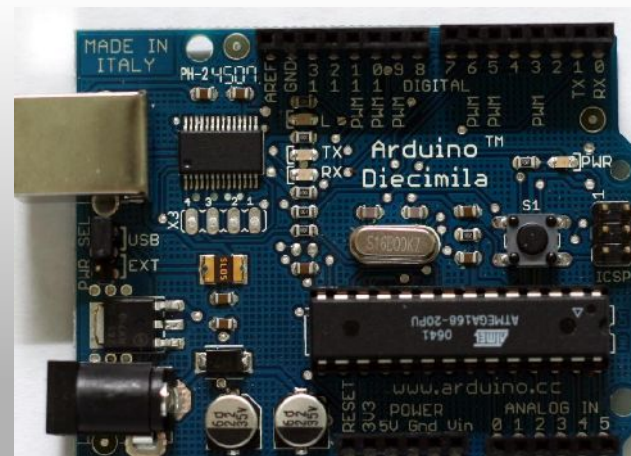
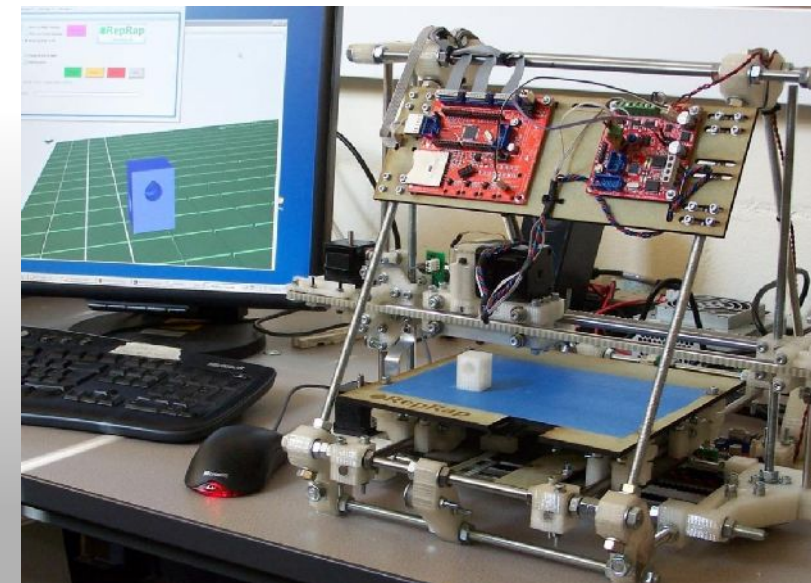


Personal Fabrication

Erik de Bruijn
Siert Wijnia





Personal Fabrication, RepRap

derivatives
and

enablers of open hardware



CandyFab

Two categories

<http://www.youtube.com/watch?v=a8SewJ2lvf4>



Search

Browse

Upload

Create

RepRap, 3D printing household objects: Batist's bath plug

Erikdb

26 videos



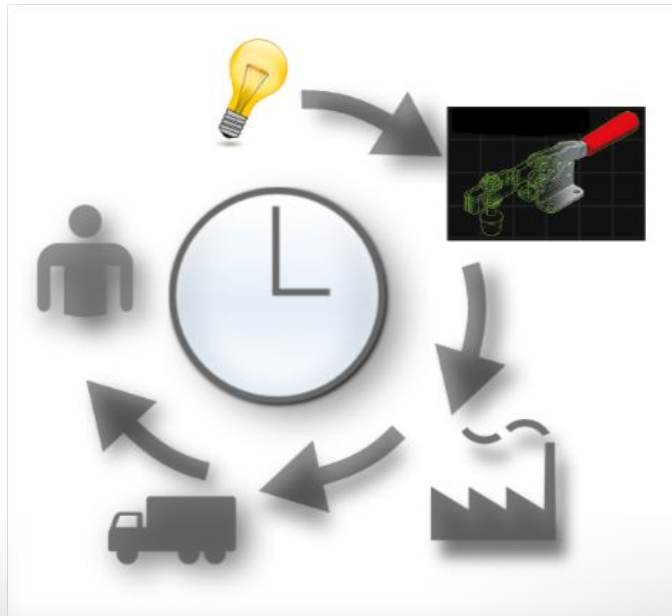
Subscribe



But, that is just content!

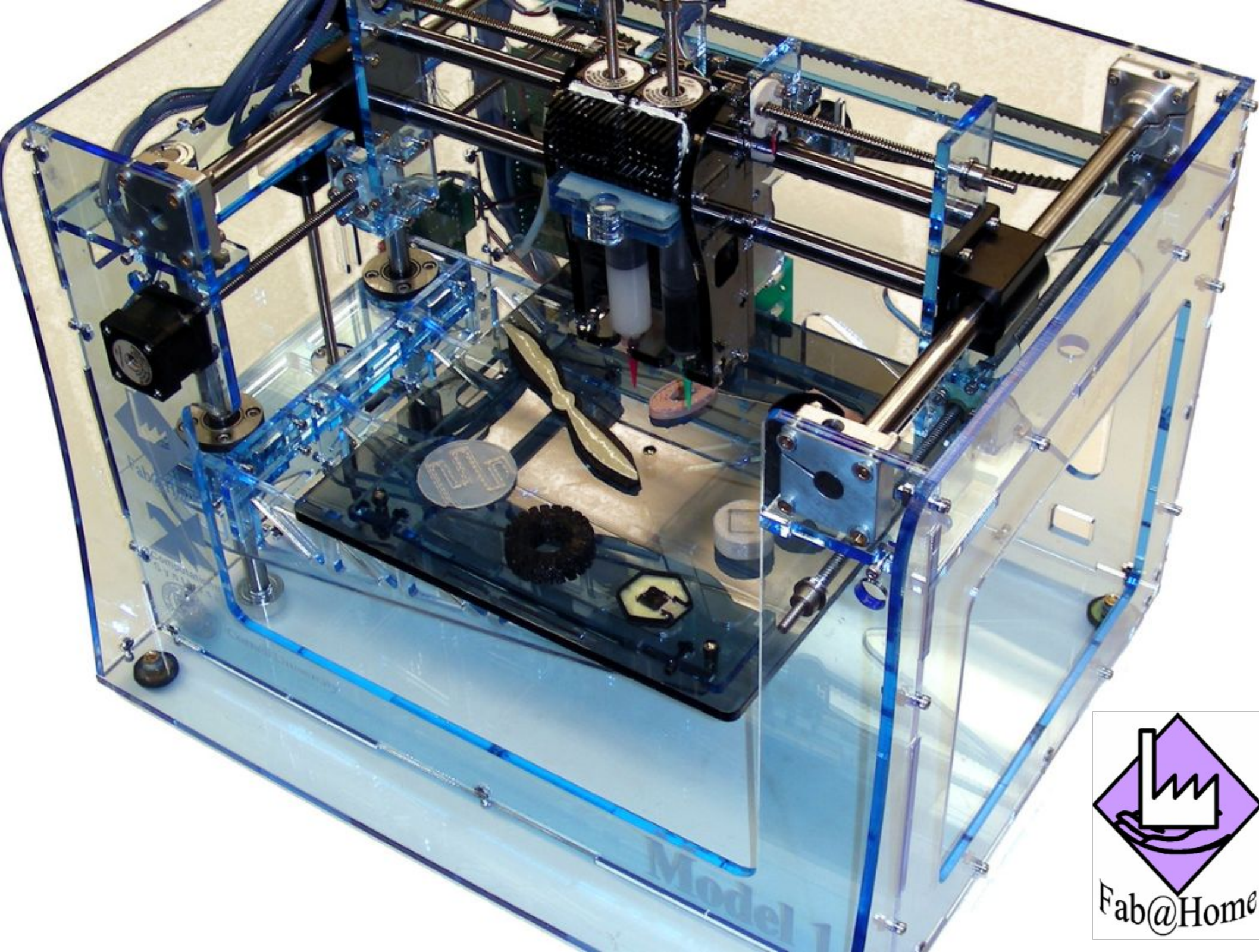
What about real innovation?

What is innovation?



My definition:
Invention + Diffusion

diffusion can occur through
commercialization...



MakerBot™





CandyFab.org

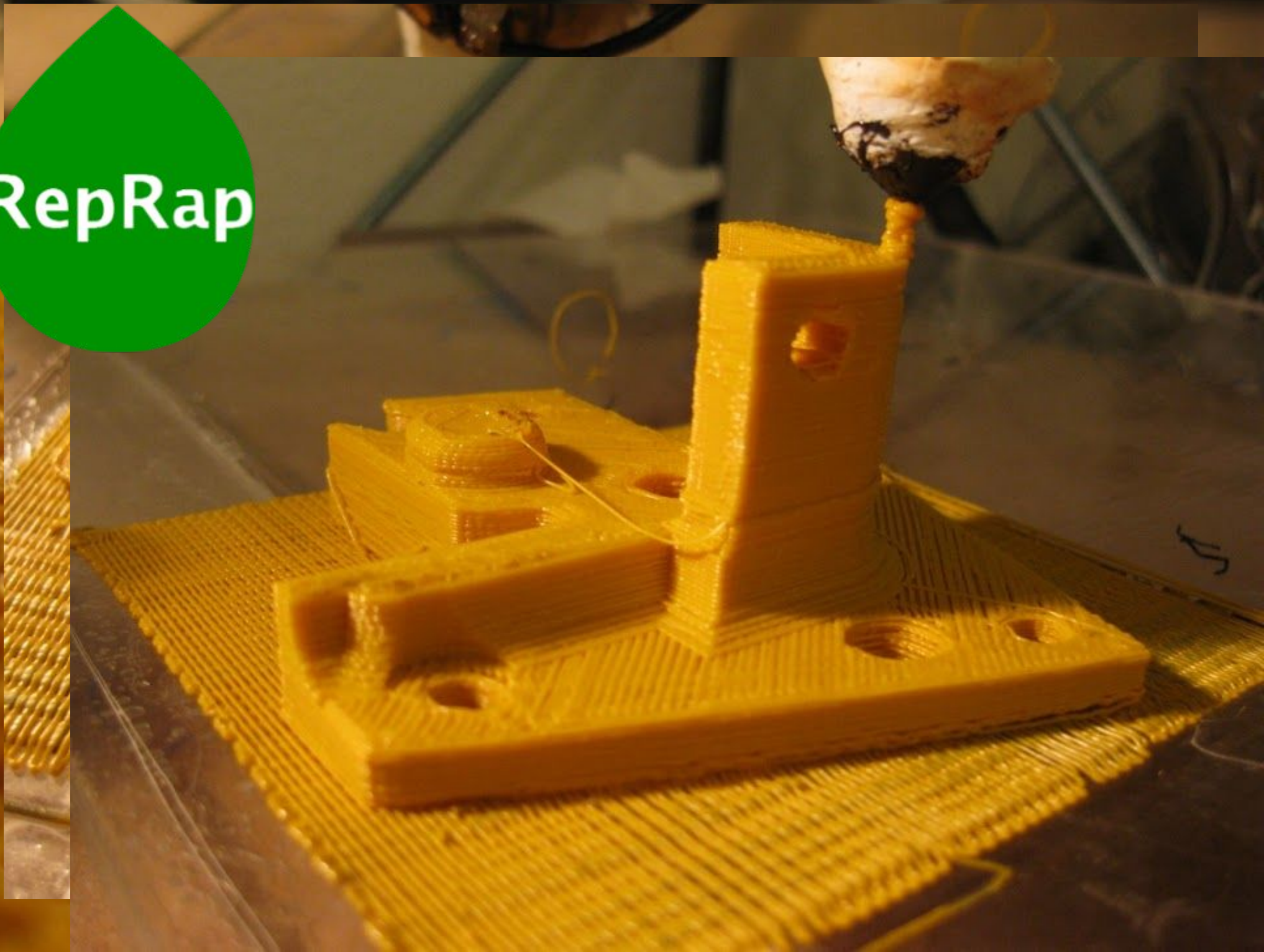
A close-up photograph of a 3D printed surface, likely a plate or tray, showing a dense, textured pattern of small, raised rectangular features. Several circular holes are visible, some of which are slightly recessed. The material has a warm, yellowish-brown hue. In the upper left corner, there is a green teardrop-shaped logo containing the text "RepRap" in white.

