From 3D Printing and Personal Fabrication to Personal Design

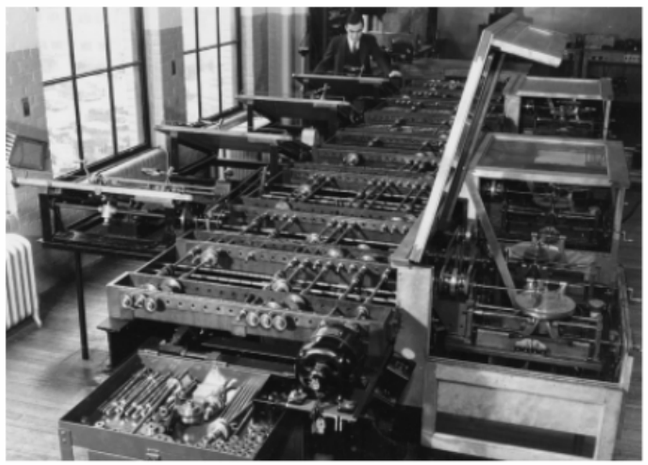
Today

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

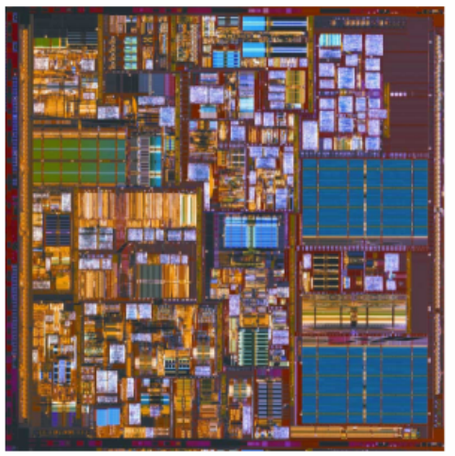
The 3rd Digital Revolution?

