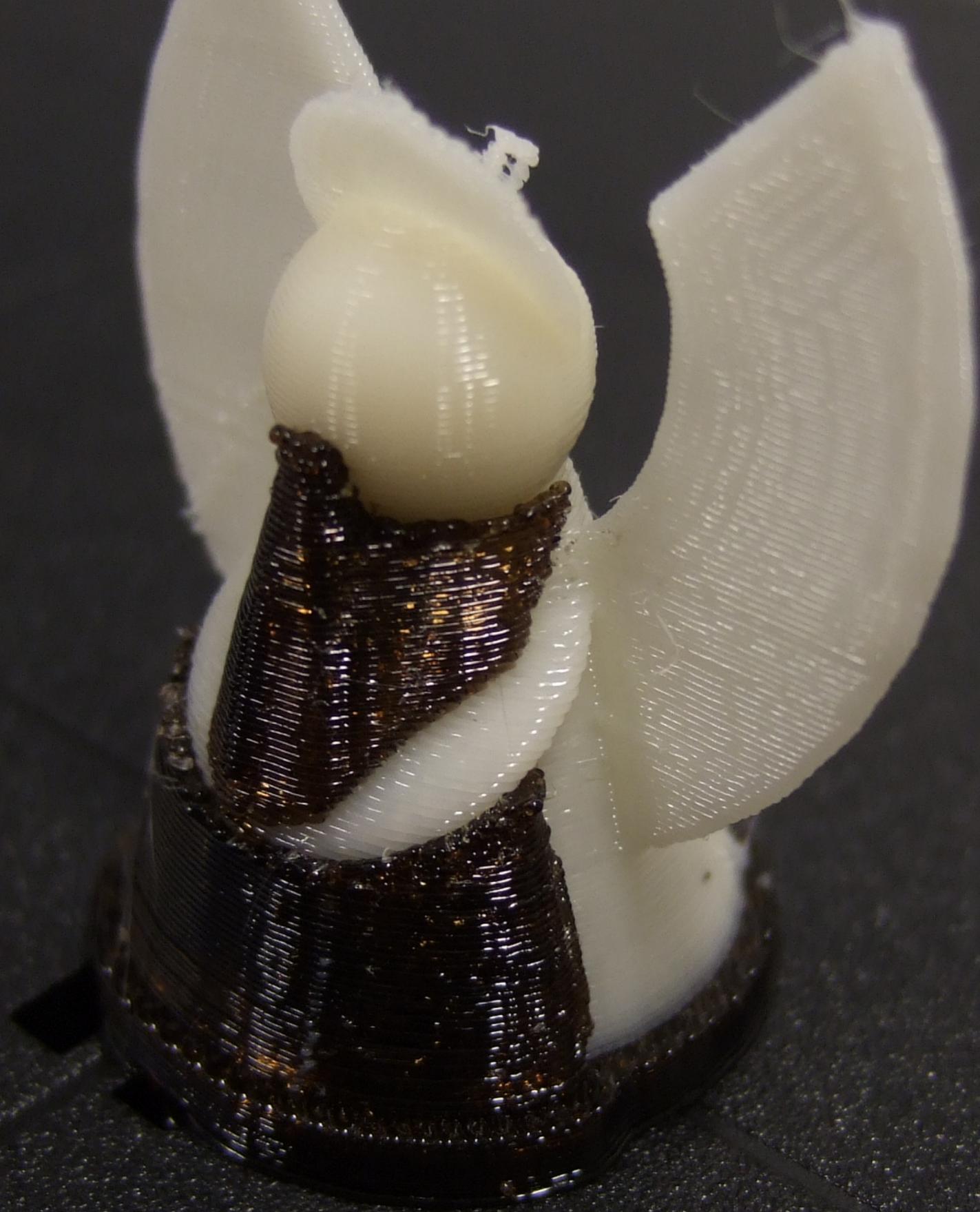
fablab.rwth-aachen.de

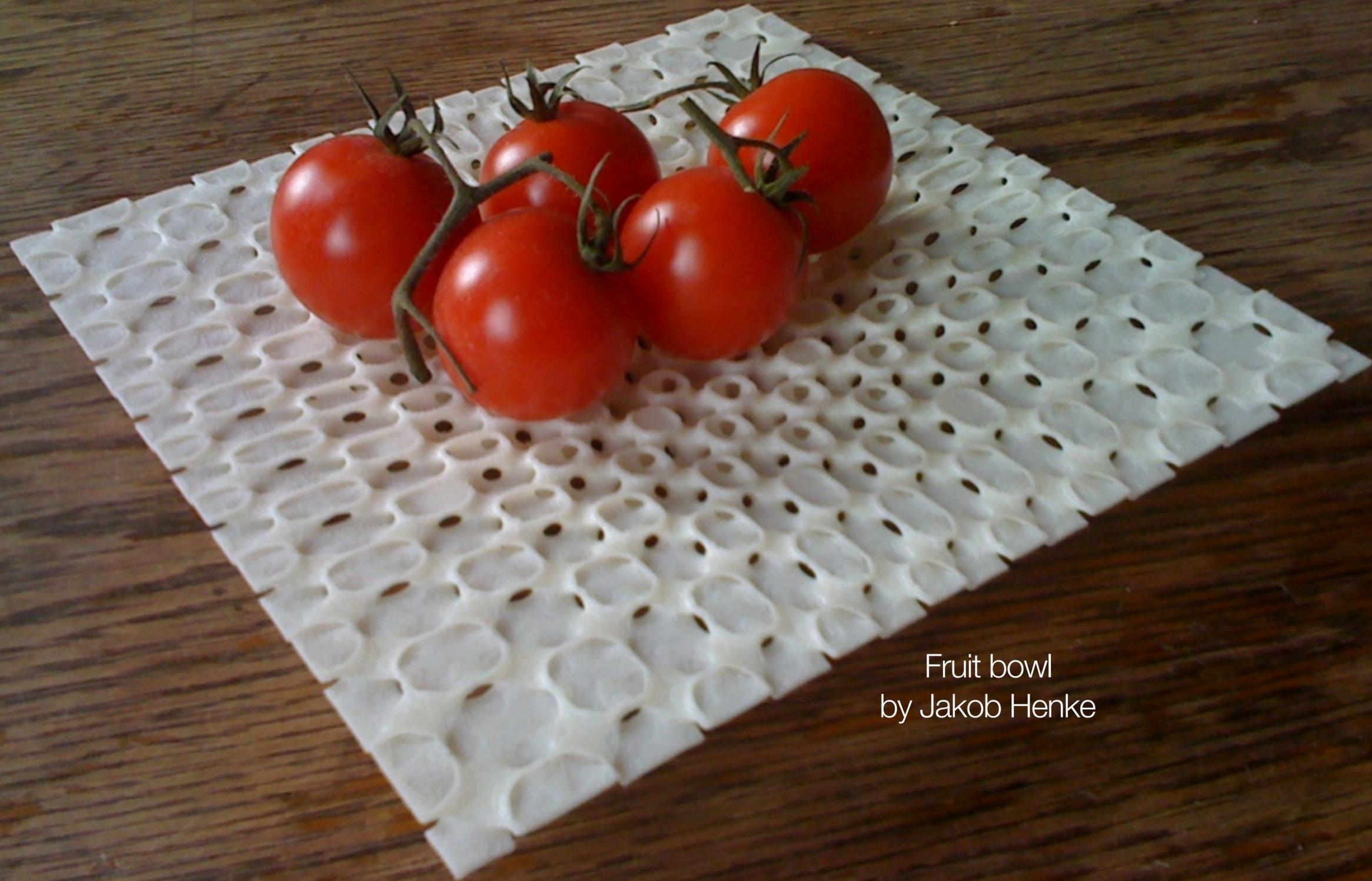


3D Printer

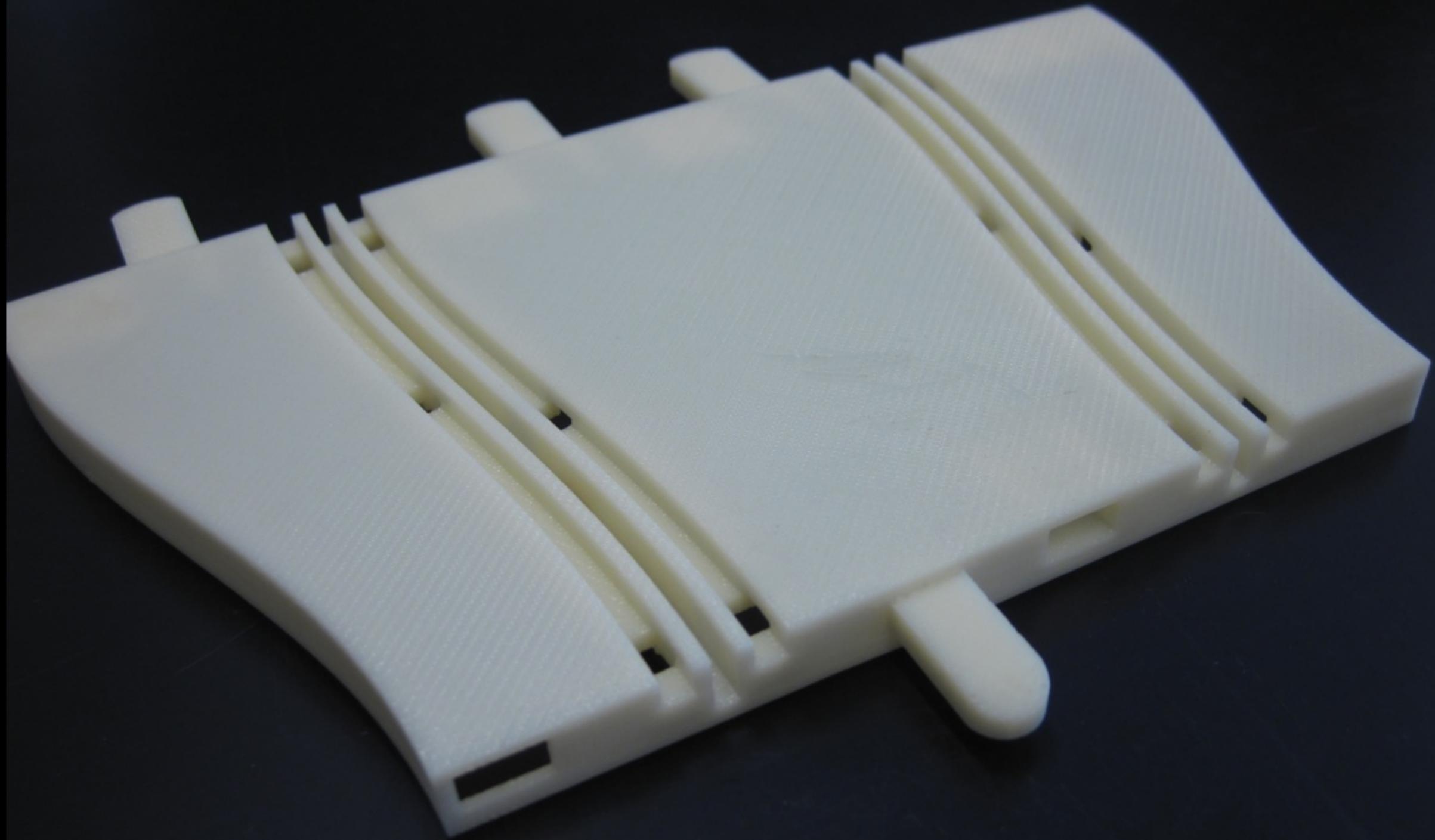


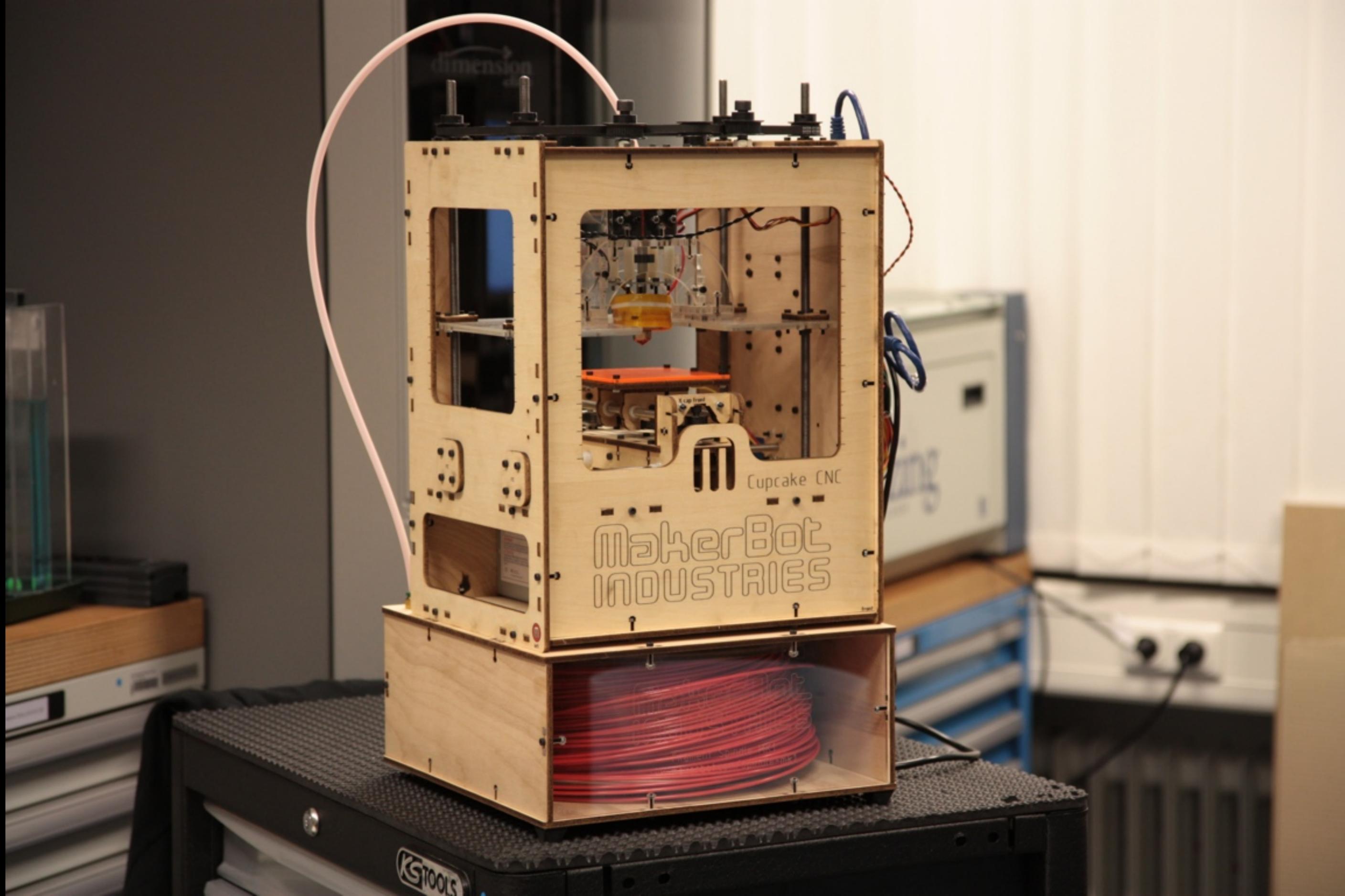




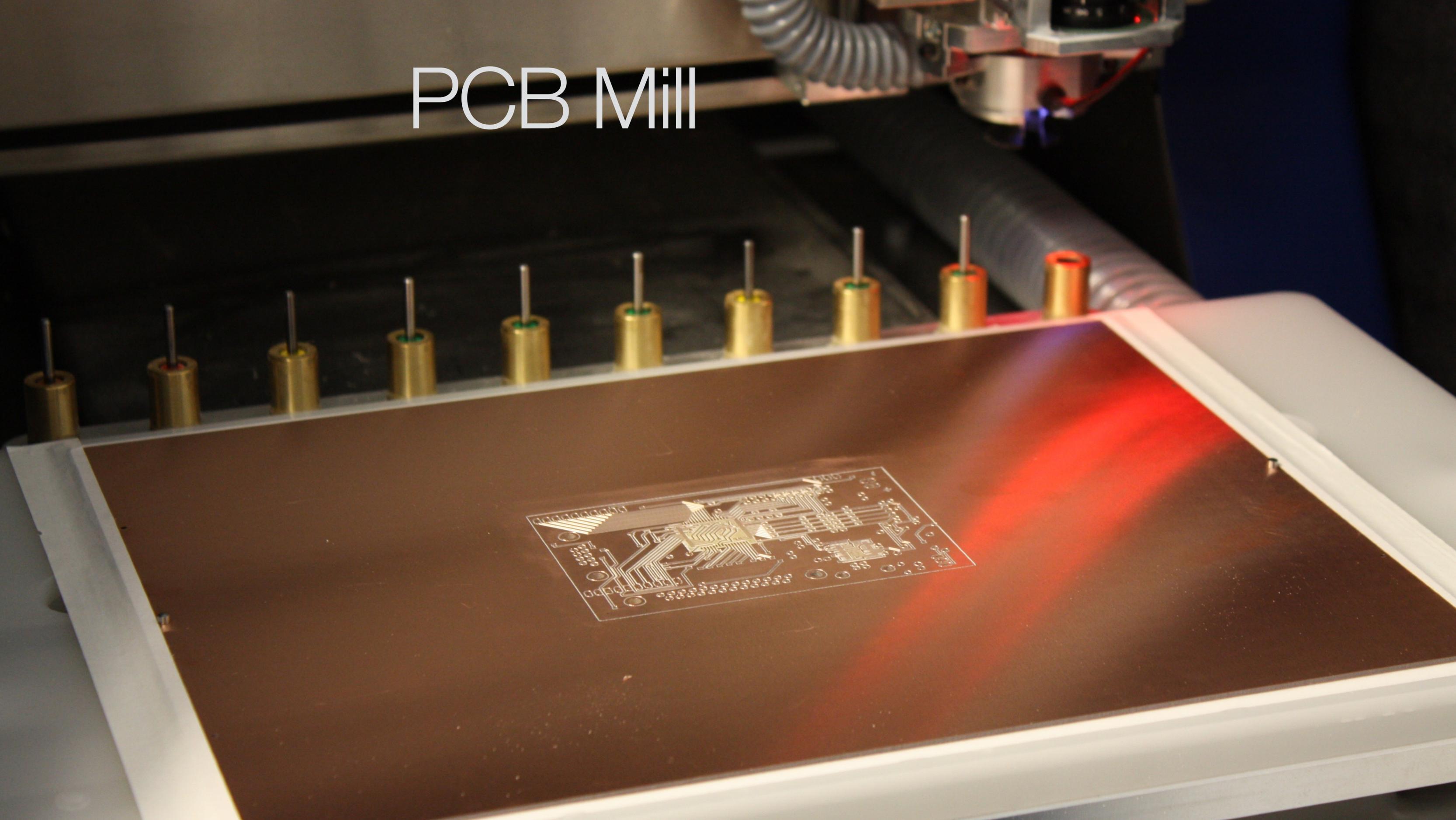