RepRap

RepRap



RepRap



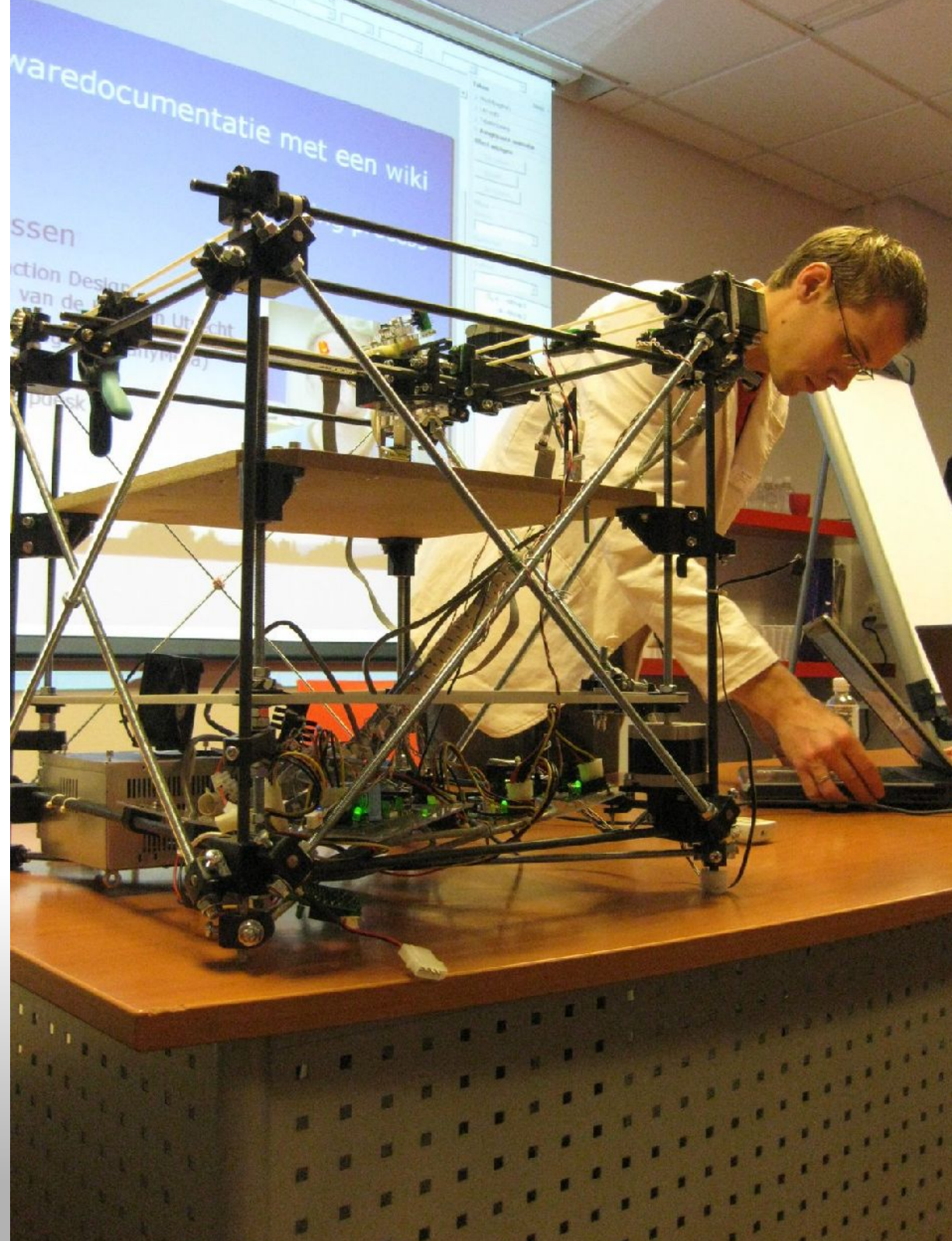
What's the RepRap?

A "3D printer"
or
"object fabricator"

Prints in (bio)plastics
(currently)

Makes objects on-
demand of arbitrary
shape.

Movie / Demo



Nature

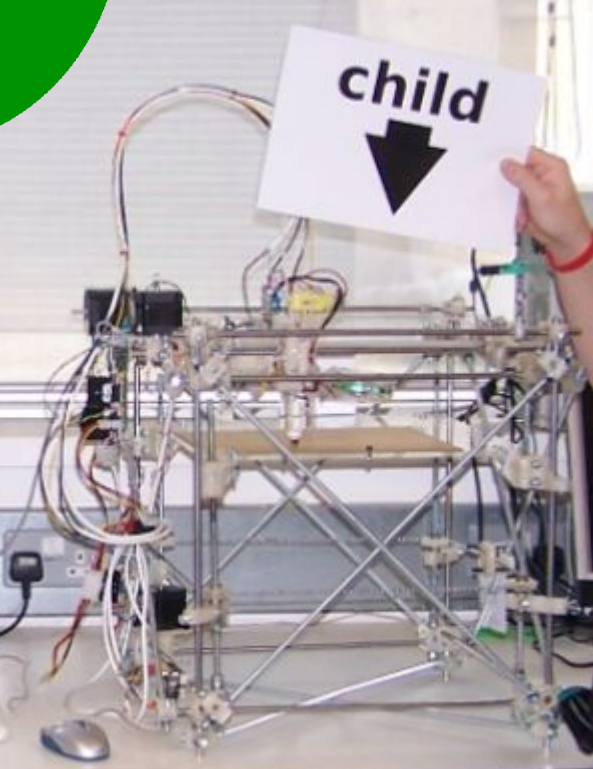
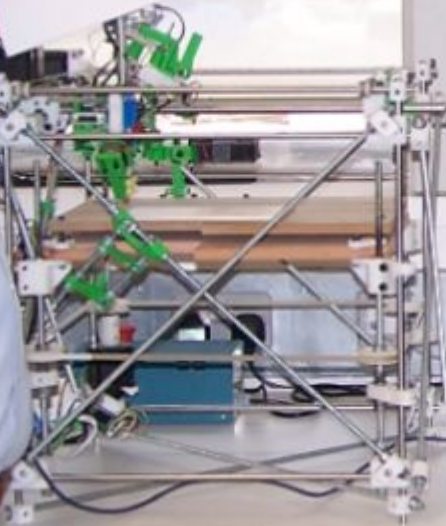
- **Grows**
- **Regenerates
(heals)**
- **Evolves**