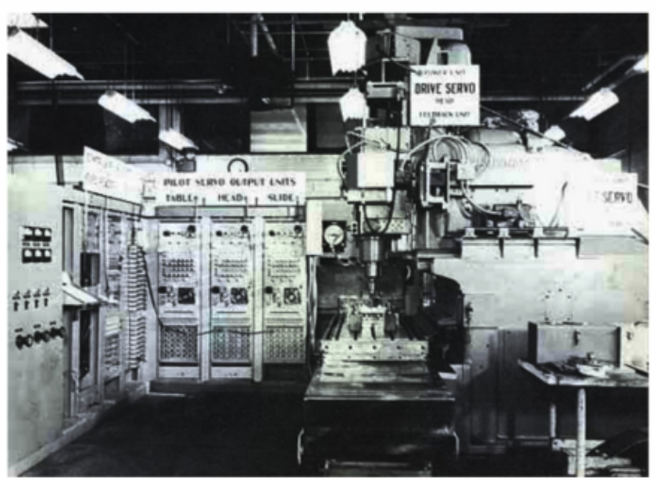
Digital Revolutions

analog → digital communication
~1945

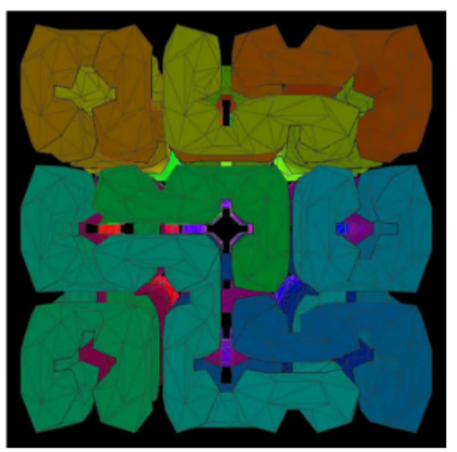


analog → digital computation
~1955





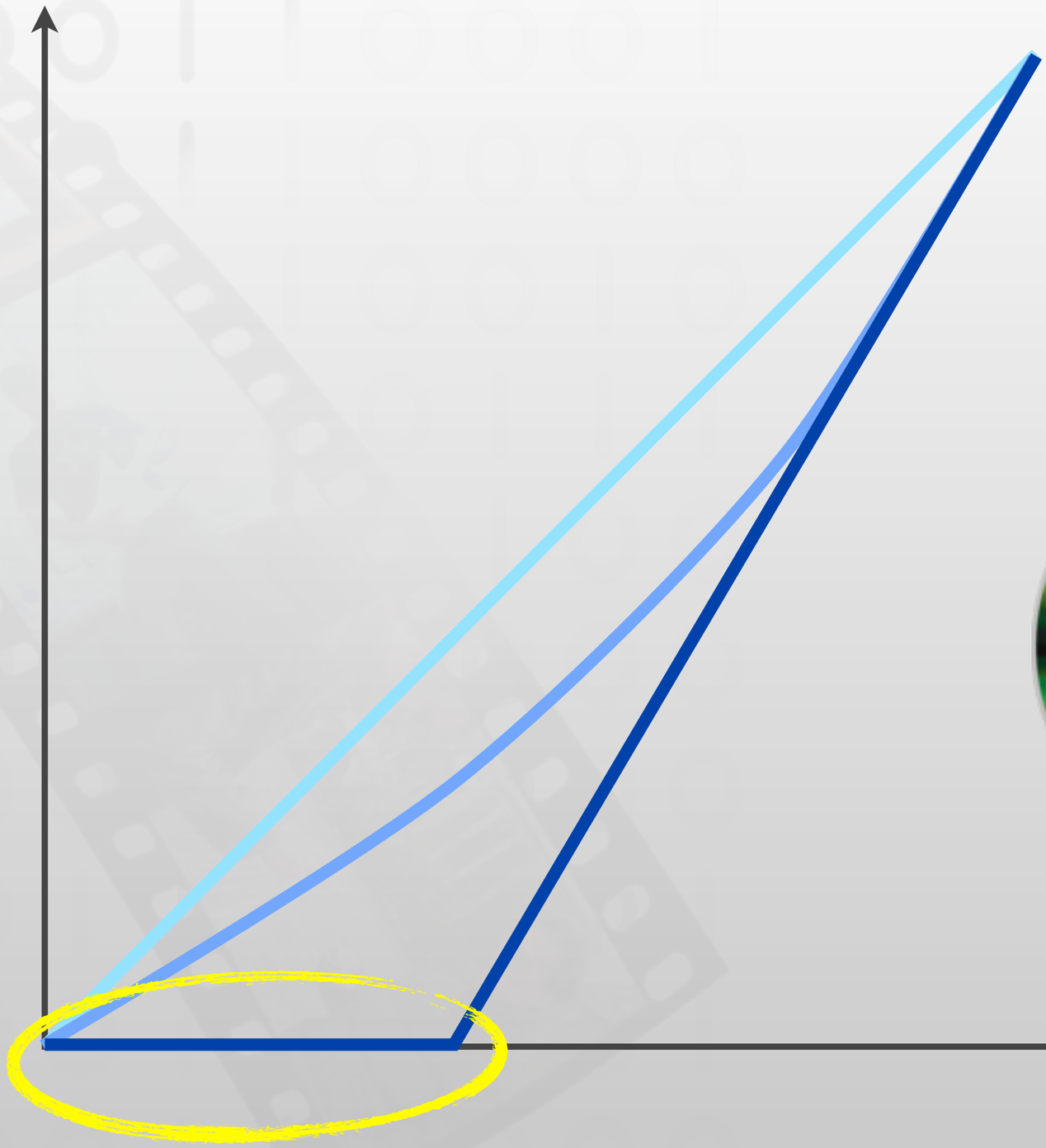
analog → digital fabrication
~2005



Source: Gershenfeld 2010

10 10 10

Errors



Noise

Analog

Analog+

Digital

After Gershenfeld 2010

lossless

fast

cheap

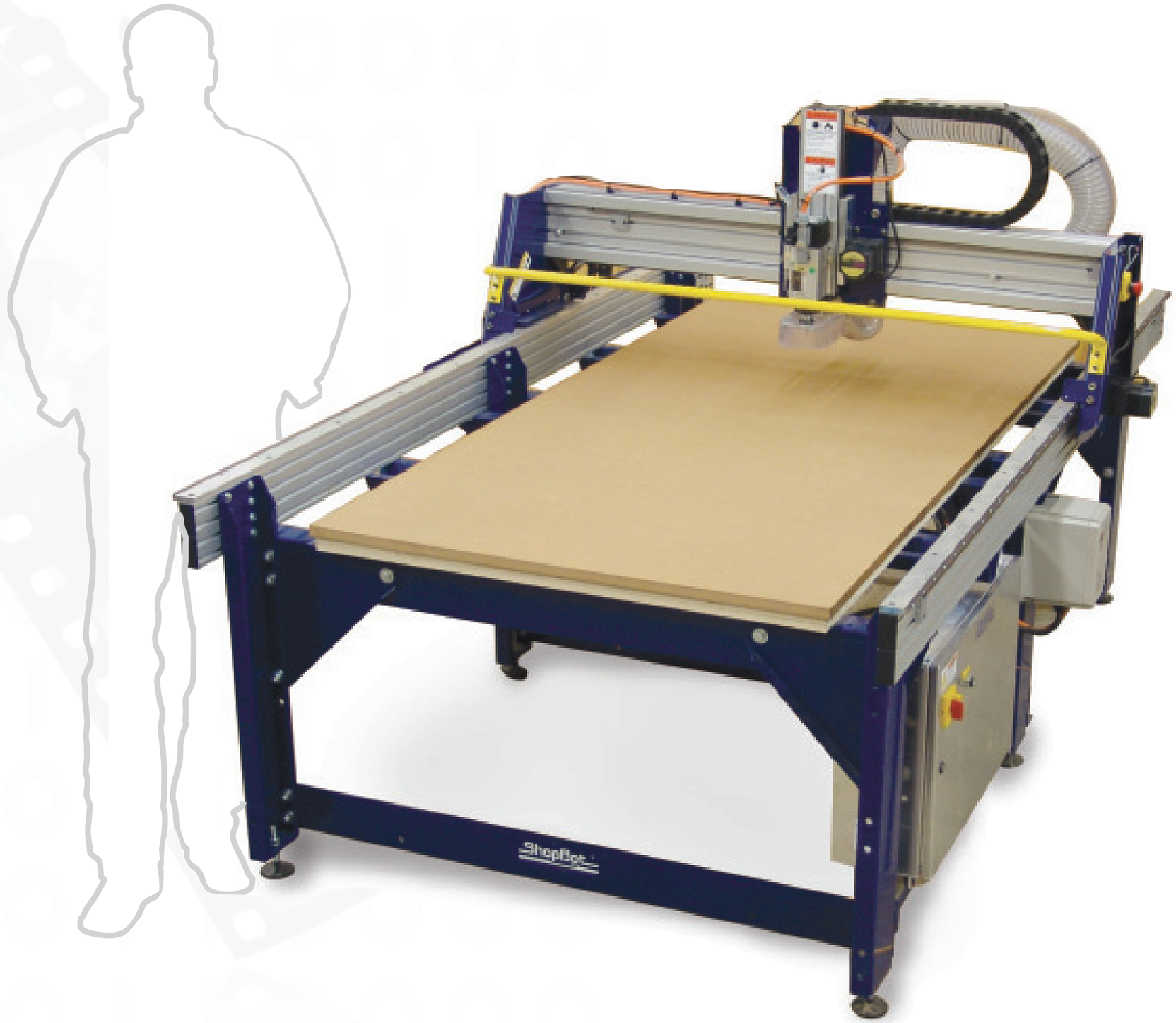
Personal Fabrication (Fabbing)