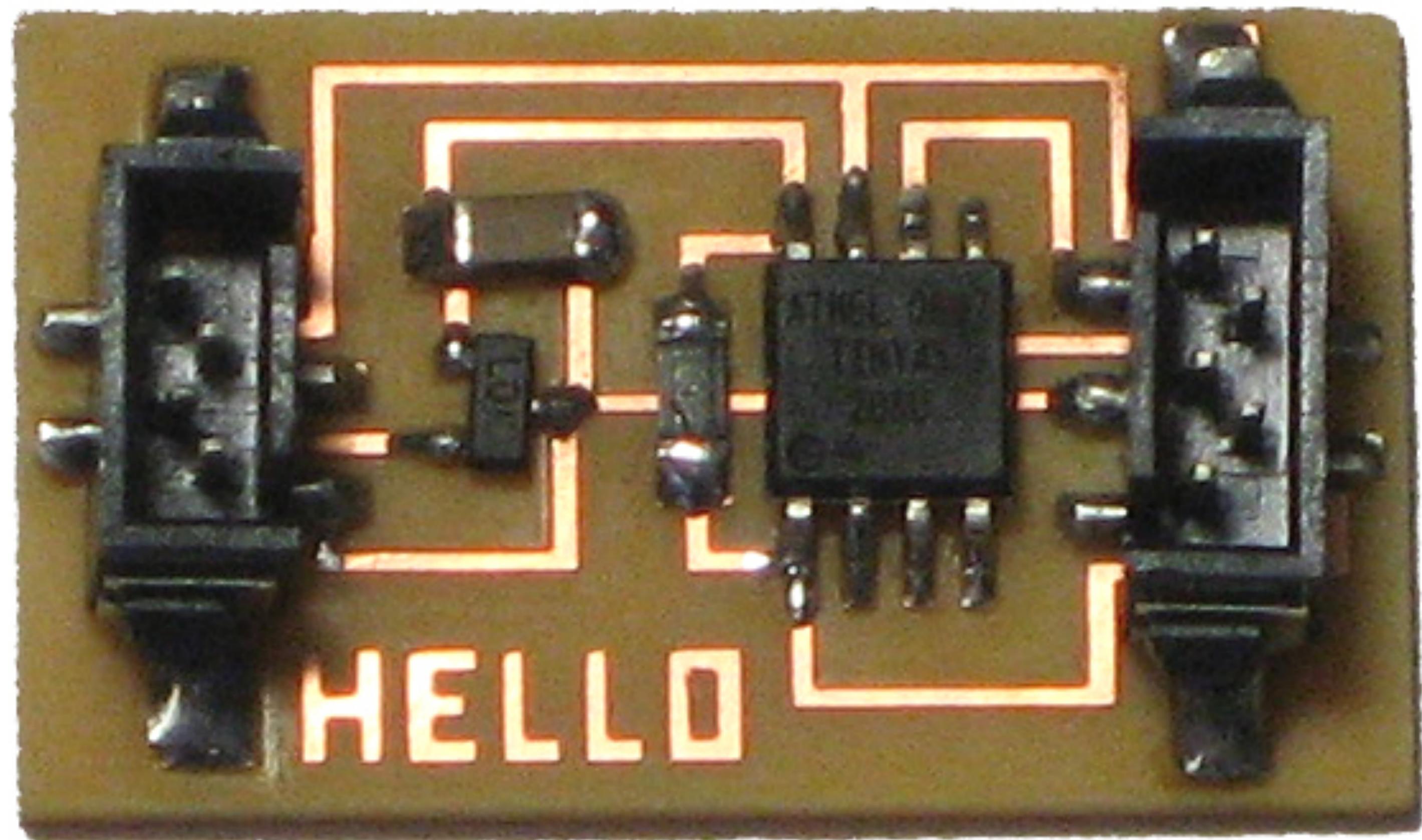
Fruit bowl
by Jakob Henke





PCB Mill

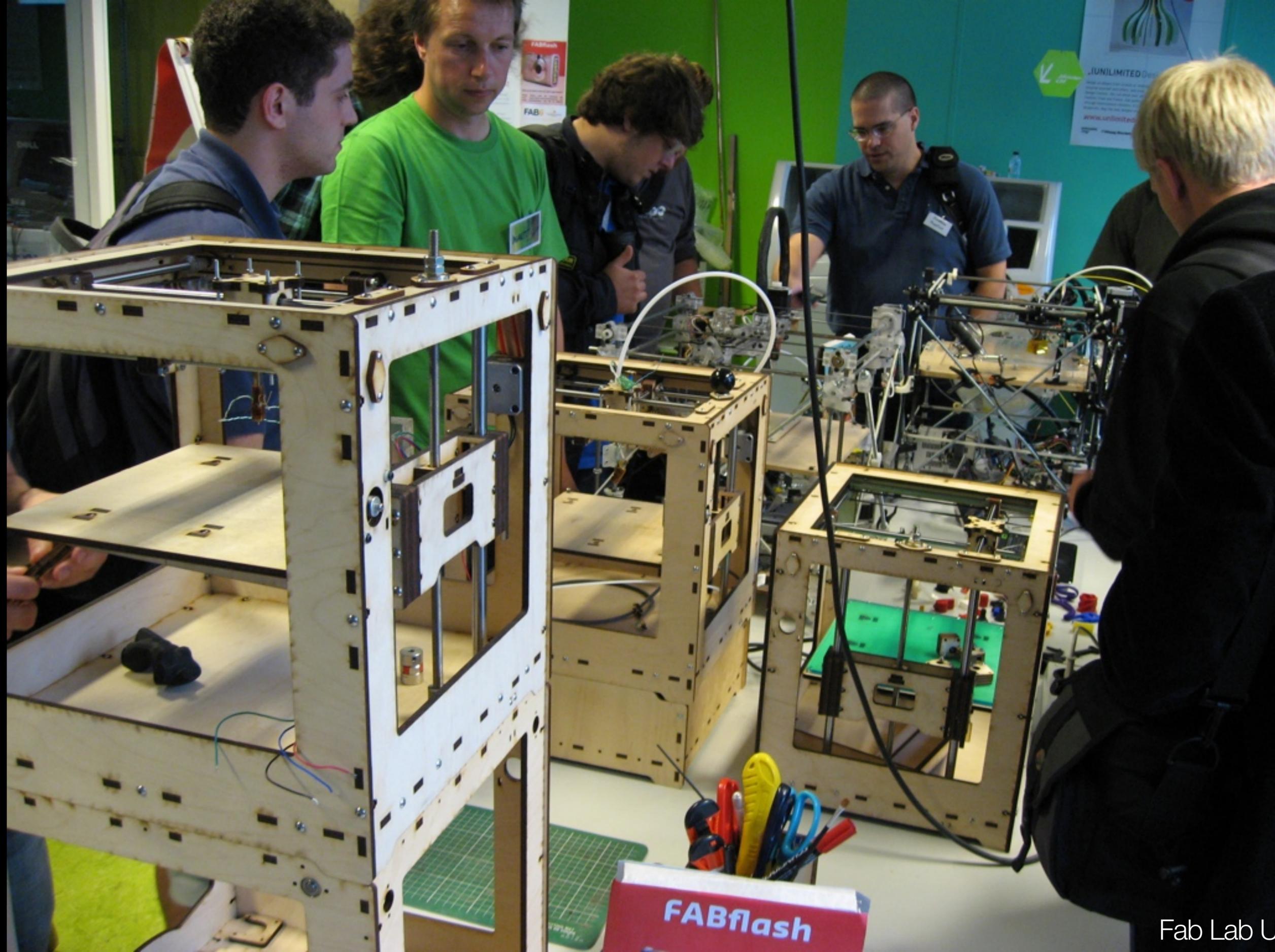




HELLO

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





LIN ENGINEERING