RepRap

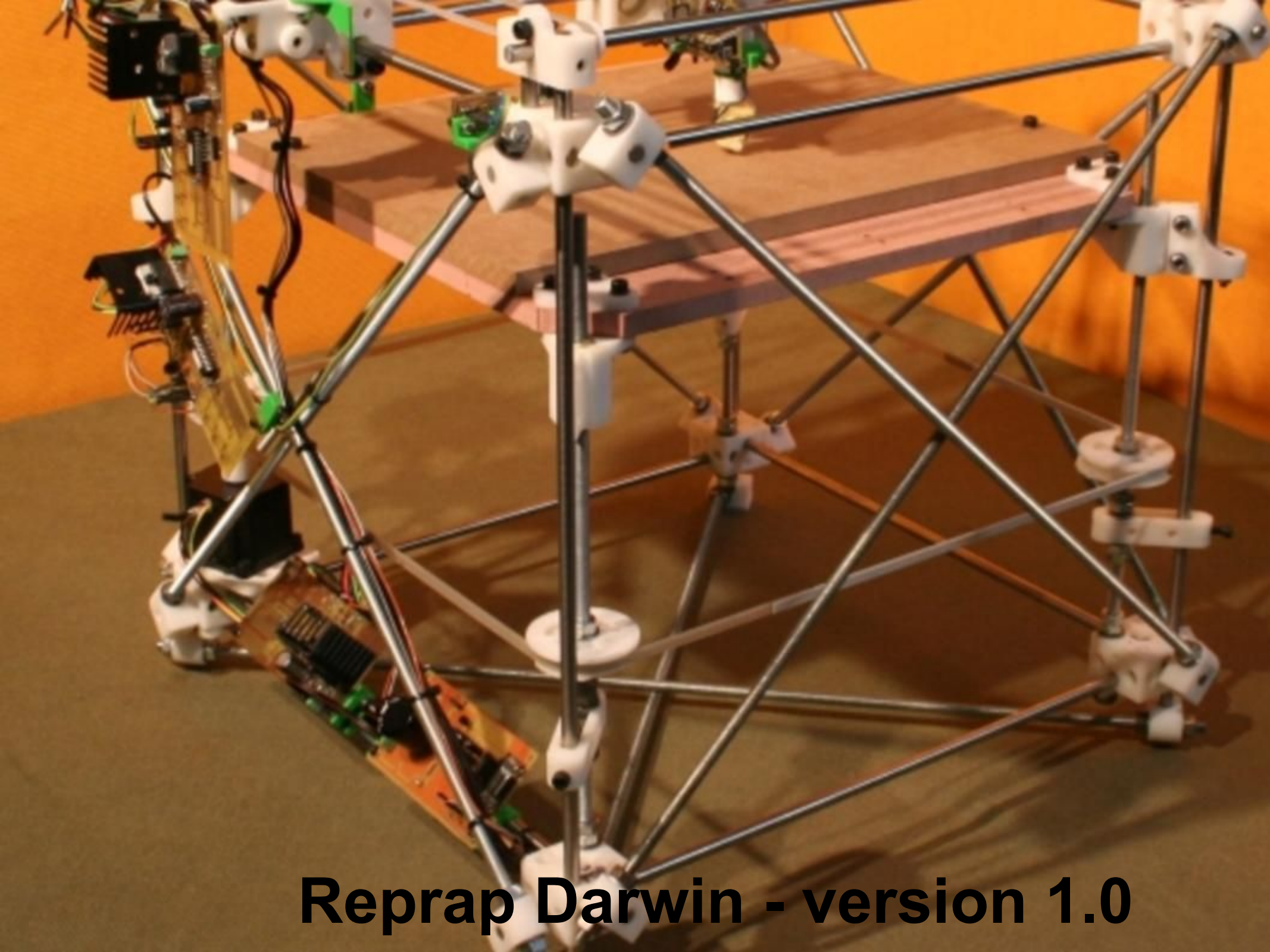


parent
↓

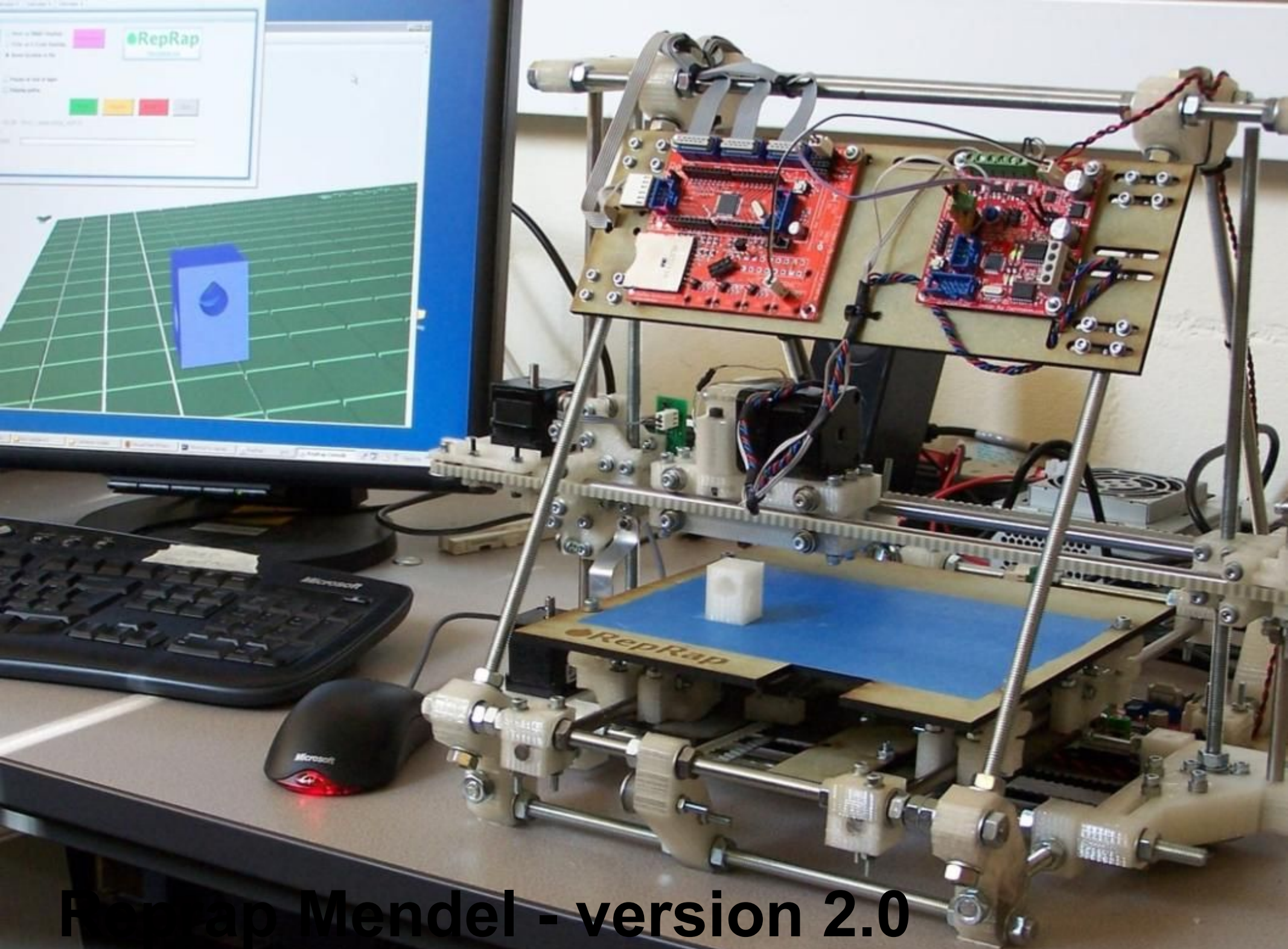


child
↓





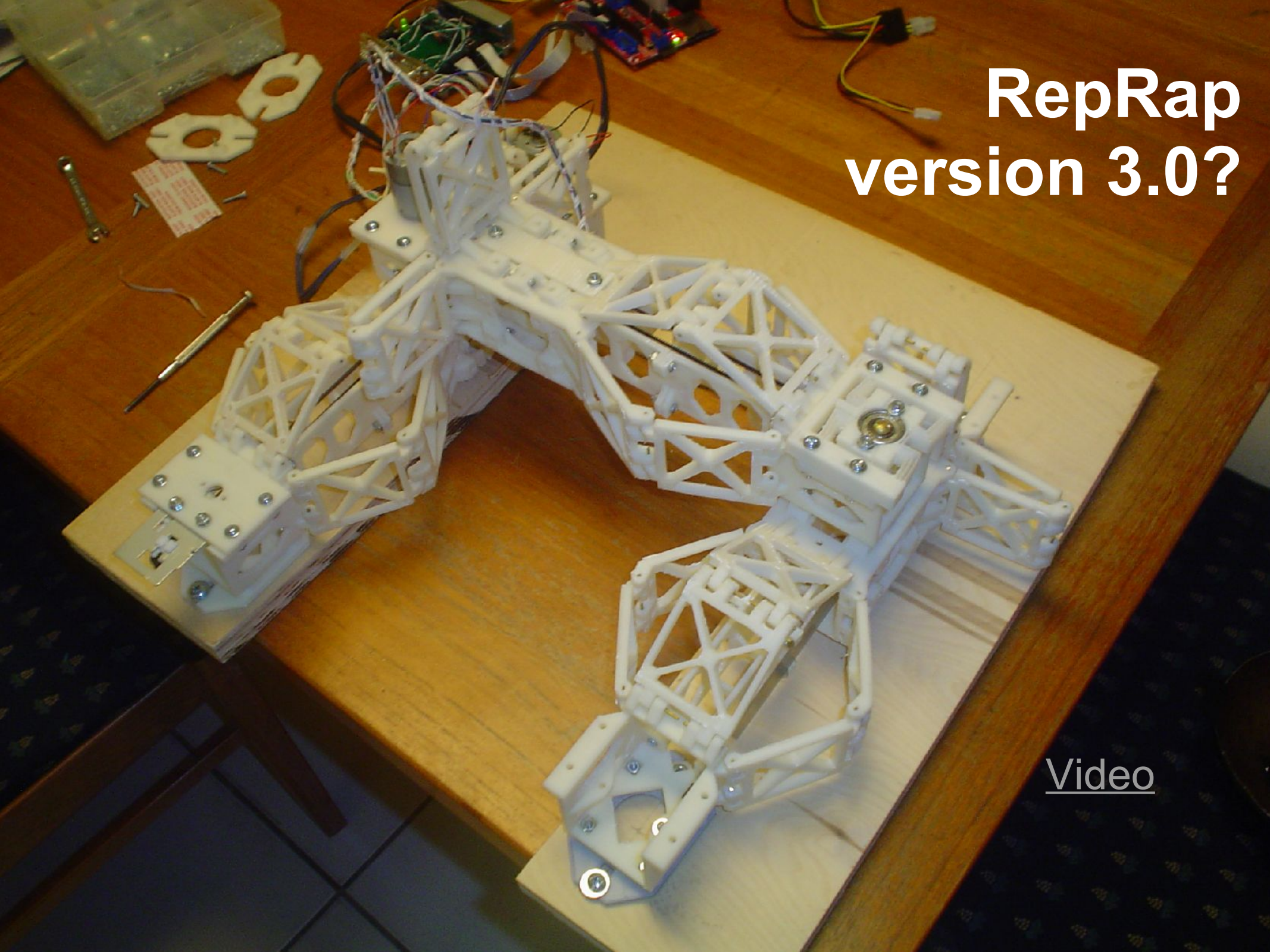
Reprap Darwin - version 1.0



RepRap Mendel - version 2.0

RepRap version 3.0?

[Video](#)