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

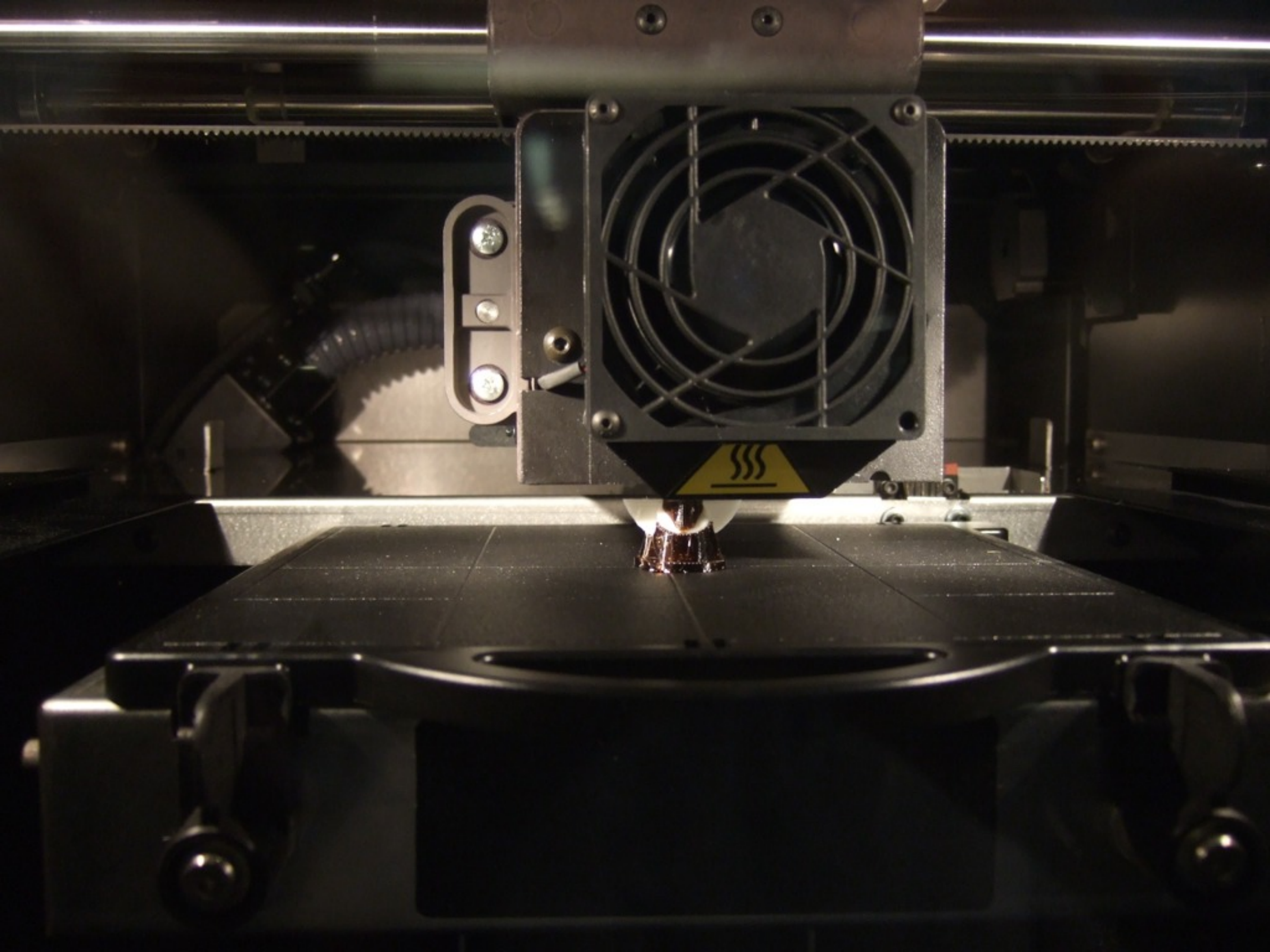
Lasercutter

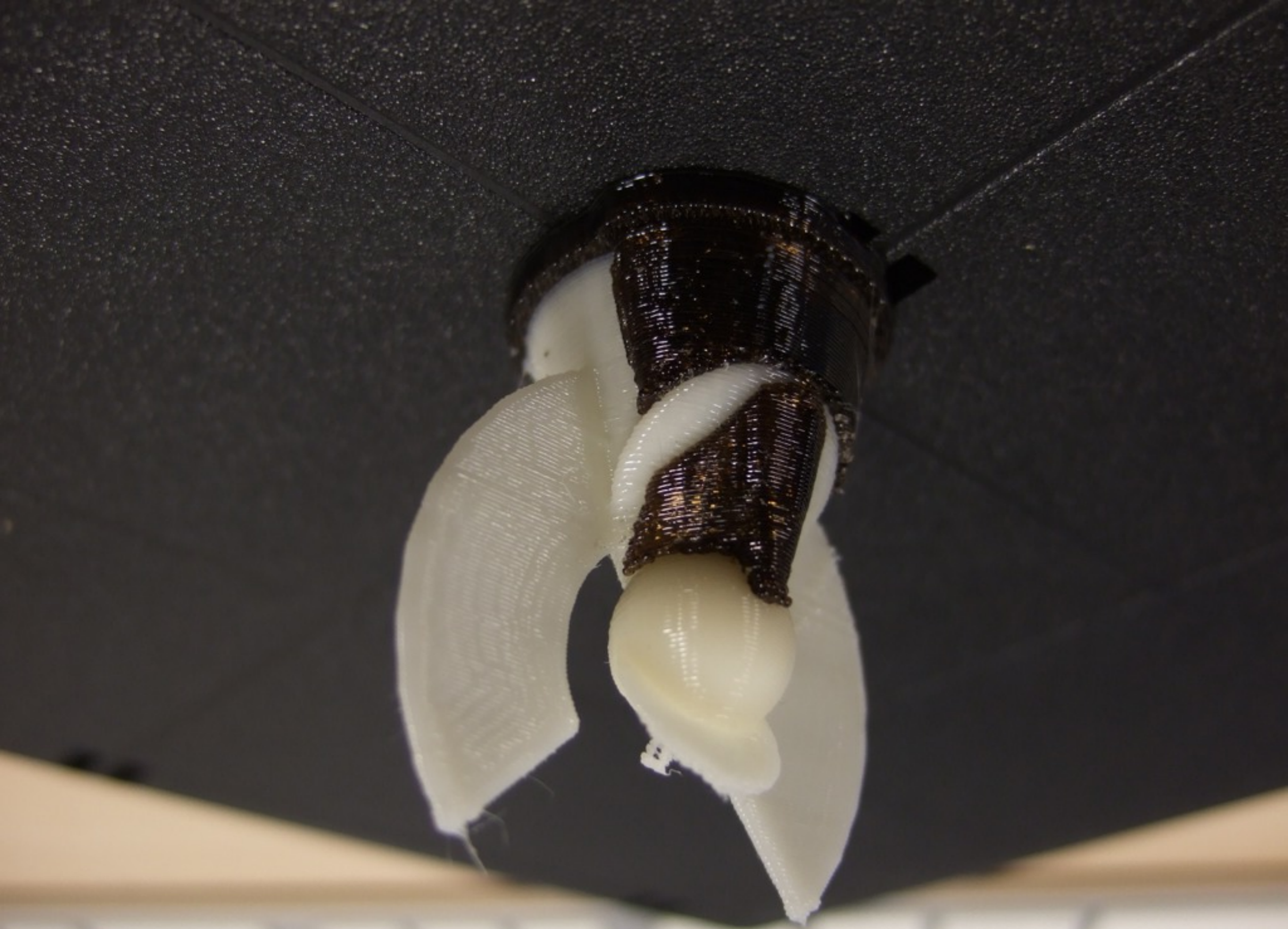
fablab.rwth-aachen.de

CNC Router

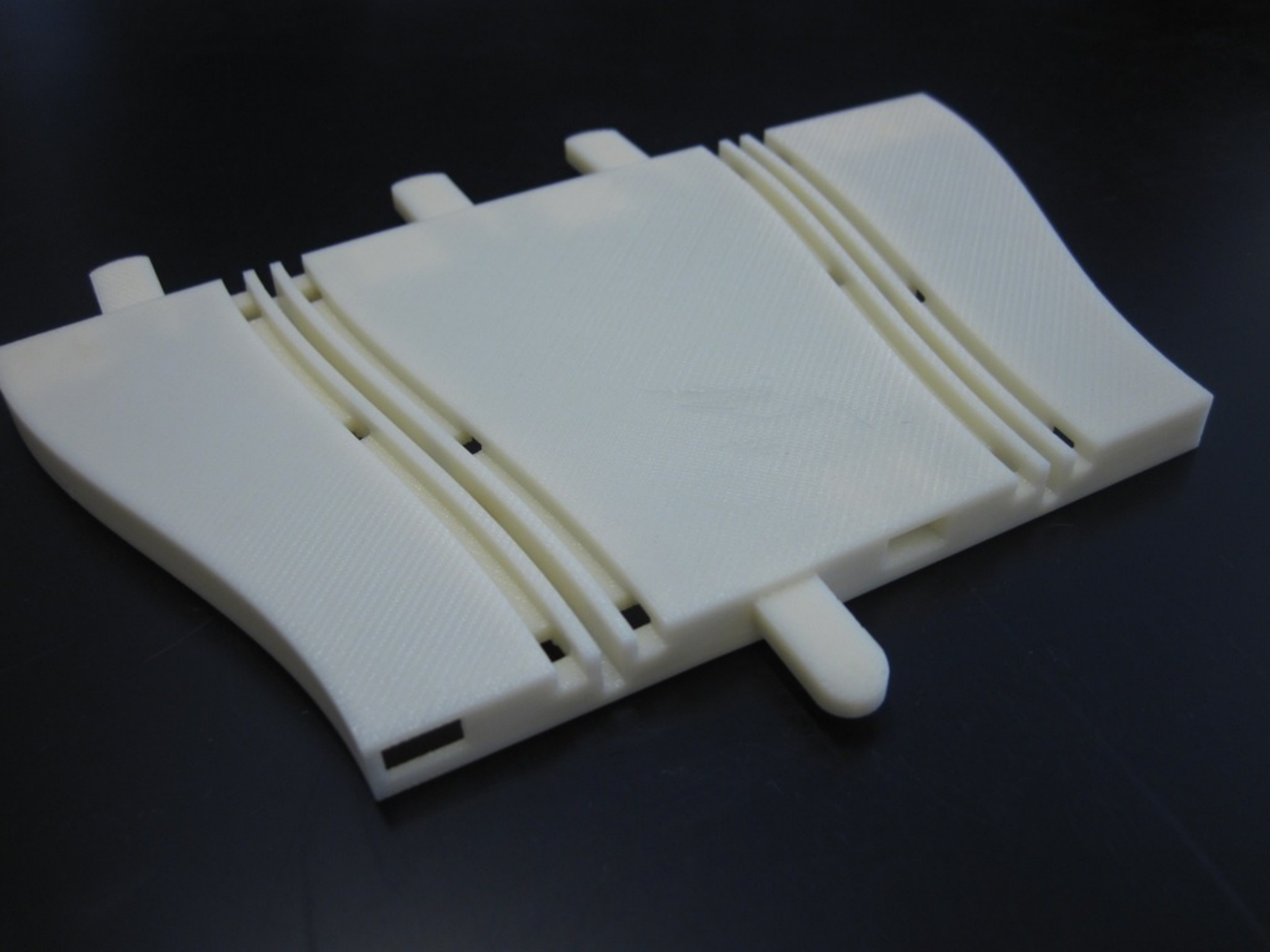


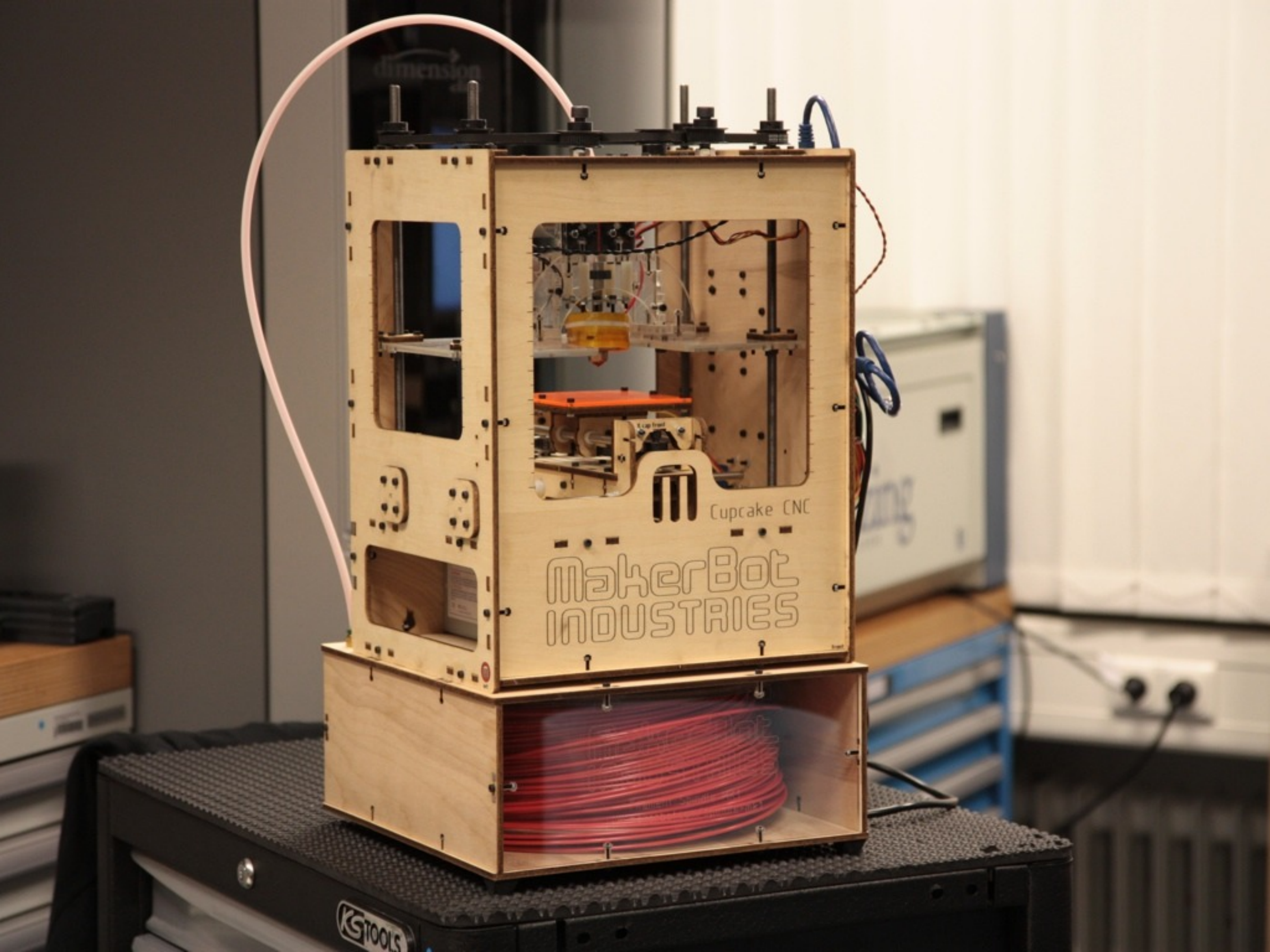
fablab.rwth-aachen.de

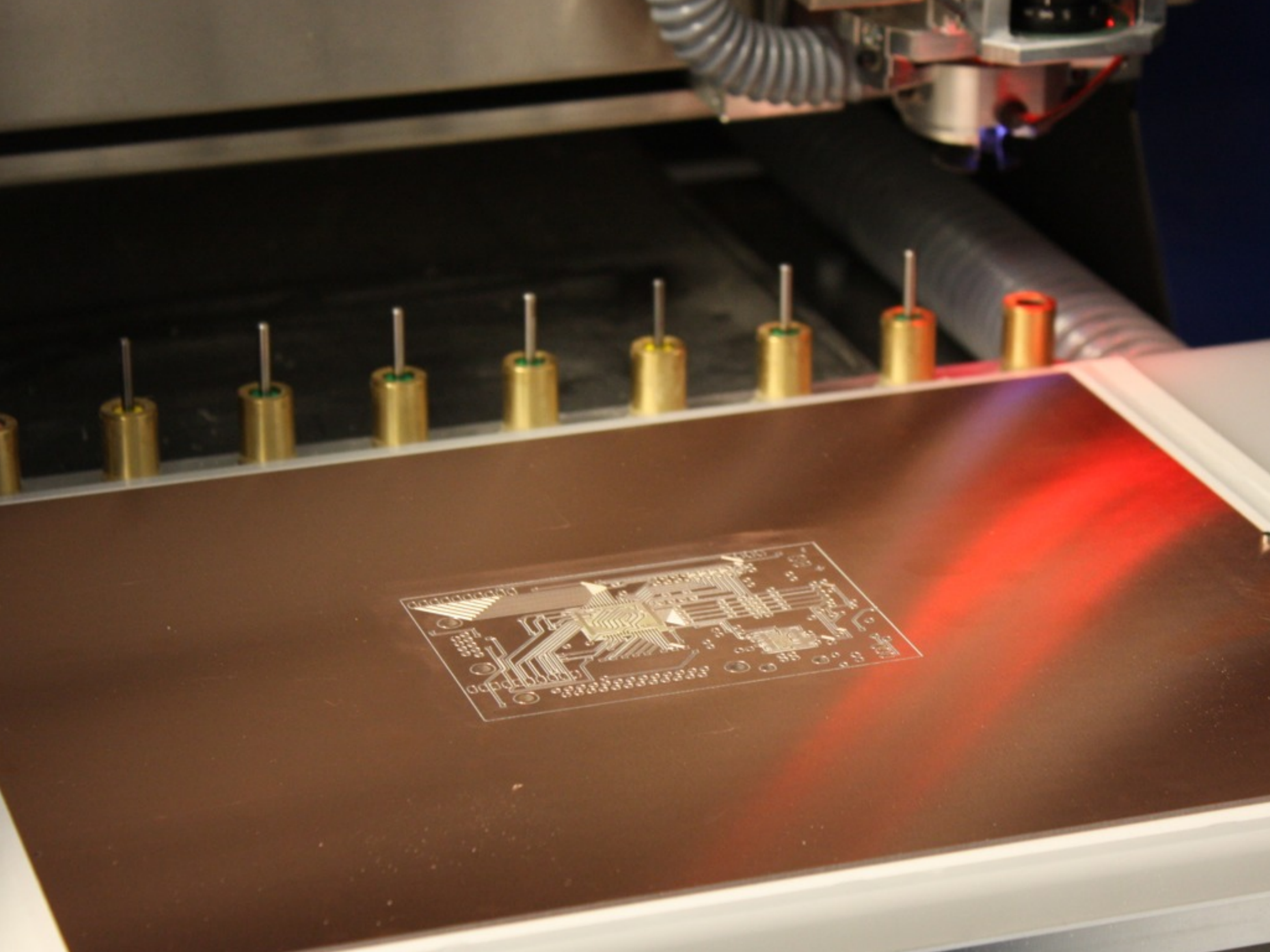


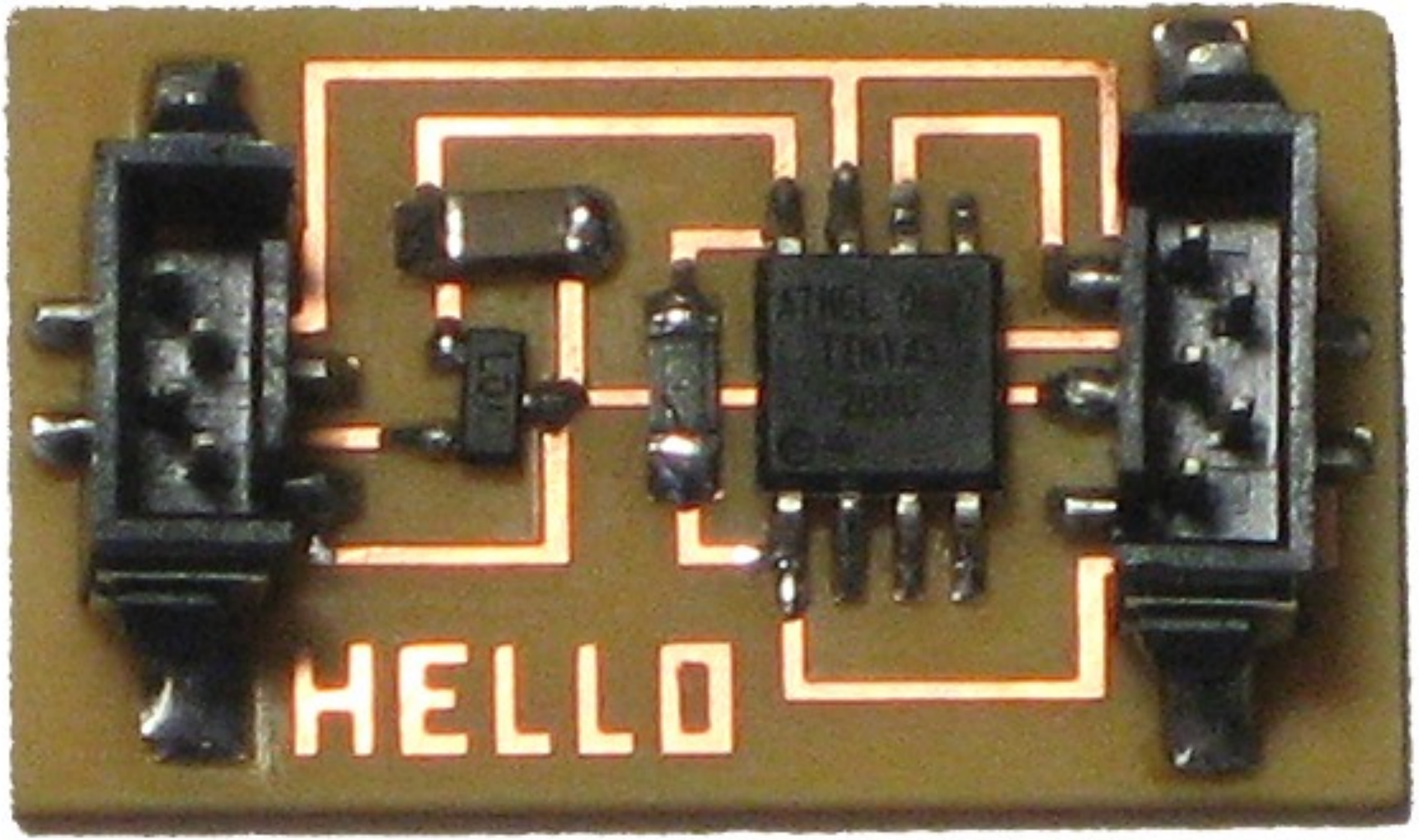


Obstschale
by Jakob Henke



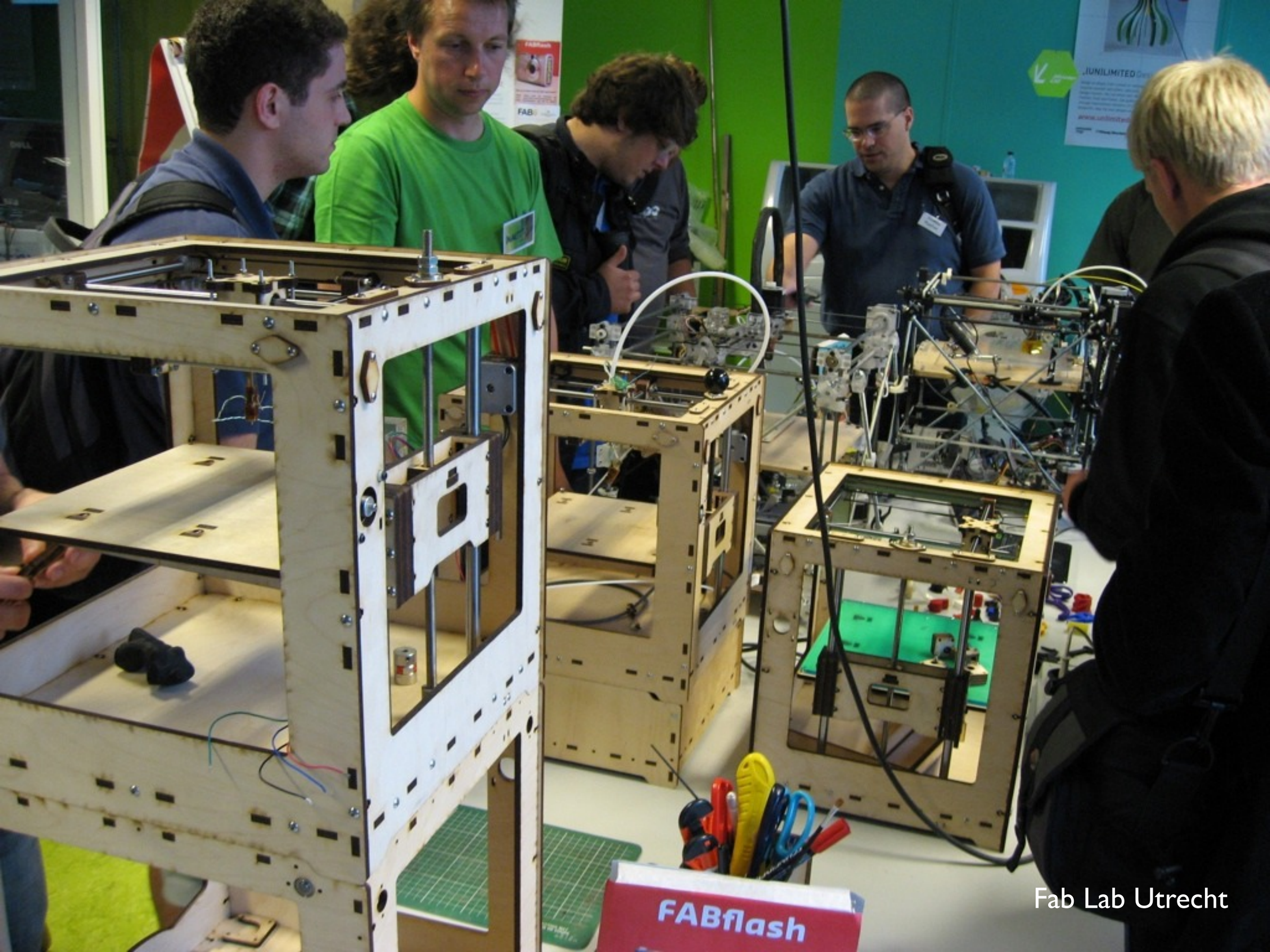

Cupcake CNC
MakerBot
INDUSTRIES
KSTOOLS




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



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

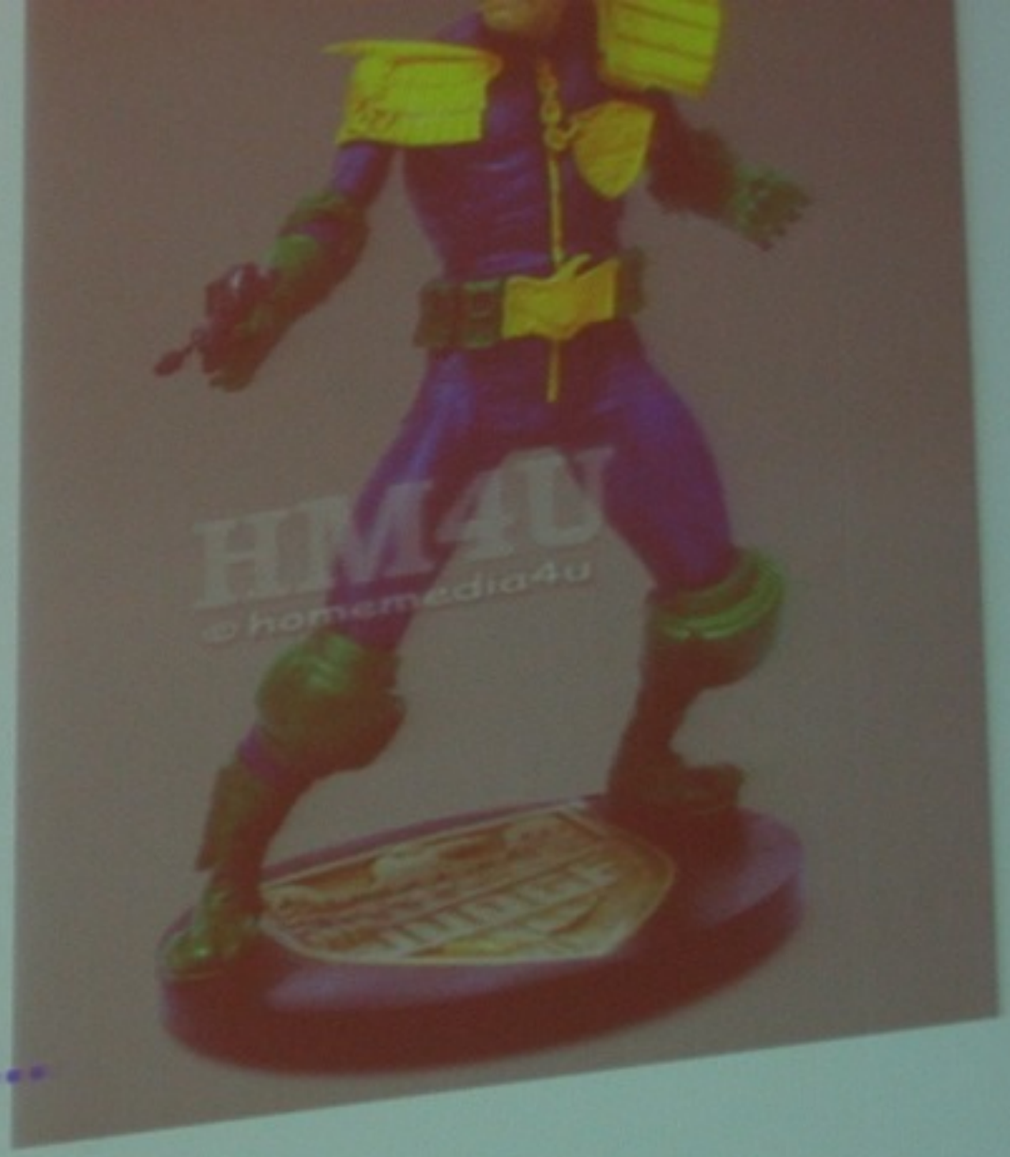