4118862-0780 104 7-2008

Physical Literacy

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

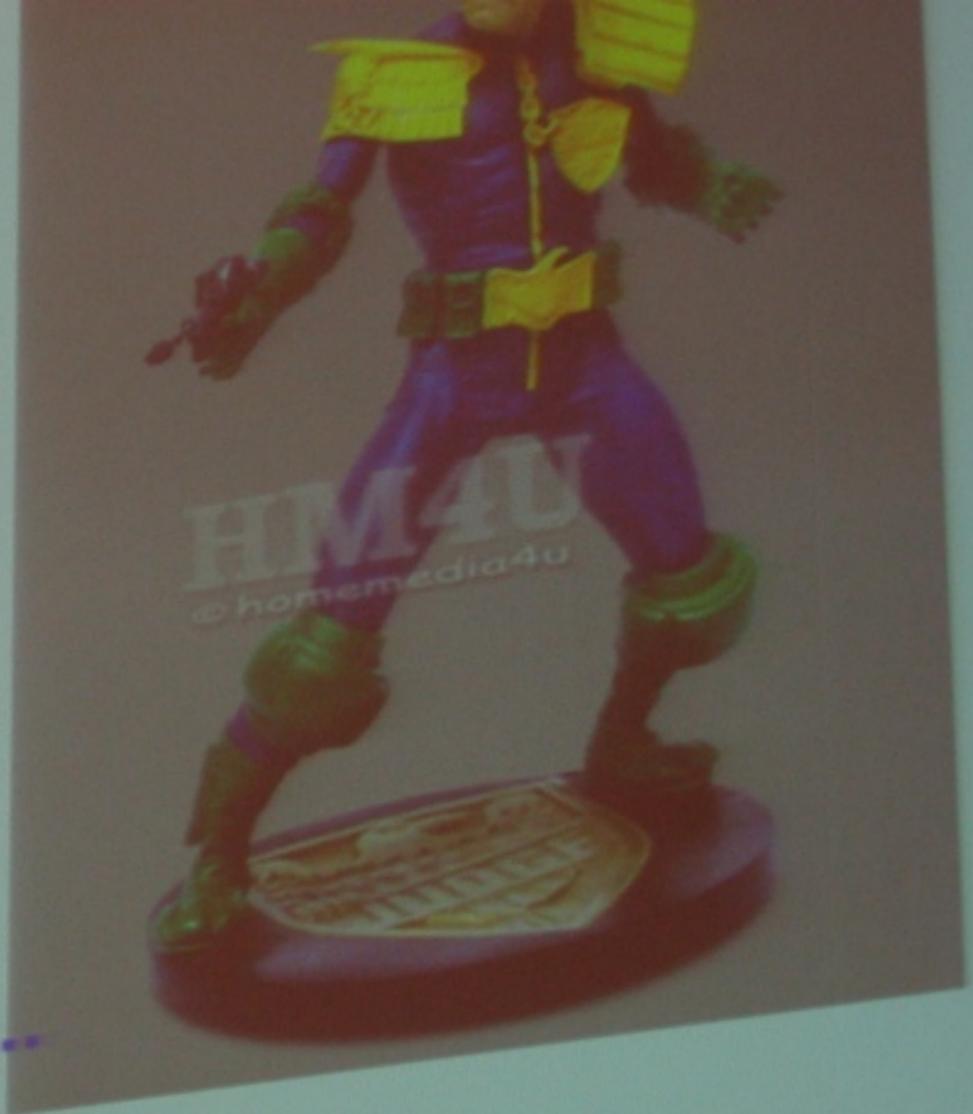
Impact on Society



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

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