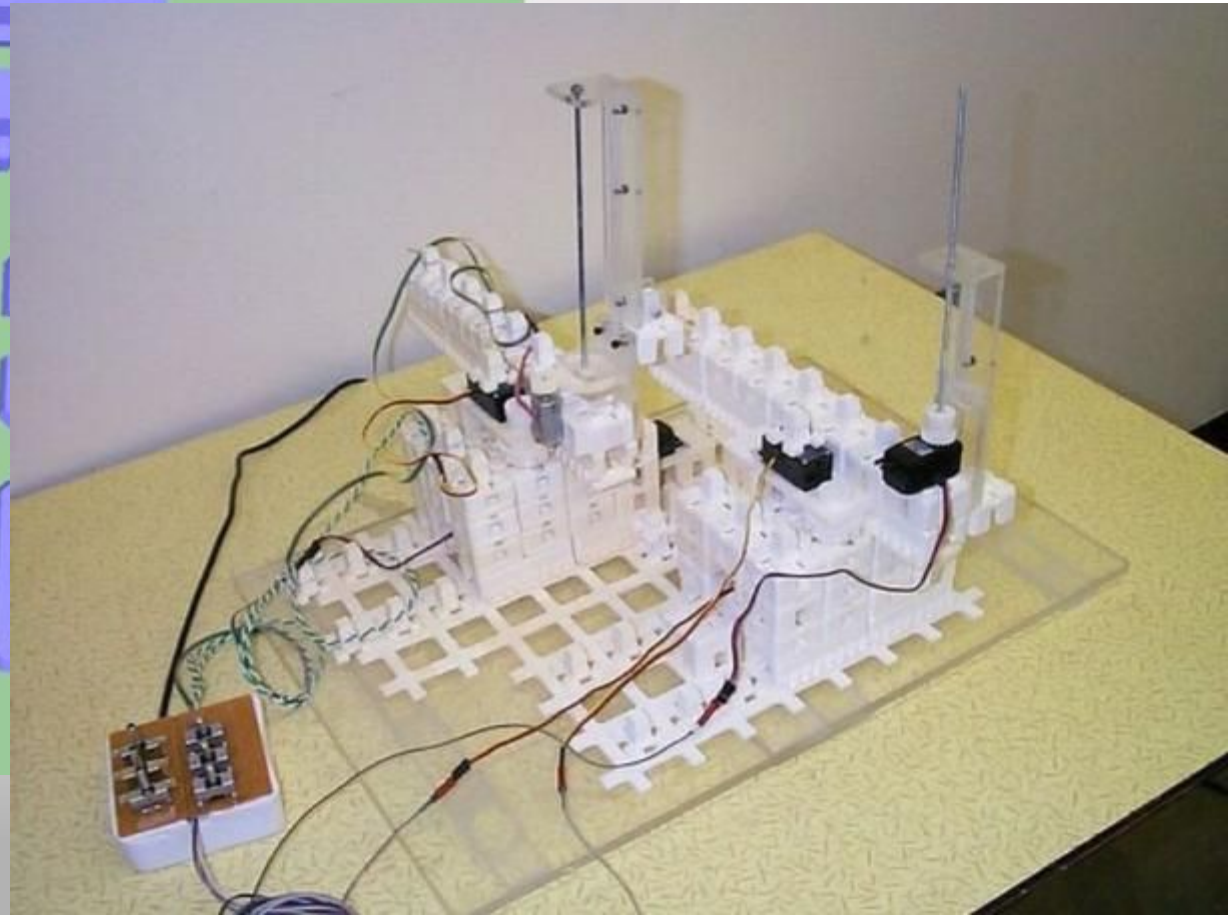
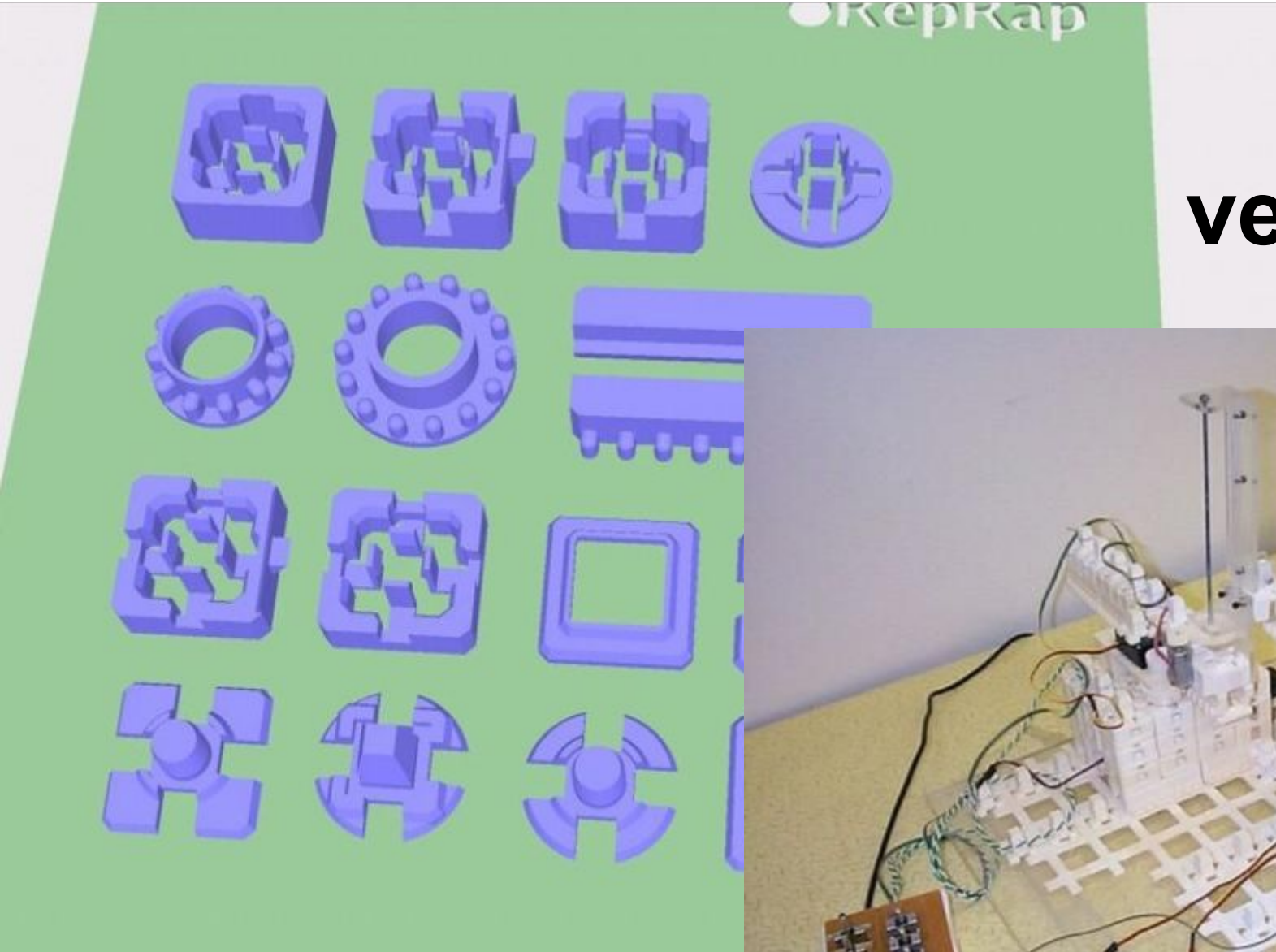


Self assembly

Download: www.thingiverse.com/thing:978

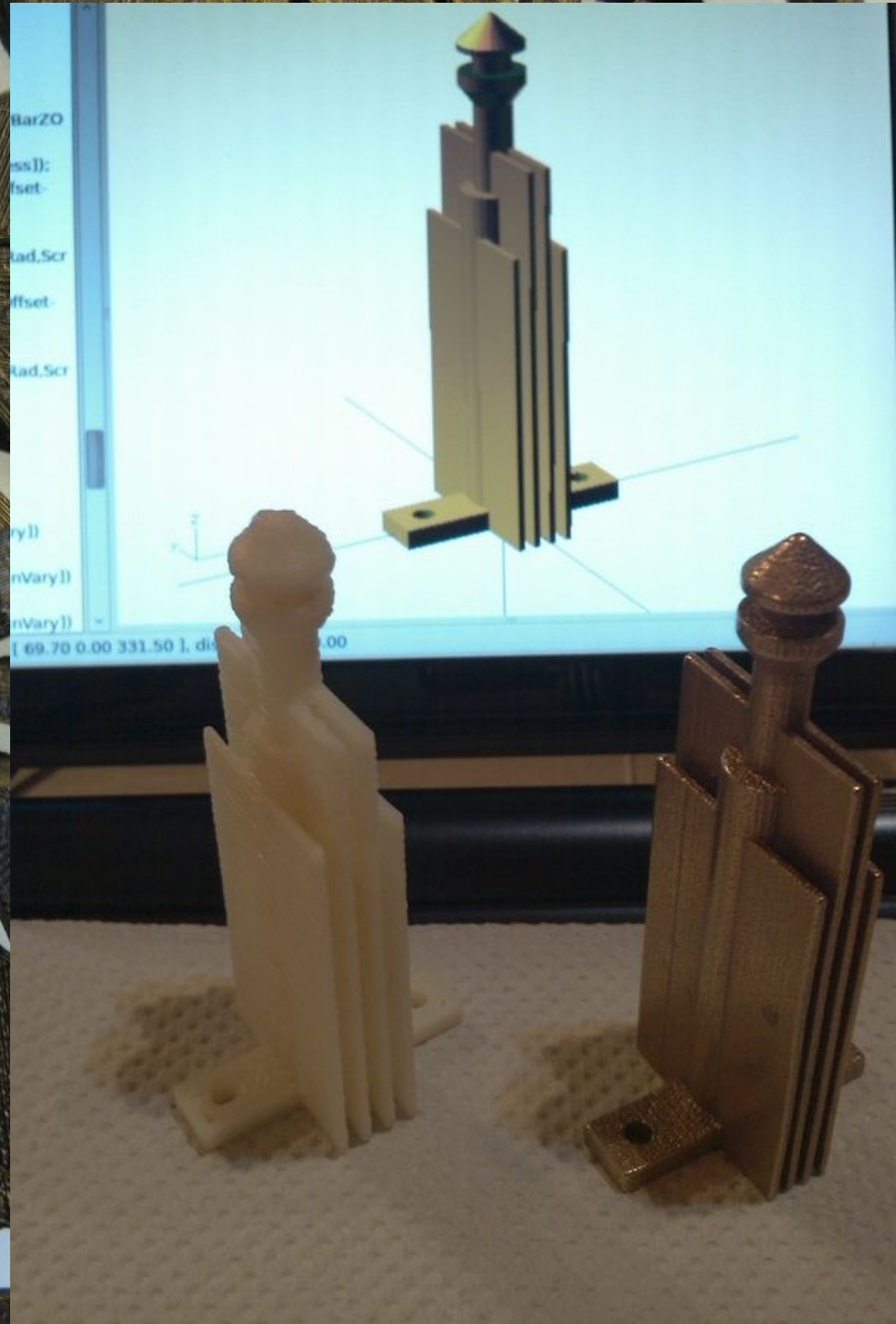
[Video](#)

RepRap version 4.0?