2 You can't forge (pass off)

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

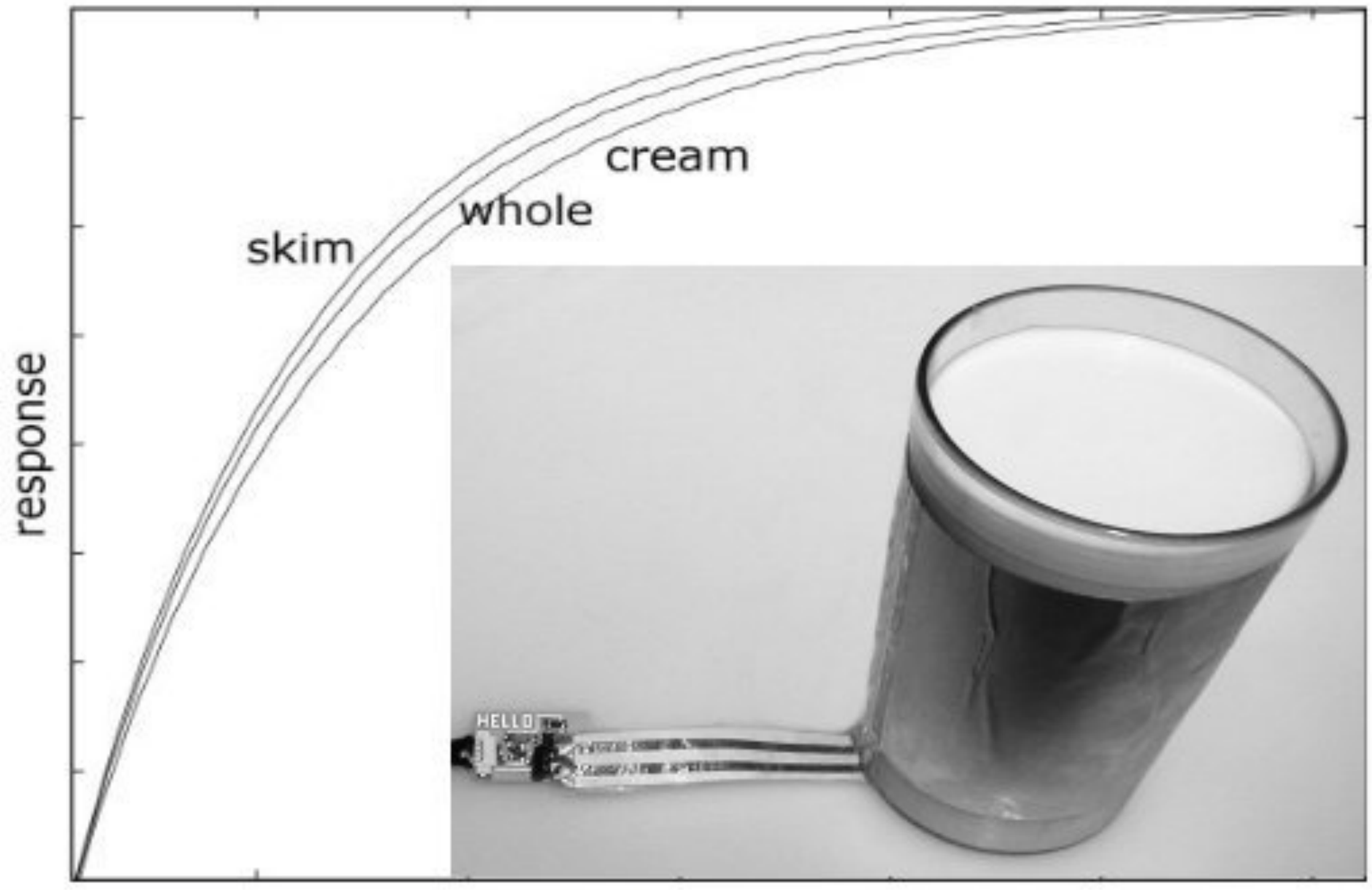
RepRap

Adrian Bowyer (Bath)

Fab Labs

- Free, open access
- Teach “revolutionary” skills
- Community based
- 60 around the world
- Fab Lab Aachen: Germany’s first
- http://fablab.rwth-aachen.de

we make things
no war
Fab Lab
Afghanistan



Source: Gershenfeld 2010

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

http://weatherella.wordpress.com/

Personal Fabrication *Requires* New User Interfaces

Reprap 3D printer
$40.000 → $400

Altair: $397 (1975)

File Edit Goodies Font FontSize Style