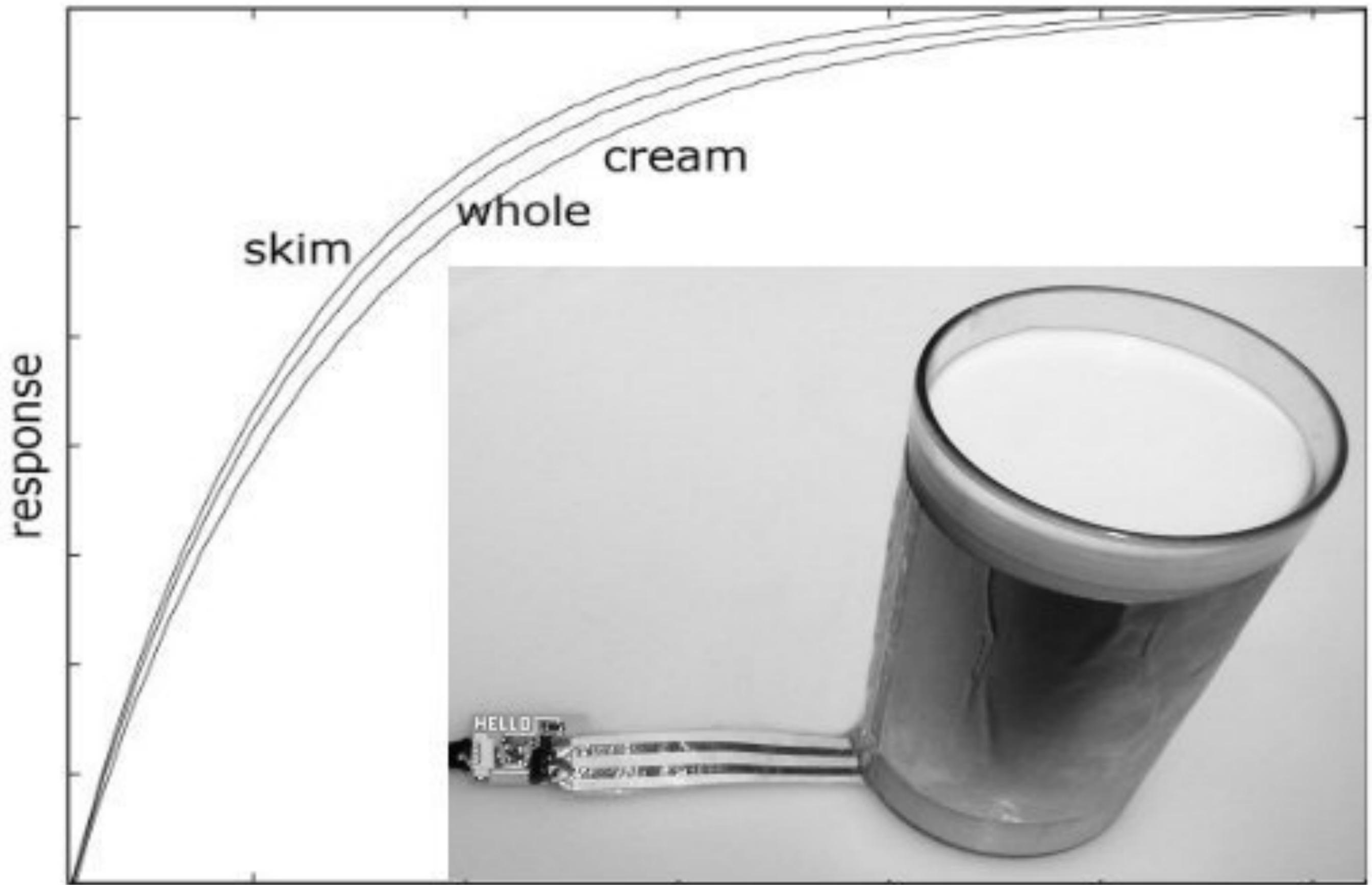
- Free, open access
- Teach “revolutionary” skills
- Community based
- 432 around the world (240 in Europe)
- Fab Lab Aachen: Germany’s first
- <http://fablab.rwth-aachen.de>