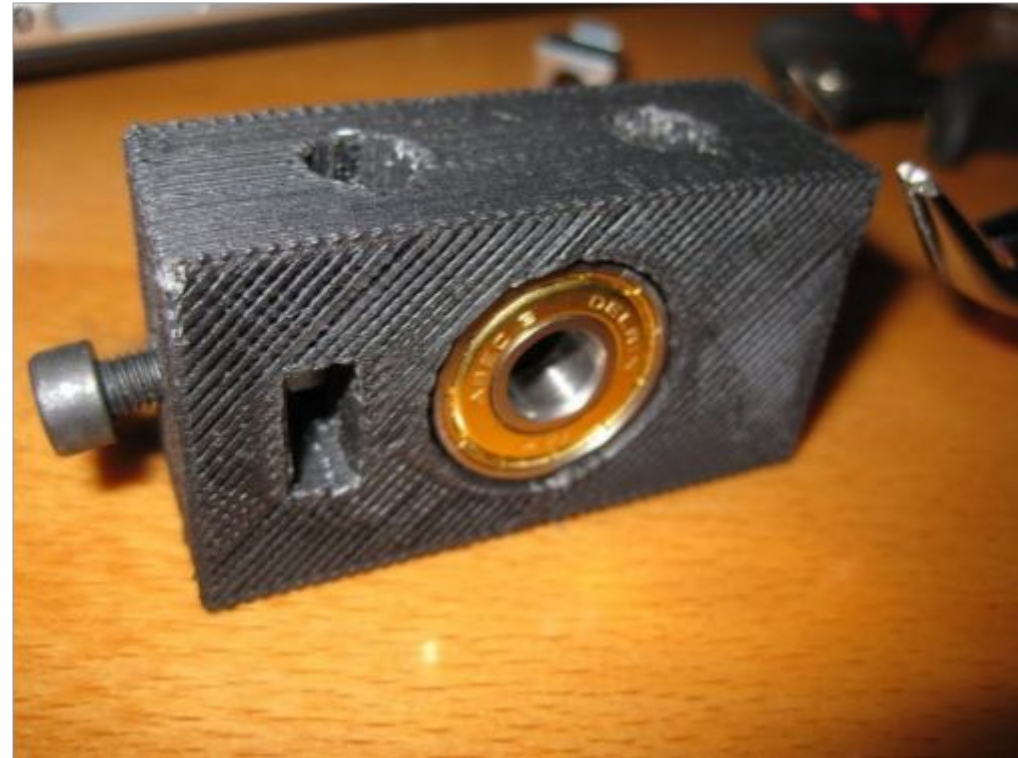




RepRap

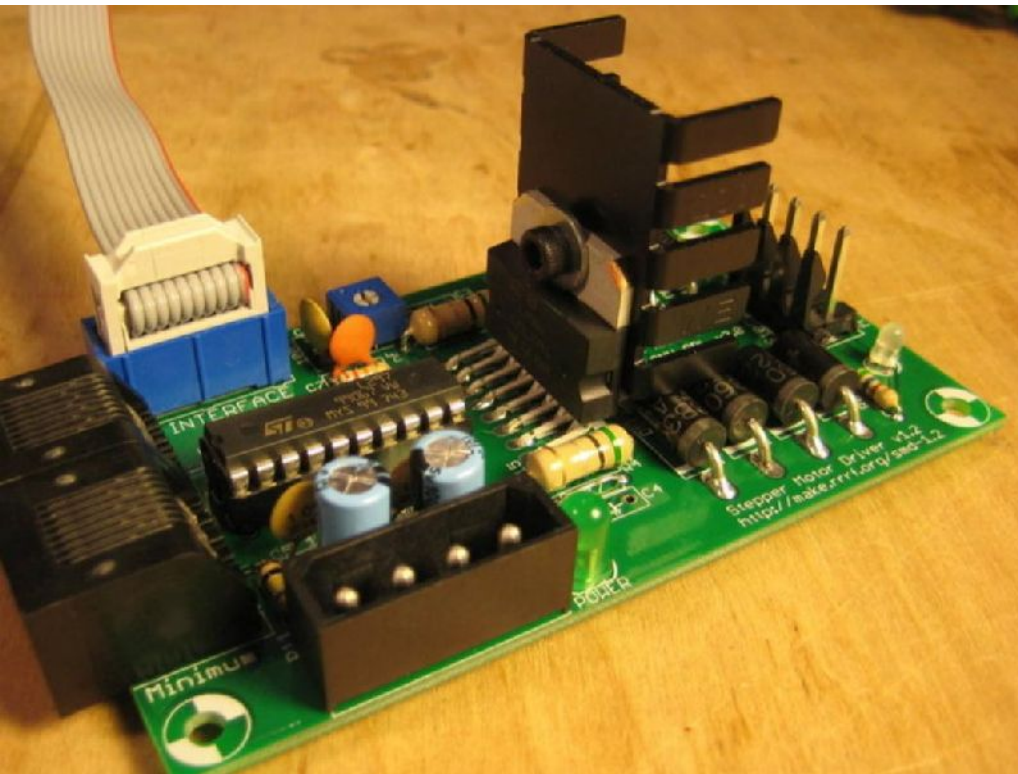


Evolving mechanics

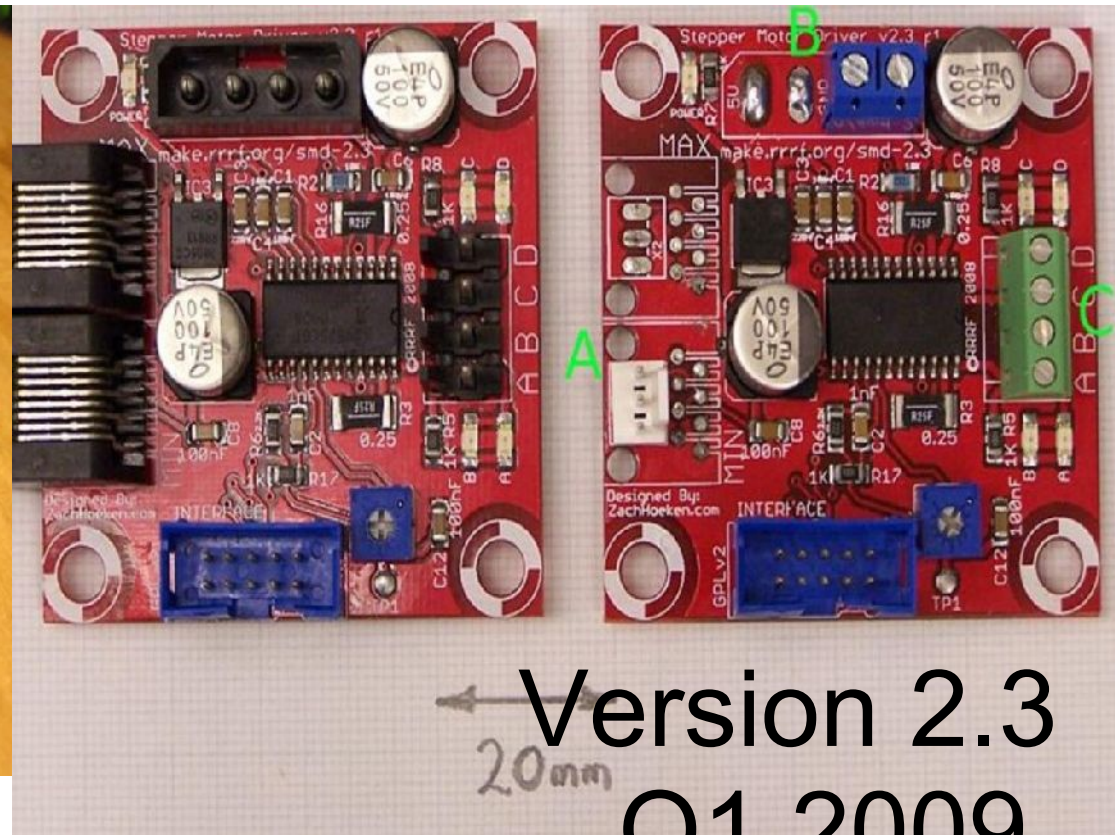


Print yourself: 50 cents
vs. 88 euros commercially

Evolving electronics



Reprap Stepper
Driver version 1.2)
Q2 2008

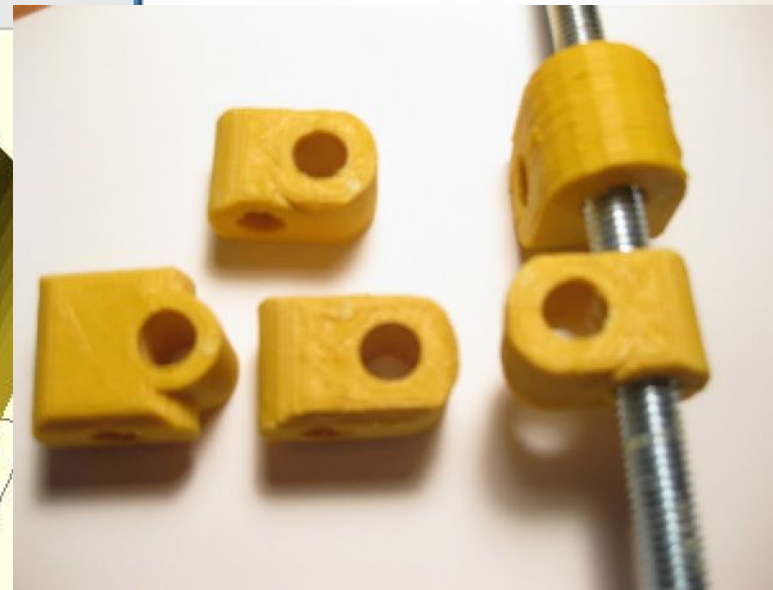
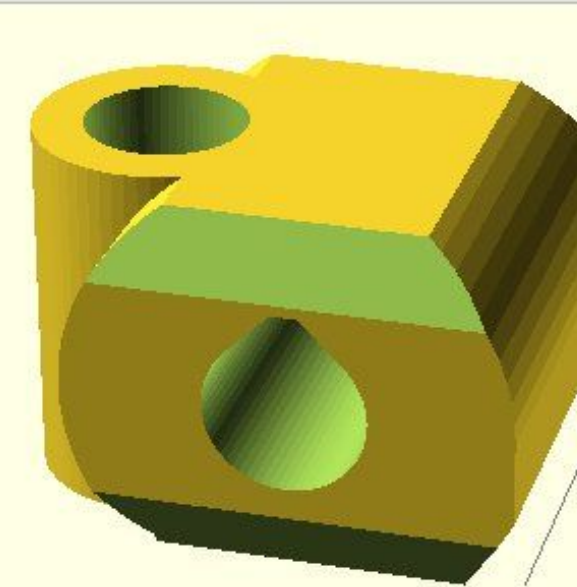
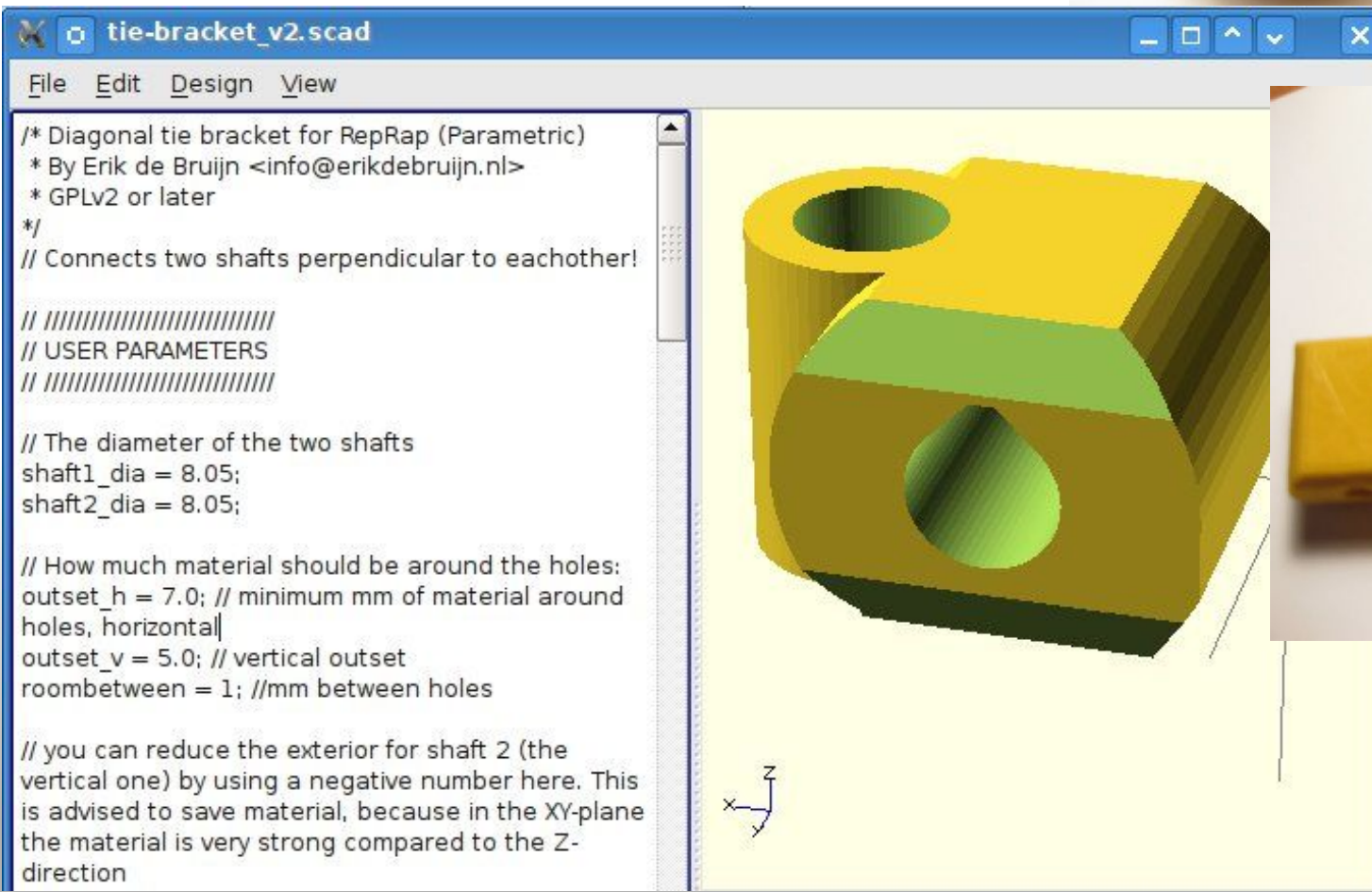