untitled

Jan Borchers, RWTH Aachen University: Personal Design

Lego Compatible Disc Buttons by clothbot - Thingiverse

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

a MakerBot Industries website

THINGIVERSE

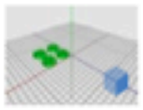
THINGS TOOLS TAGS BLOG

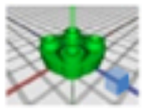
Welcome back, jan.
Thingiverse is awesome because of you.
[LOG OUT]

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





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

Jan Borchers, RWTH Aachen University: Personal Design

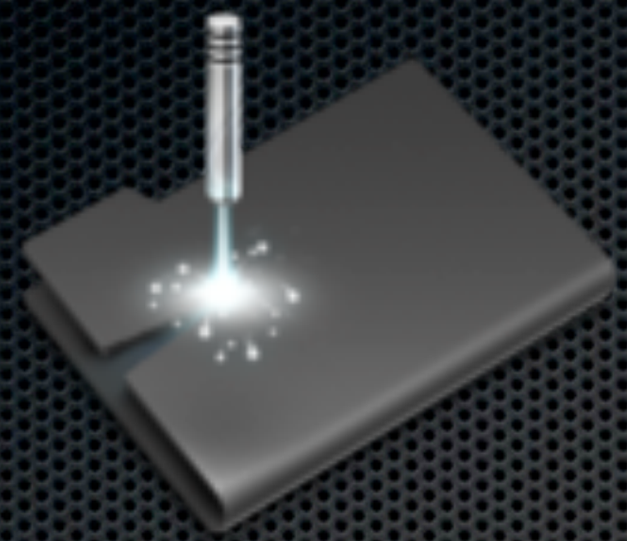
Make awesome stuff.