we make things
no war



Fab Lab
Afghanistan 





FABLABHOUSE

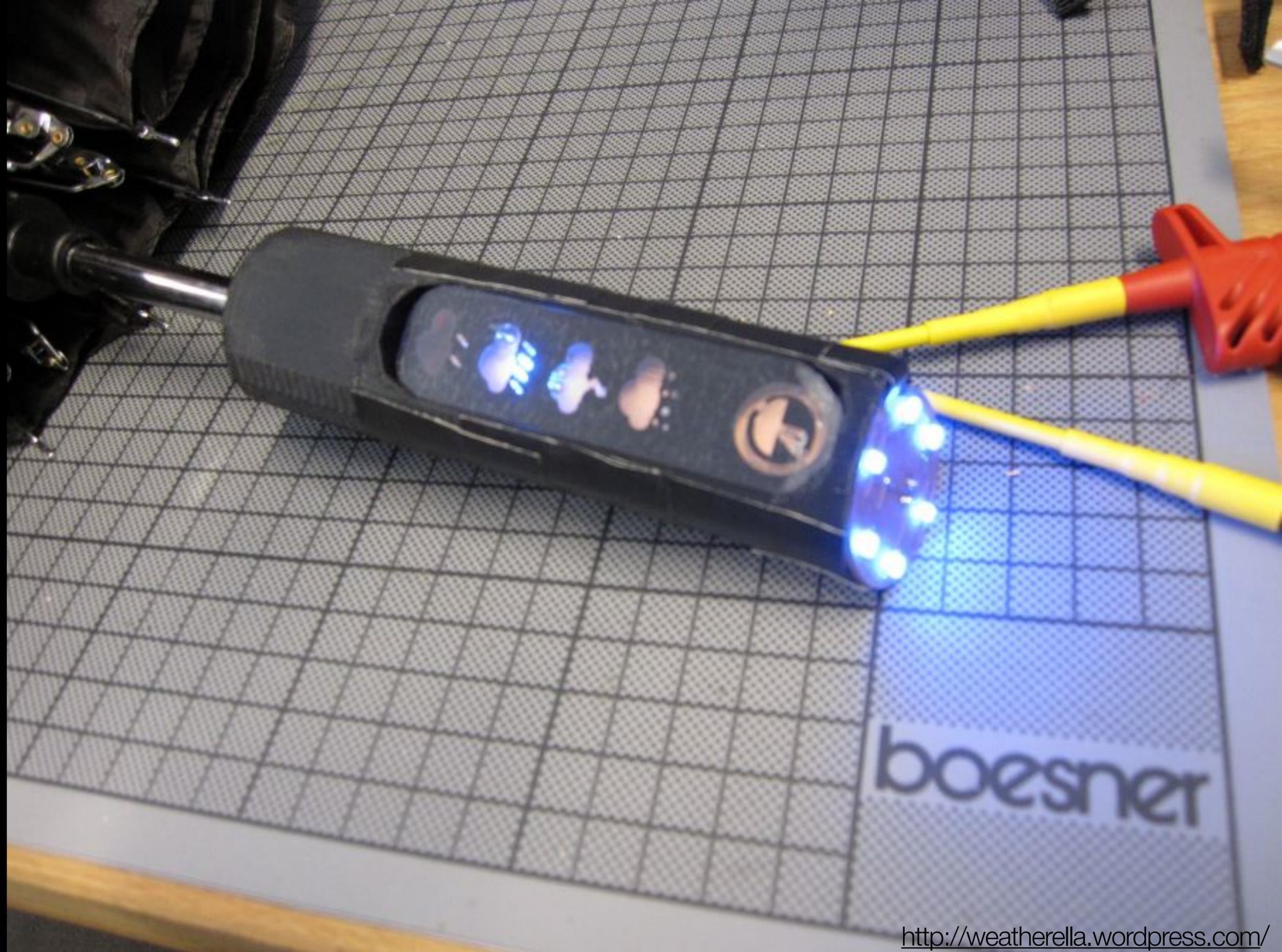
IaaC | CBA | Fab Lab

FABLABHOUSE www.fablabhouse.com
PROTOTIPO DE VIVIENDA SOLAR
SOLAR DECATHLON EUROPE
www.SDEUROPE.ORG