Version 2.3
Q1 2009



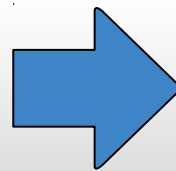
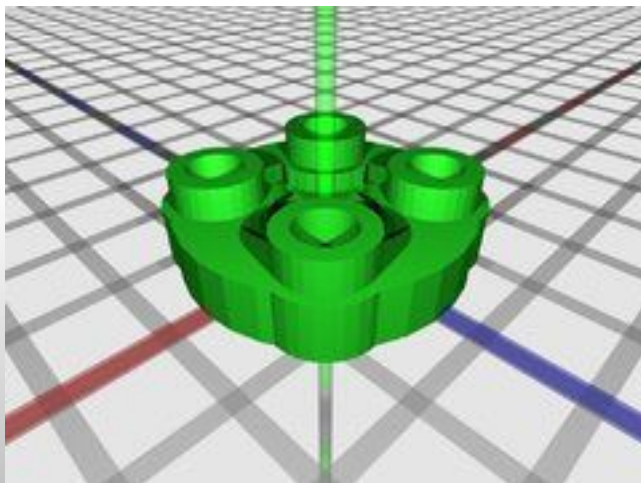
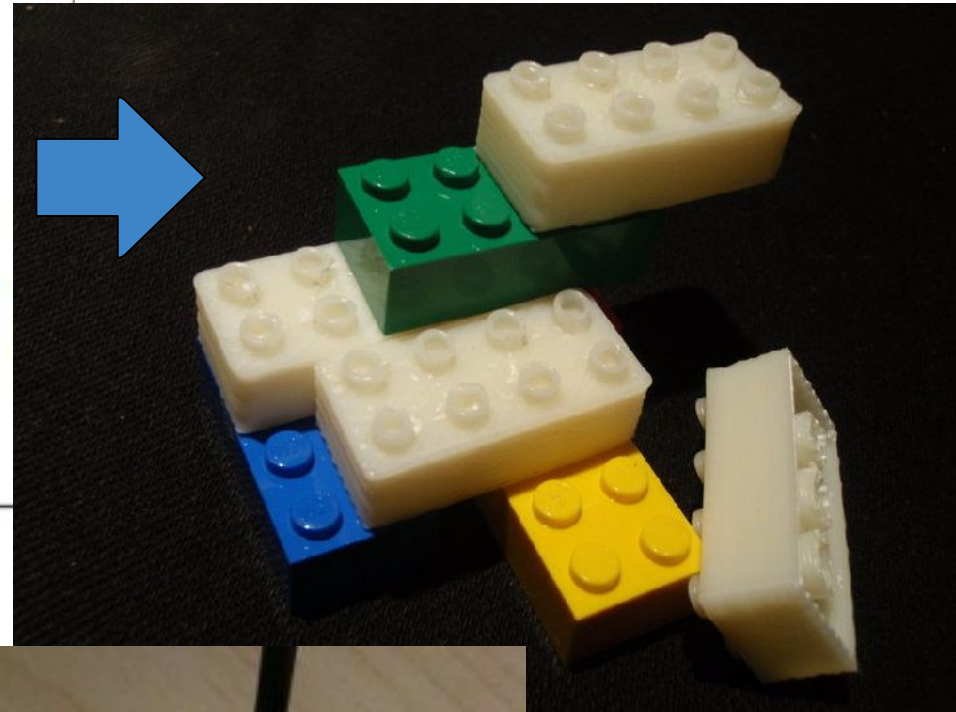
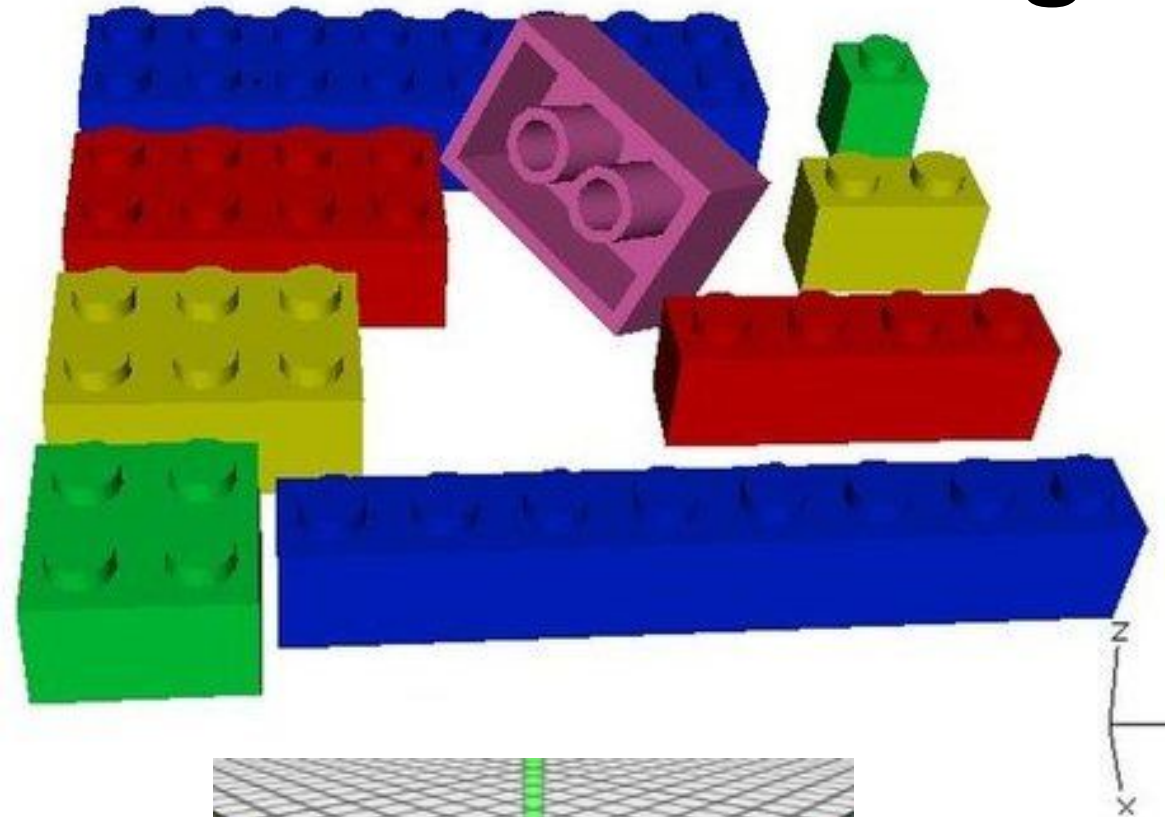
Evolving software

Parametric design
(OpenSCAD)

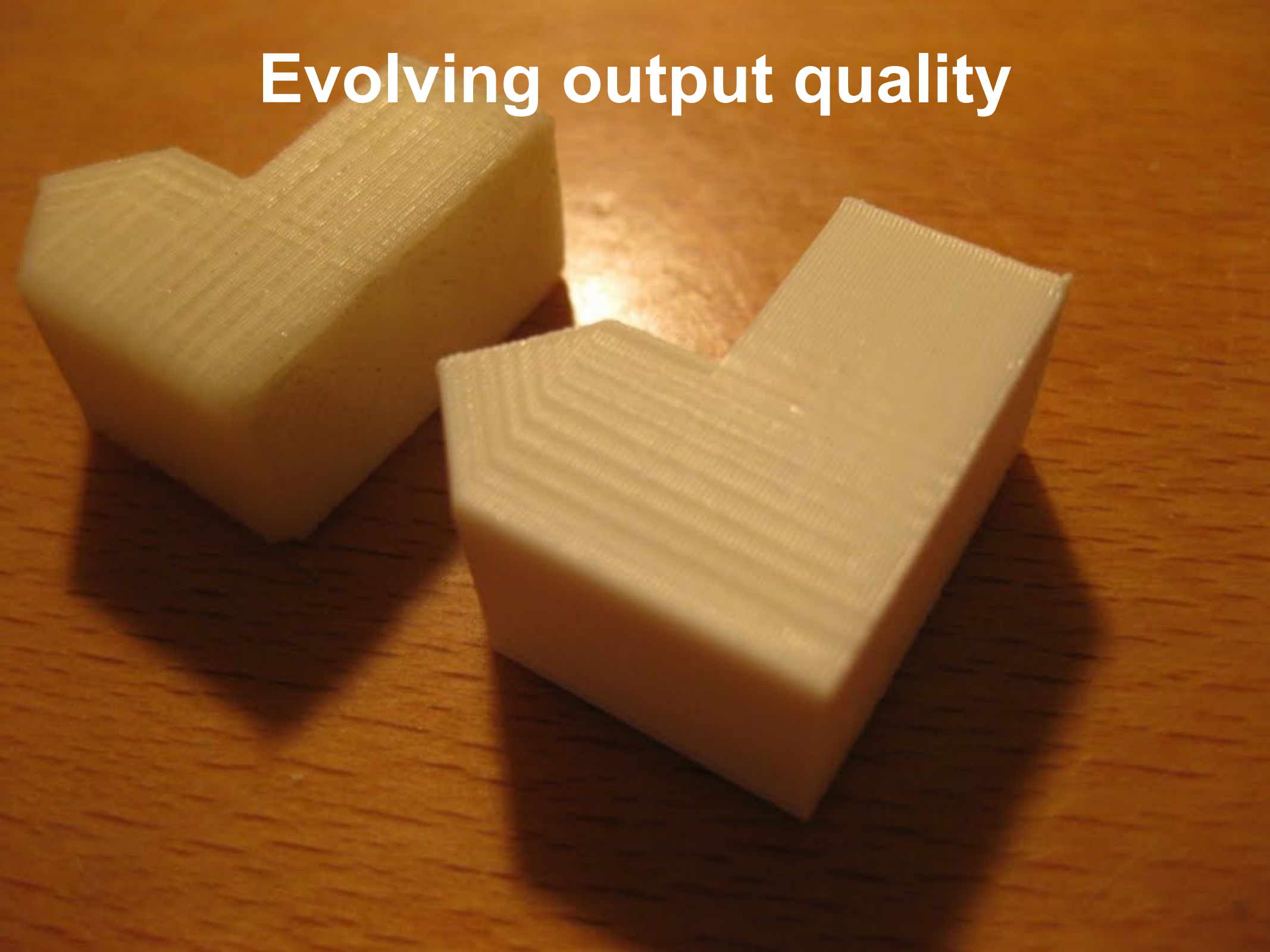


Evolving software

Parametric design
(OpenSCAD)