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

→ Meet the 123D Apps

123D	123D Catch	123D Sculpt	123D Make
Design stuff you really want to make, send it straight to a 3D printer.	Automatically convert ordinary photos into extraordinary 3D models.	Shape and paint digital clay into amazing 3D sculptures on your iPad.	Transform 3D models into a pattern for assembling real artful creations.

VisiCut

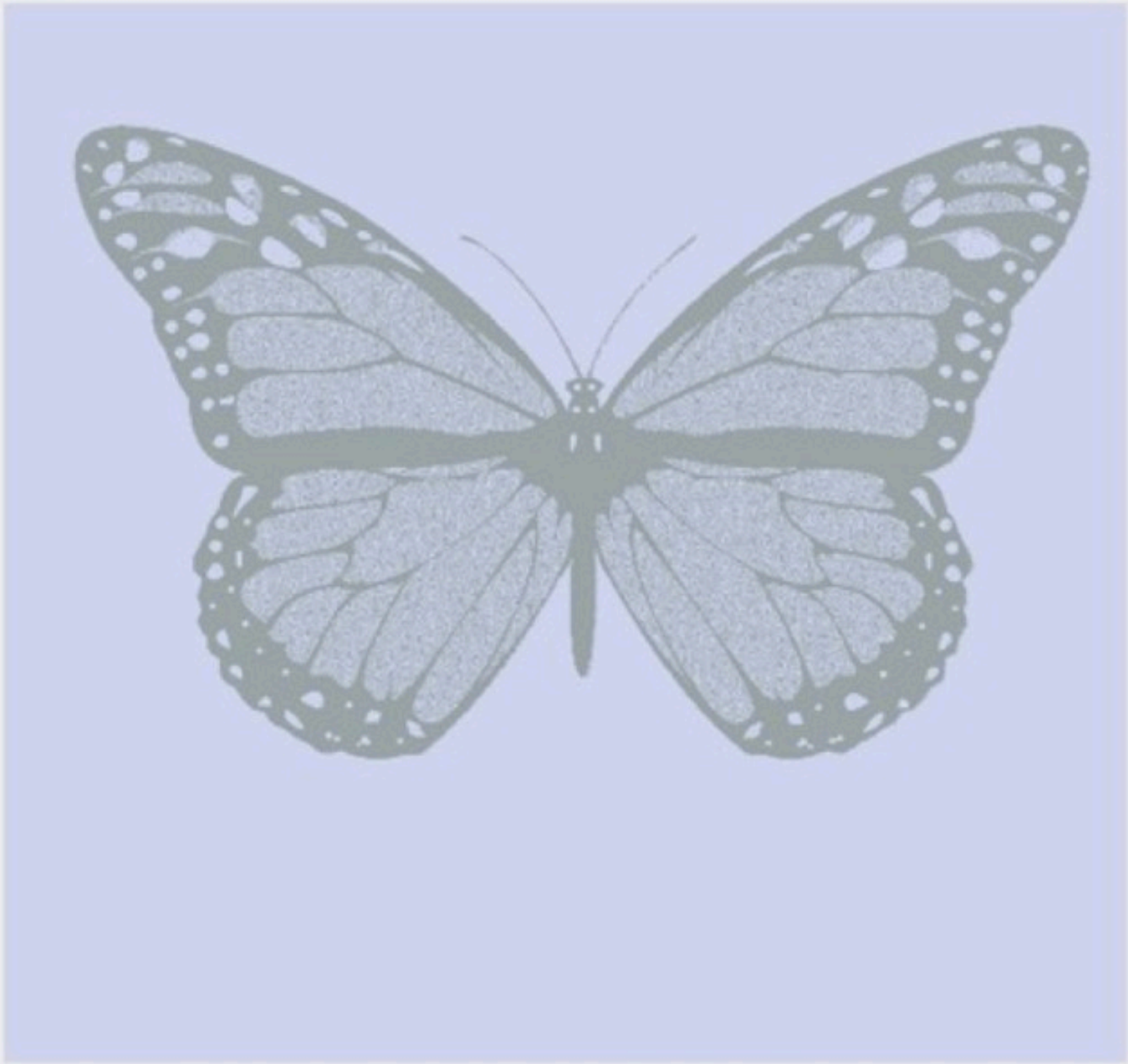


- The VisiCalc of LaserCutting
- Open-source, free
- http://hci.rwth-aachen.de/visicut

- VisiCut

Full Preview | Cutting Preview | Zoom: 517 | Capture Foto

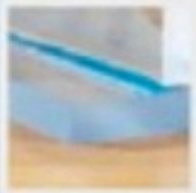
Preview



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

FORMULOR* Editor

http://www.formulor.de/createDesign

Google

FORMULOR* | Create Design | Design Templates | Materials | EPS/SVG upload | Help | Shopping Cart | Login

interactive view

3 mm Acrylic GS
orange, opaque
181x181 mm
EUR4.34
plus shipping costs

add to cart

add layout...

Save in your Formulor account

Material | Create design

Engraving | Options

Cutout

Position
X 70.9
Y 129.3

Size
Width 46.8
Height 46.2
lock

Rotate
30

Flip

Composition

Edit points
Copy
Delete shape

181

50 mm

74%

Jan Borchers, RWTH Aachen University: Personal Design

FabScan (RWTH)

hci.rwth-aachen.de/fabscan

$150

hci.rwth-aachen.de/fabscan

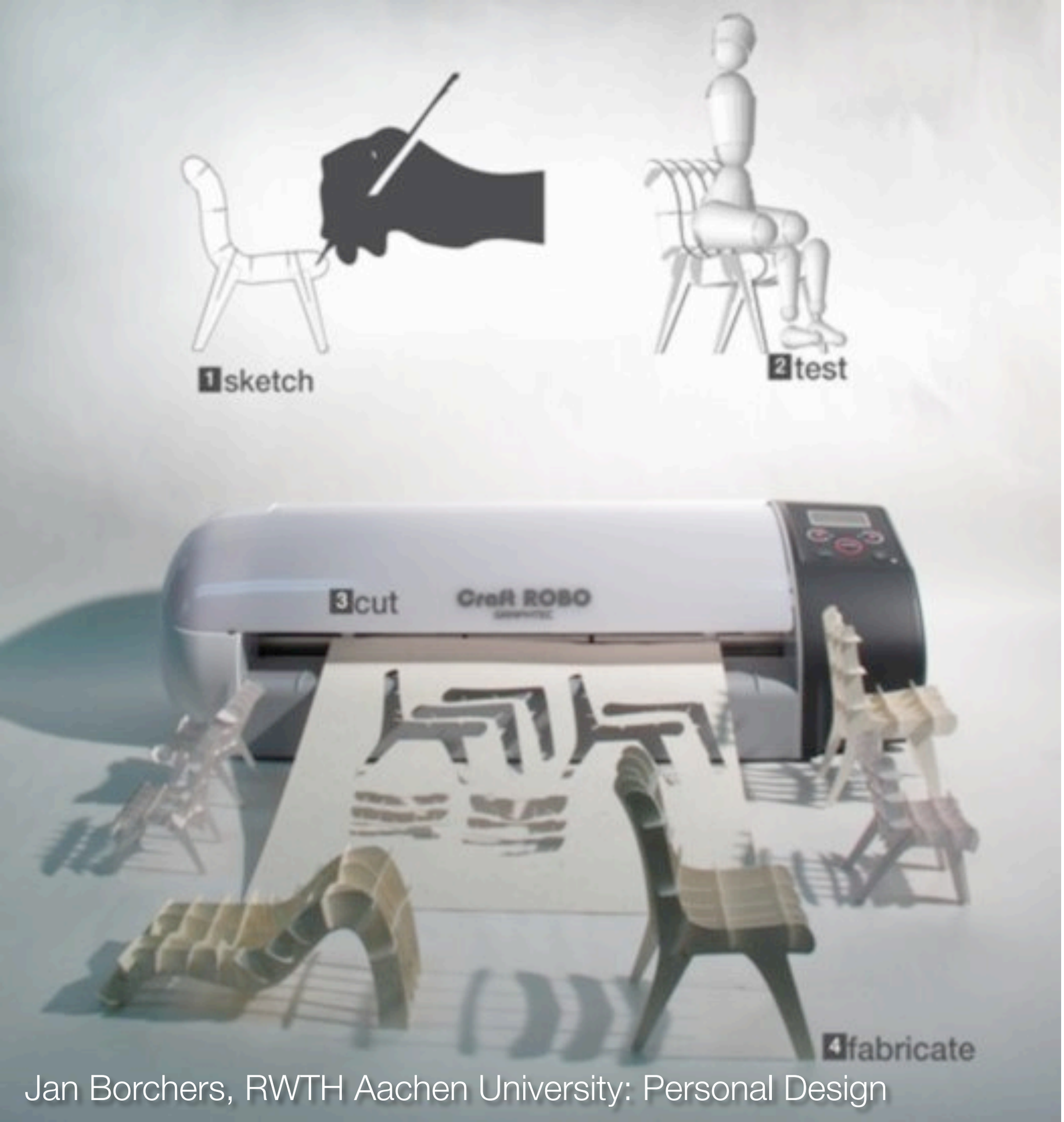
Jan Borchers, RWTH Aachen University: Personal Design