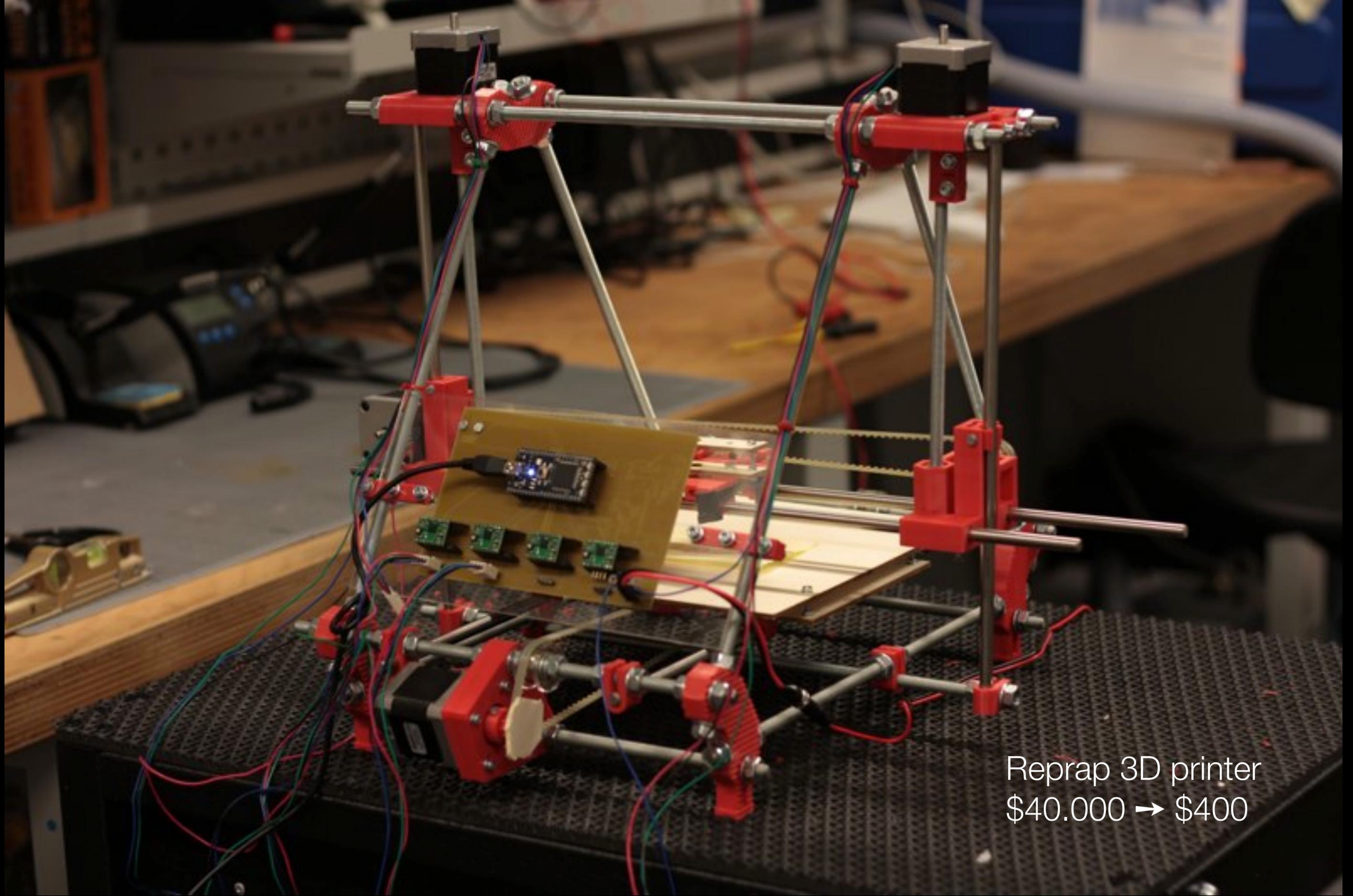
IAAC- INSTITUTO DE ARQUITECTURA AVANZADA DE CATALUÑA
www.iaac.net
MIT- CENTER FOR BITS AND ATOMS
cba.mit.edu
FAB LAB NETWORK
fab.cba.mit.edu



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



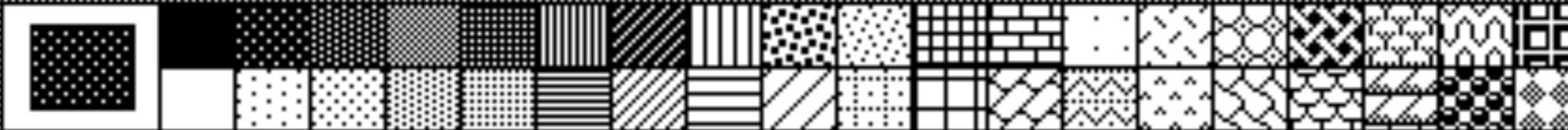
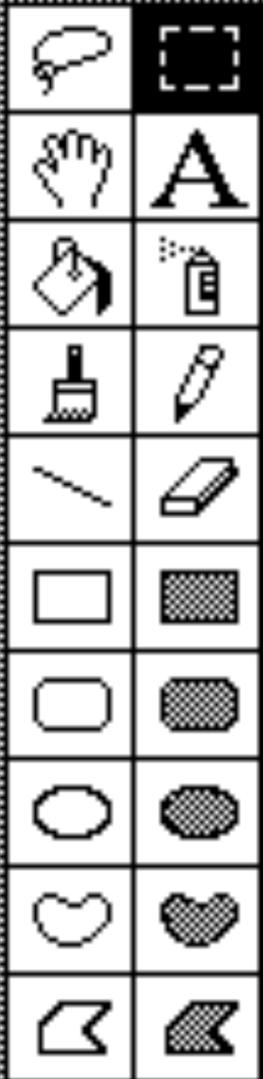
Personal Fabrication *Requires* New User Interfaces



Reprap 3D printer
\$40.000 → \$400



Altair: \$397 (1975)



Lego Compatible Disc Buttons by clothbot - Thingiverse

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

Reader Google

a MakerBot Industries website

THINGIVERSE

THINGS TOOLS TAGS BLOG

Welcome back, [jan](#).
Thingiverse is awesome because of you.
[LOG OUT](#)

SEARCH

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! ;-)

Tweet 0 Like 1 submit Flattr 0

Sort By **Date** Popular File Type

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

Instructions

0. Download the STL. It prints four buttons.

ADVERTISEMENT
AdChoices [The 3D Printer](#)





2.1

123D Design 2.1 is here!

Explore all the new features and refinements – download v2.1 now!

Get 123D Design v2.1

Download 10K+ free 3D models, or use free 3D modeling apps to create your own!

Start with a 3D model, then customize it to your liking. Or, start from scratch with any of these amazing, free apps.

Meet the Apps

Browse 3D Models



123D Catch

Generate 3D models from photos



123D Circuits

Design your next electronic project



123D Design Updated!