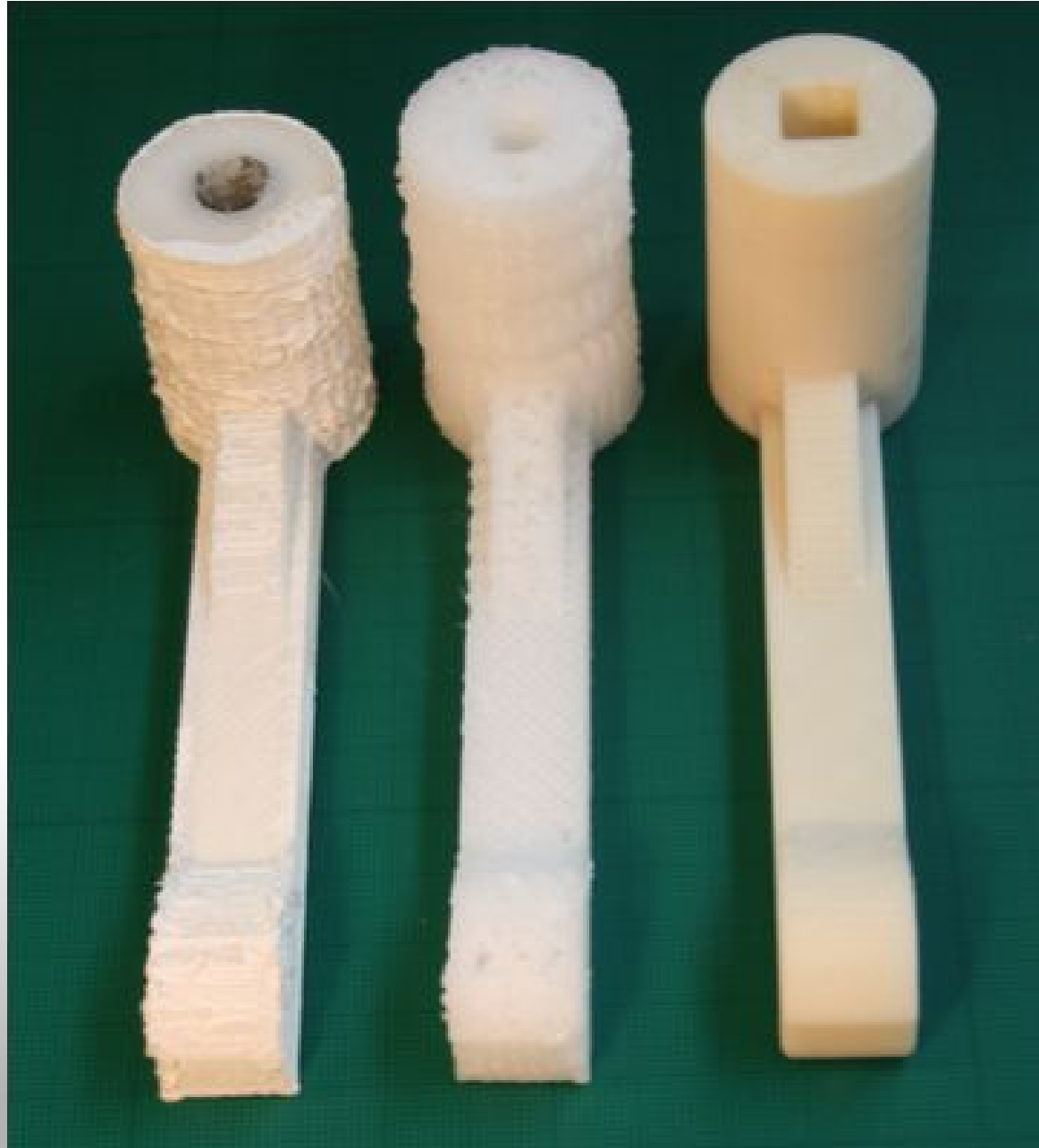


Evolving output quality



Evolving output quality

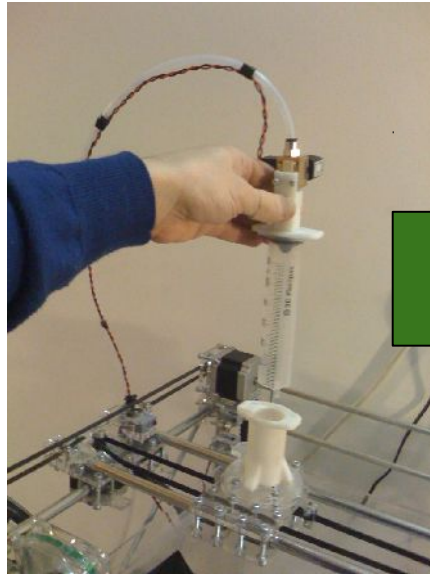
2006



2008

New materials & scales

Pottery 2.0



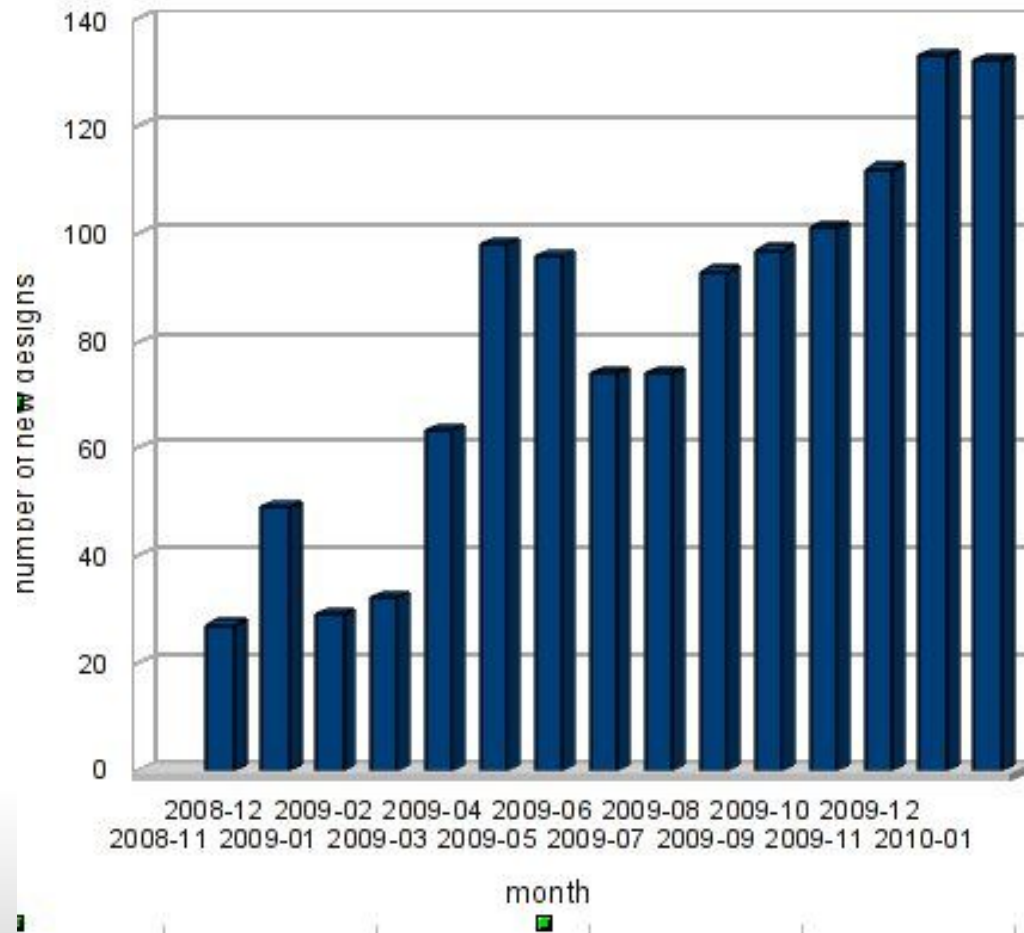


Digital pottery

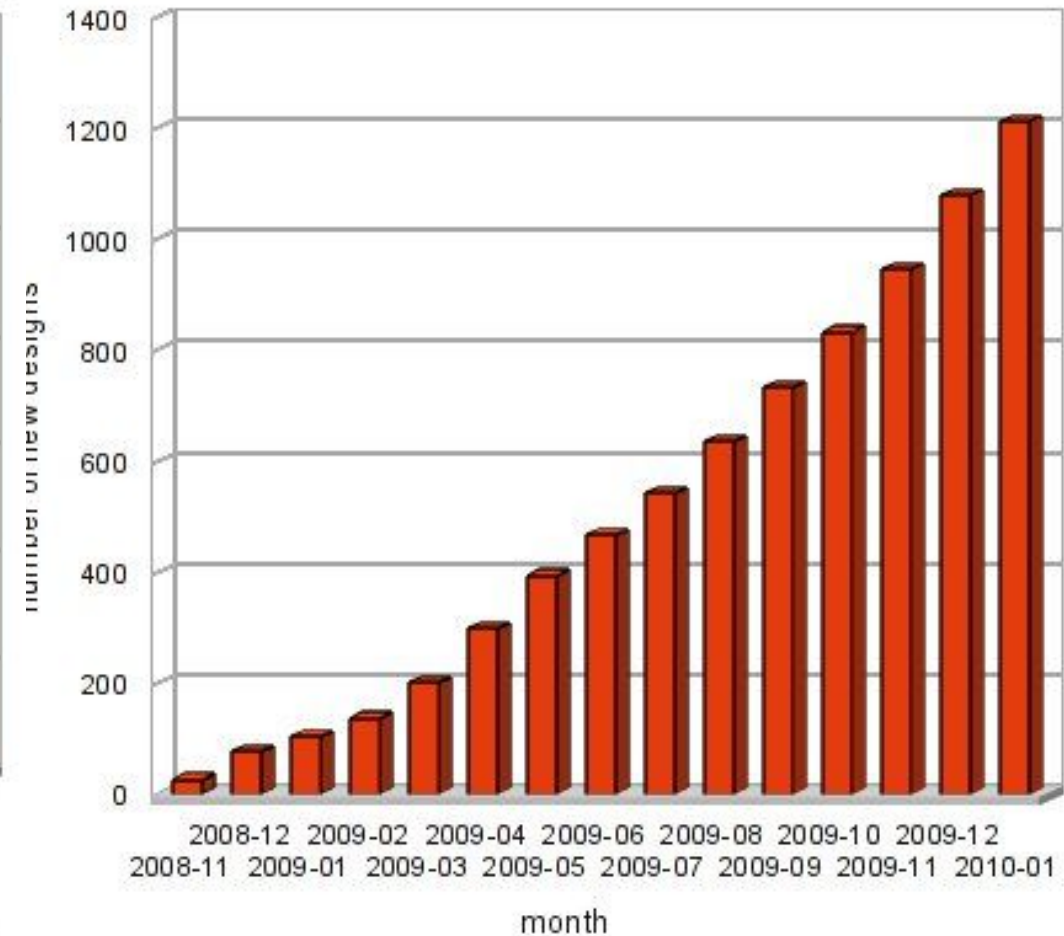
Evolving infrastructure

Thingiverse

Number of designs added monthly

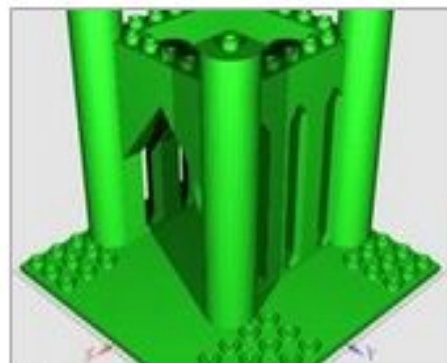


Total number of designs over time





Doblo factory - OpenScad modules for building DUPLO structures and bricks by [danielkschneider](#)



Description

A set of OpenScad modules to produce "Playmobile-like" somewhat DUPLO-compatible structures. Also can be used to produce somewhat DUPLO-compatible bricks and to create Doblo/stuff-found-here mashups.

Credits: This work is based on

- 1) The parametric lego duplo by Domonoky (thingiverse.com/thing:1778). Since I can't call this a parametric block anymore, I decided to create a new thing :)