Jan Borchers, RWTH Aachen University: Personal Design

FRONT: Sketching Furniture (2007)

Jan Borchers, RWTH Aachen University: Personal Design

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

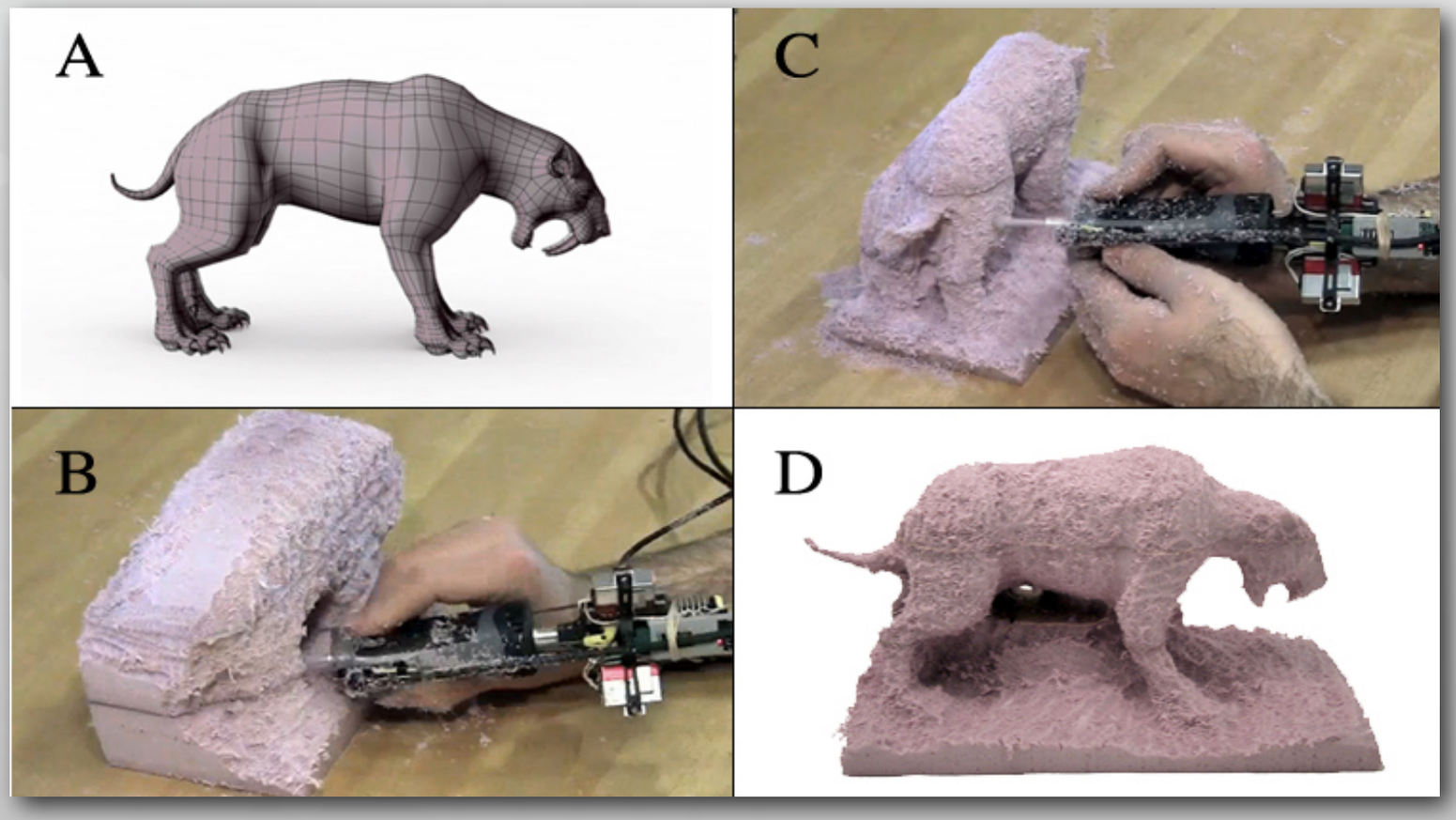
	Local Design	Outsourced Design
Local Fabrication	AutoCAD +RepRap	Thingiverse
Outsourced Fabrication	Shapeways	Traditional