Easy 3D modeling for Mac and PC



123D Make

Unique 3D models from 2D slices



123D Sculpt+

Create 3D sculptures on iPad

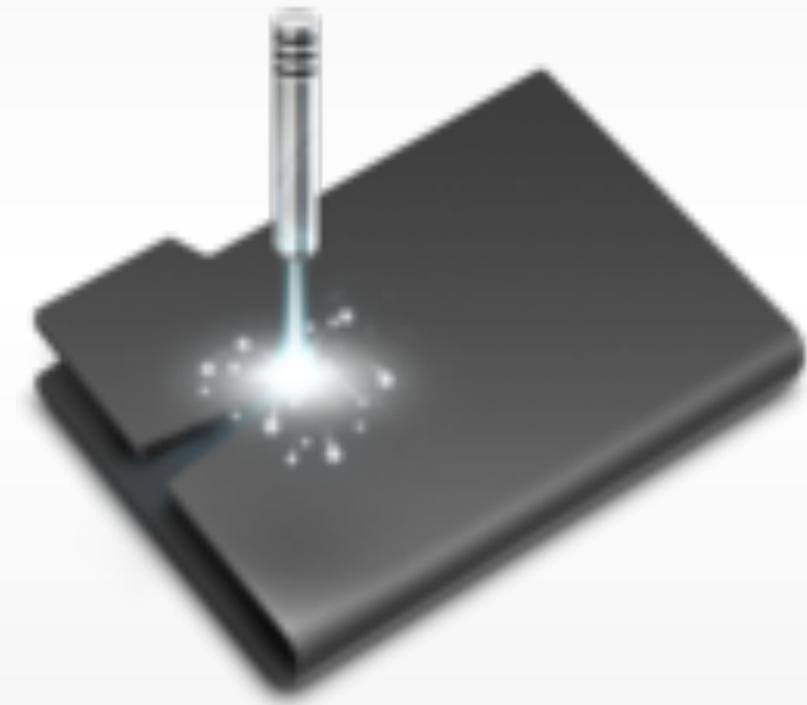


Tinkercad

Get started with 3D modeling

VisiCut

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



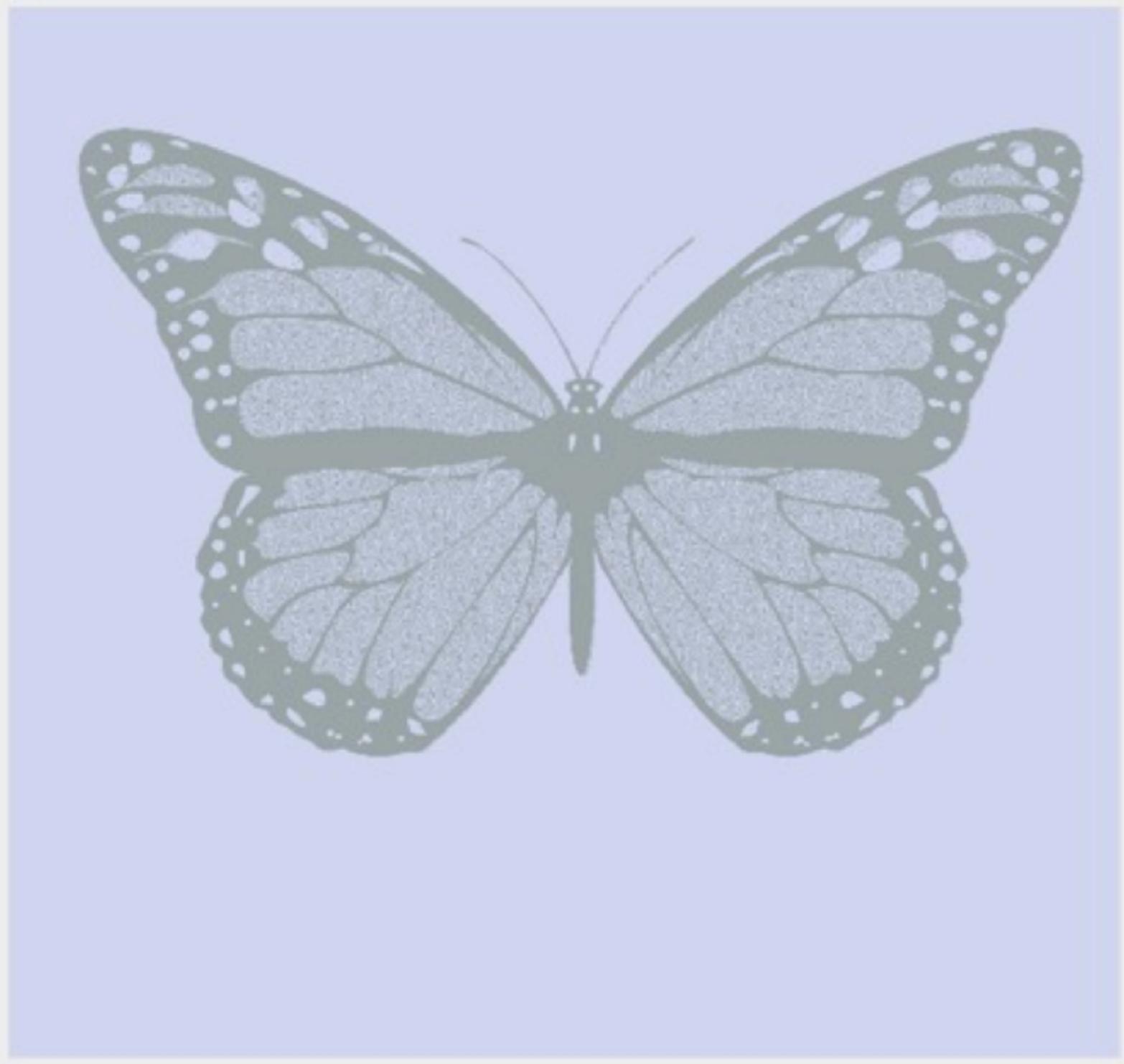
Full Preview

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

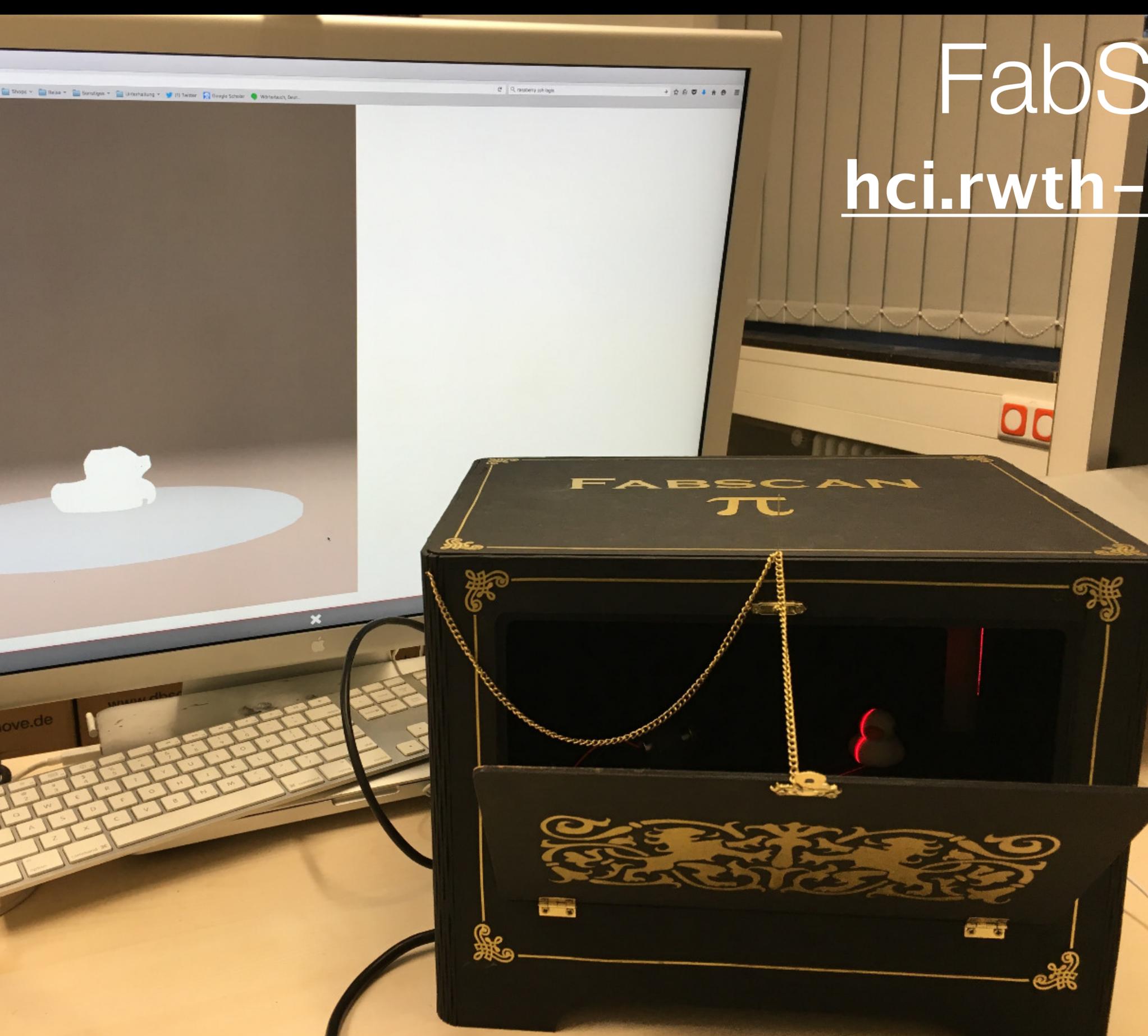
Estimated Time:

00:08:10 Calculate

Execute

FabScan Pi (RWTH)

hci.rwth-aachen.de/fabscan





Sketch Furniture by FRONT

made in collaboration with

Barry Friedman Gallery

Crescent

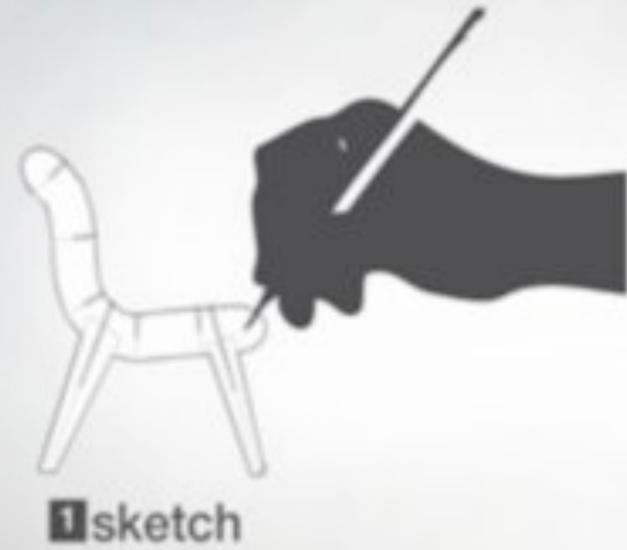
Tokyo Wonder site

Music: Hess is More

www.hessismore.com



Cassius Lamp
(AEC '09)



Sketch Chair
(Greg Saul, 2010)

Food

Furniture

Consumer
electronics

(Copyrighted)
Toys

WHAT?

Weapons

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

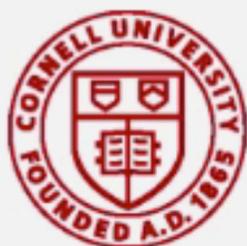
D-Coil: A Hands-on Approach to Digital 3D Models Design

- 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

Huaishu Peng¹
Amit Zoran²
François Guimbretière¹

¹ Cornell University
² The Hebrew University of Jerusalem

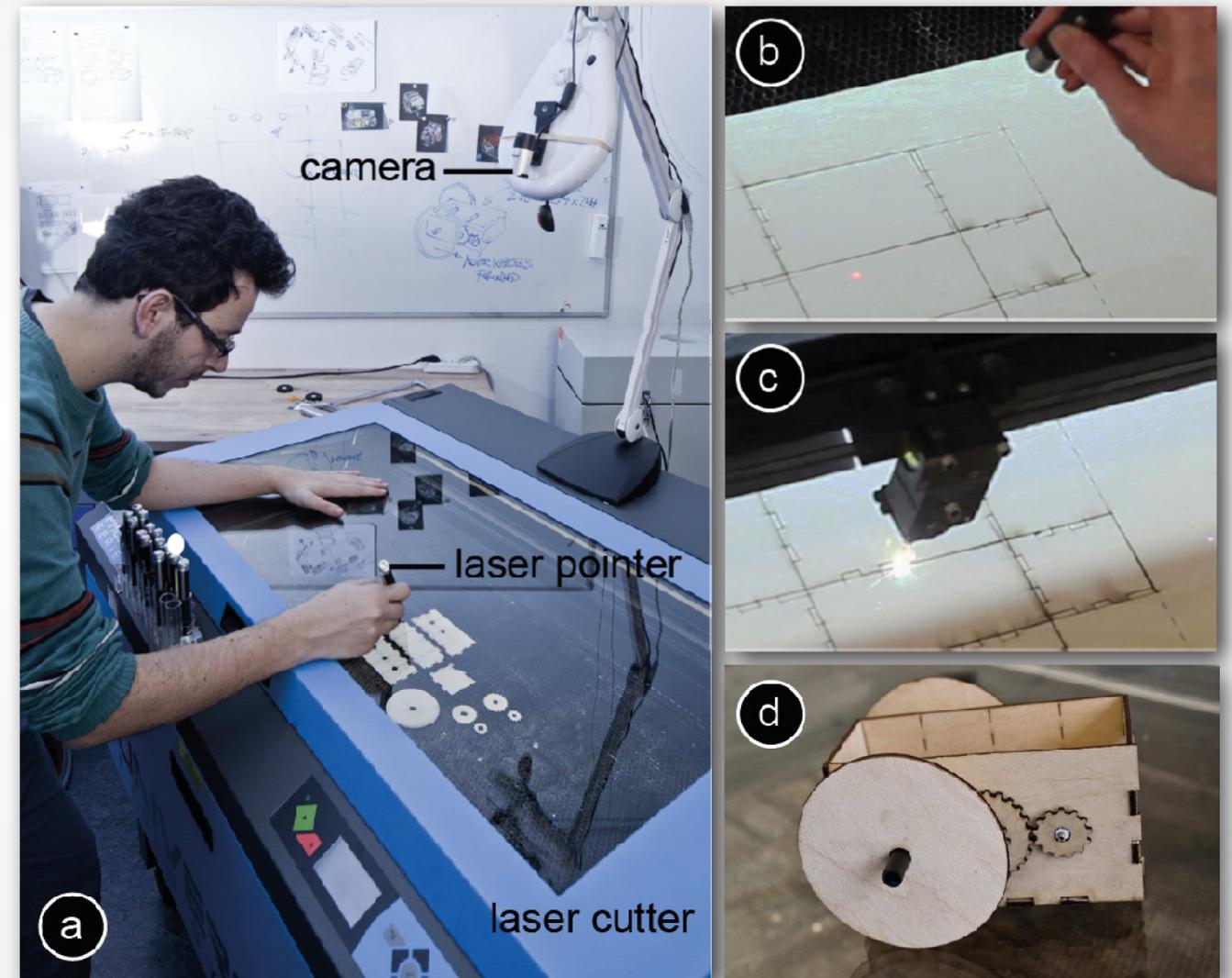


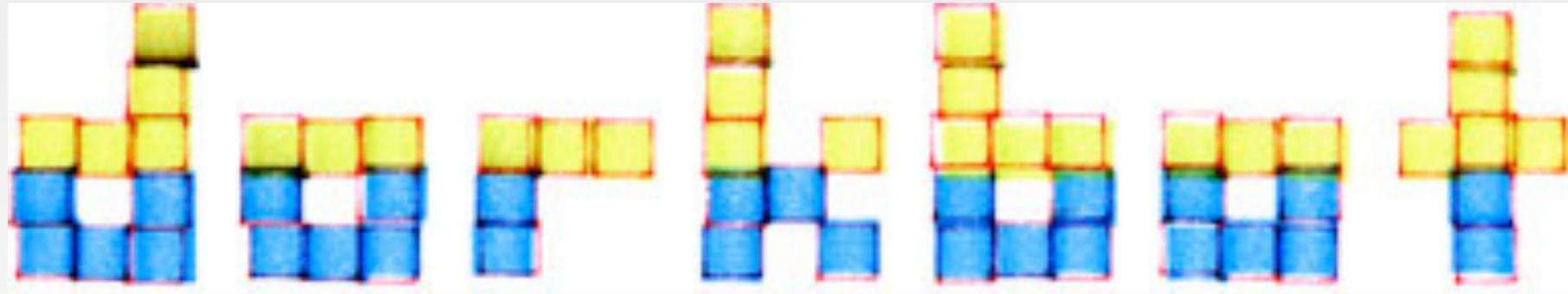
האוניברסיטה העברית בירושלים
The Hebrew University of Jerusalem



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