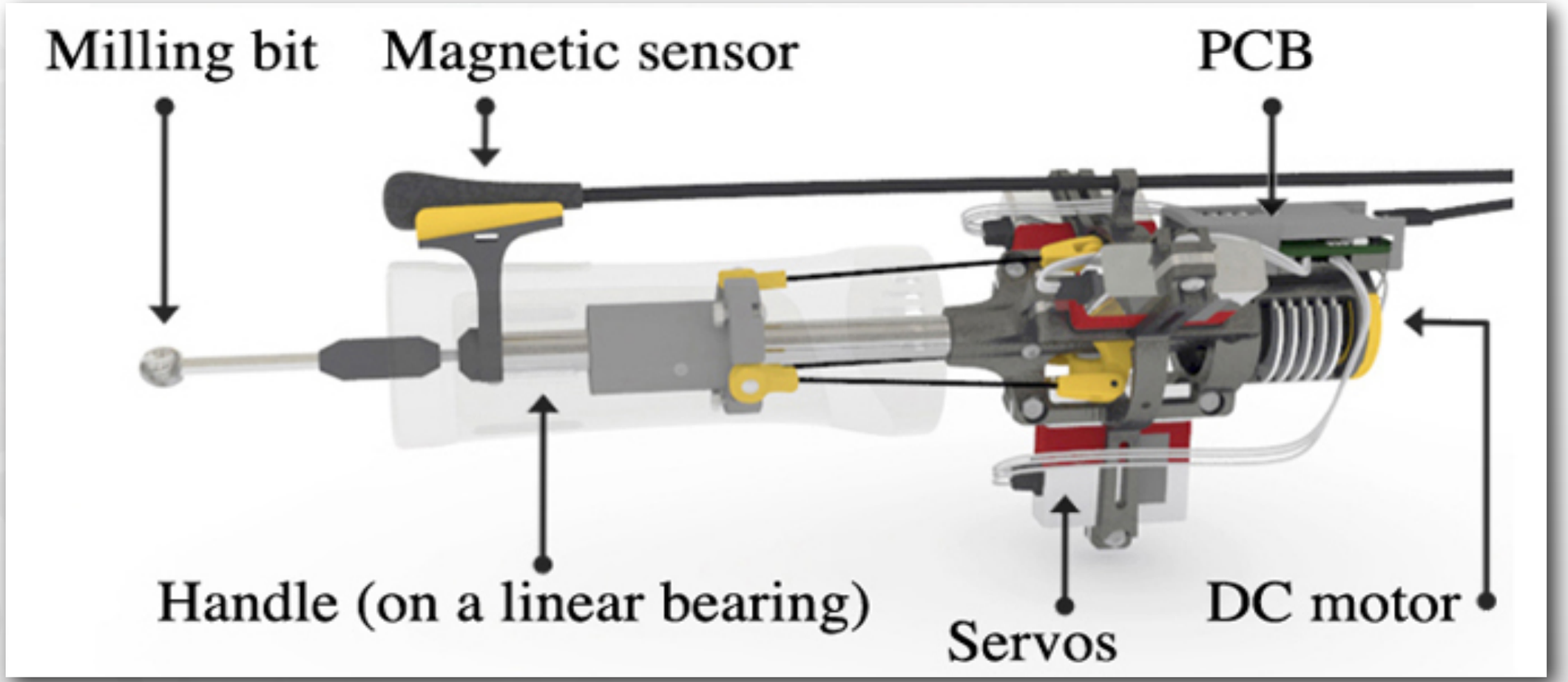
HCI Research Topics

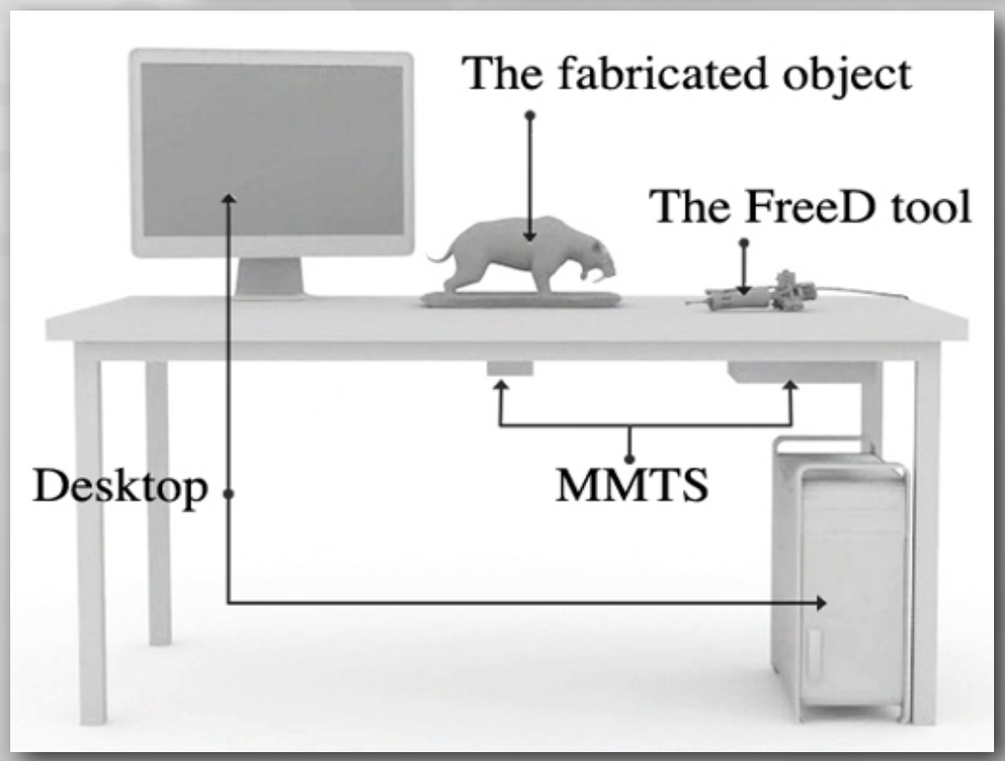
- Tools for HCI Research
  - Examples: SLAP, Madgets, Pneumatic Displays (CHI 2009)
- Software for Fabrication
  - 123D Make (Autodesk)
  - SketchChair.cc (Igarashi)
- New Interactions for Fabrication (beyond CAD)
  - FreeD
  - Constructables

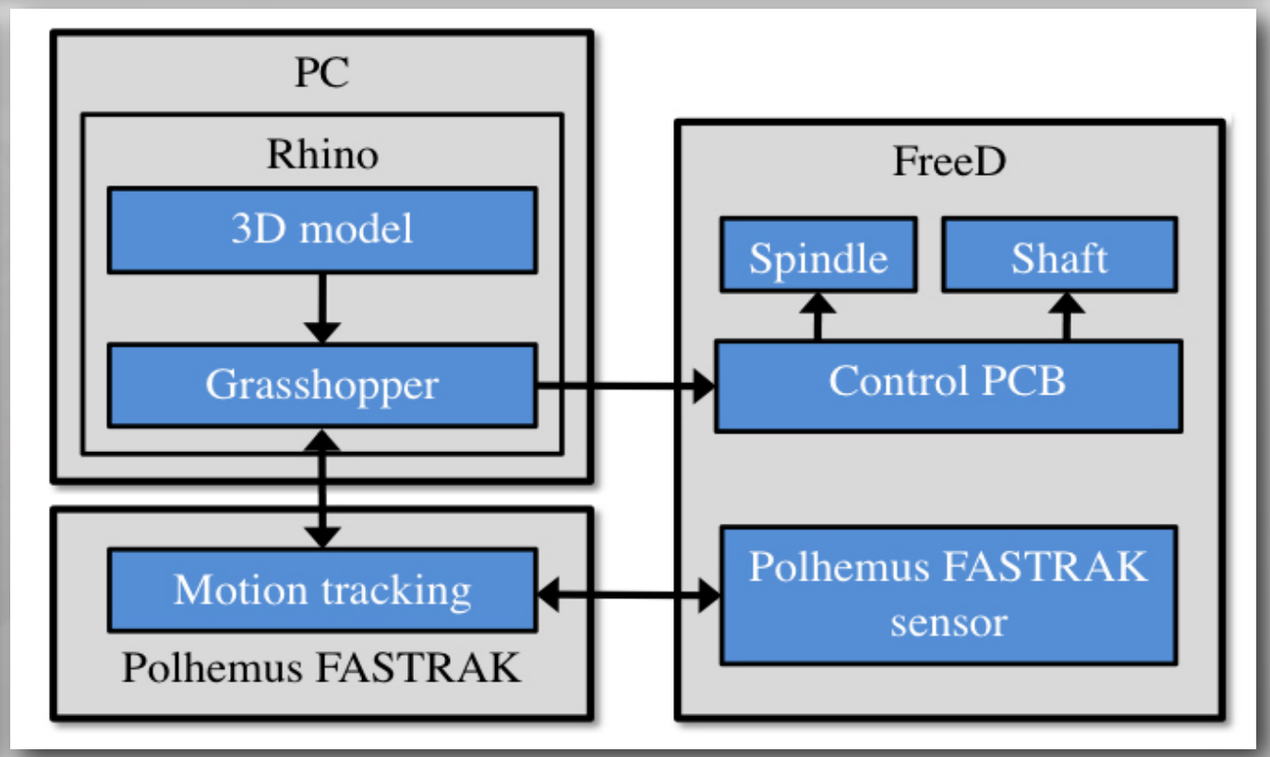
FreeD:
A Freehand Digital Sculpting Tool

- Amit Zoran, Joe Paradiso (MIT), CHI 2013 (vimeo.com/59826043)
- Handheld milling device knows 3D model, constrains sculptor to avoid, e.g., carving too deeply




Milling bit
Magnetic sensor
PCB
Handle (on a linear bearing)
Servos
DC motor

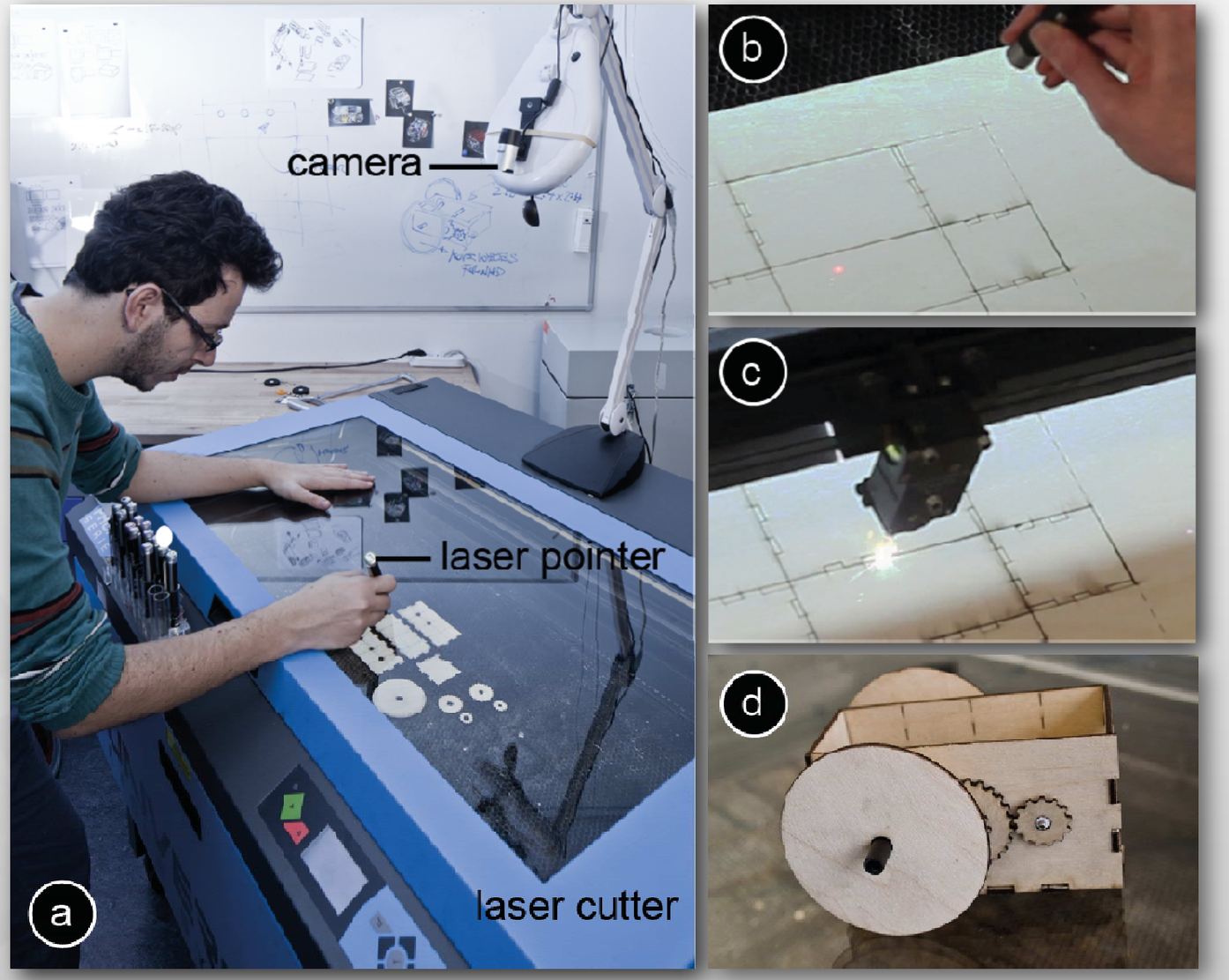

The fabricated object
The FreeD tool
Desktop
MMTS


PC
Rhino
3D model
Grasshopper
Motion tracking
Polhemus FASTRAK
FreeD
Spindle
Shaft
Control PCB
Polhemus FASTRAK sensor

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