- 2) Tony Buser's OpenSCAD Bitmap Fonts Module - thingiverse.com/thing:2054. Added on April 9 for version 1.1

This is a Beta version made by an end-user programmer. Code is dreadful, but it does work ;)

It's called "Doblo", because it's not DUPLO (TM). It just happens to fit somewhat. I did not print test if it's Lego compatible, i.e. the smaller bricks. One could imagine resizing a model by half in all directions or just change the parameters probably.

Over the next weeks, I'll try to add more stuff and I also will come up with scenarios for education.

I made one!

Creator



[danielkschneider](#)

15 days ago

Rating



4 votes

Likes

</3





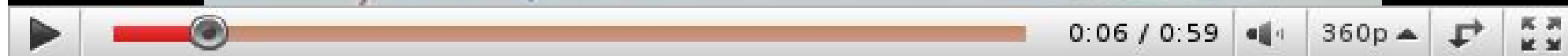
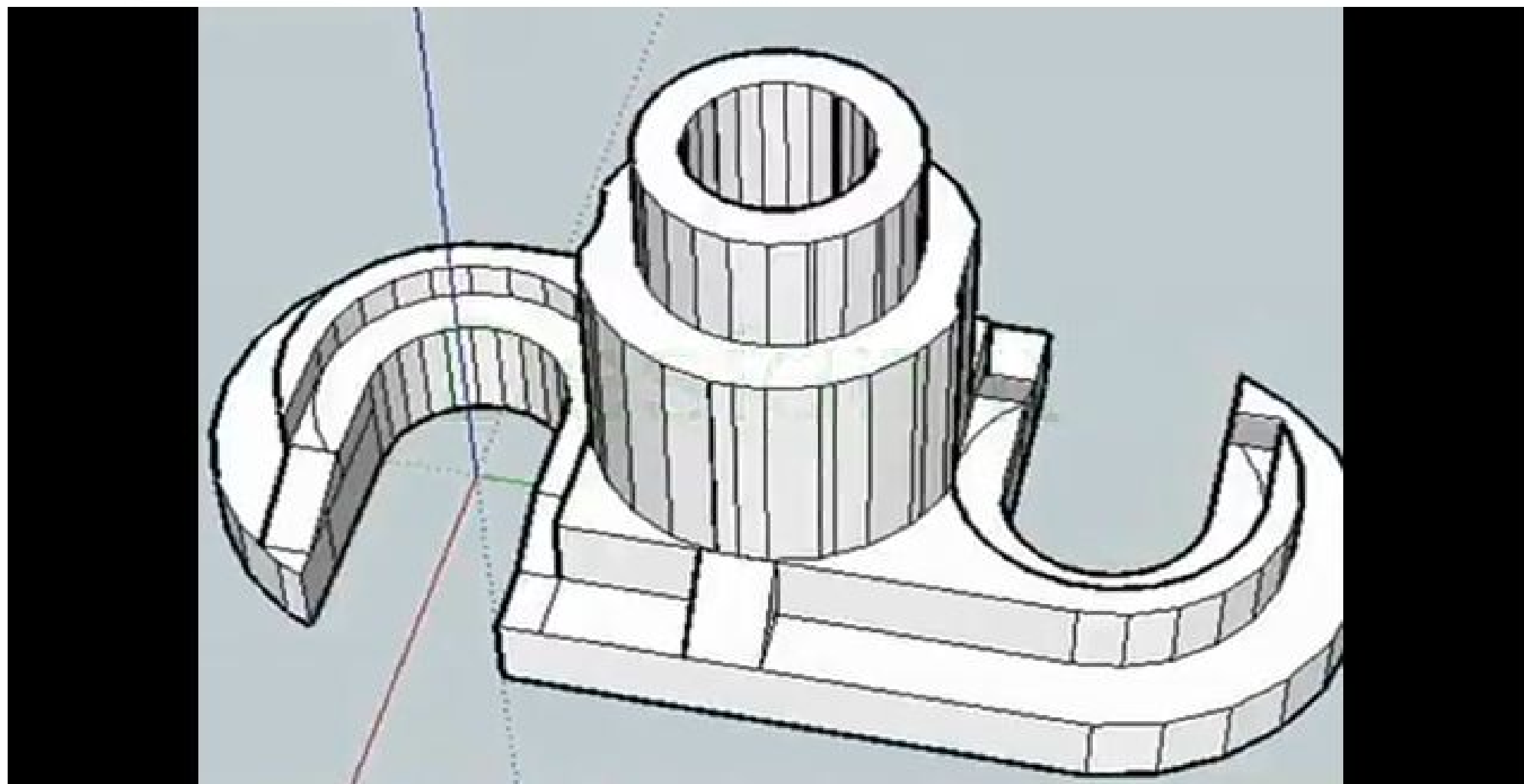
Collaboration

RepRap prints own improvements!

Erikdb

26 videos

Subscribe

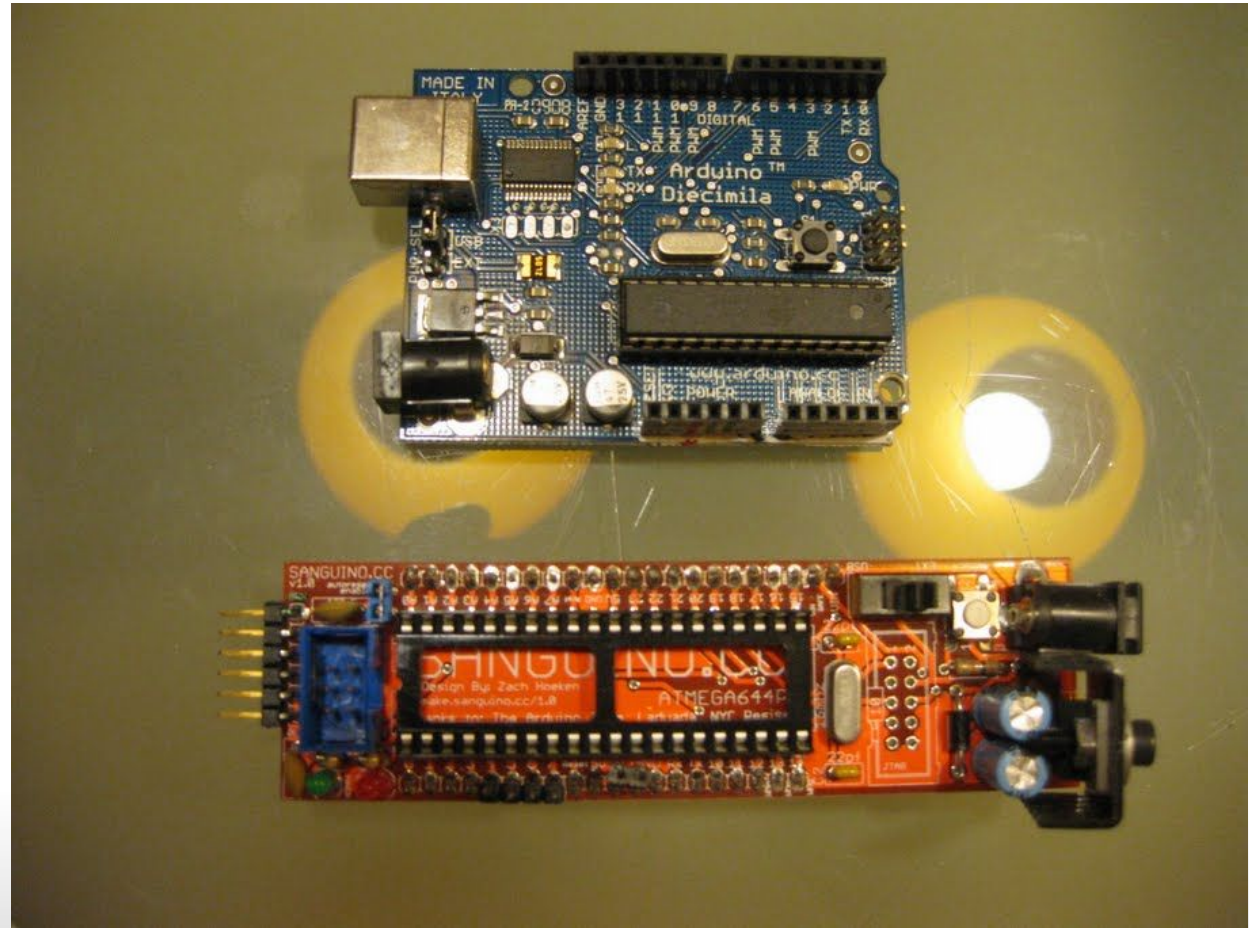


Erikdb — October 05, 2009 — This is a 1 minute video of the Open Source 3D printer "RepRap", printing a new part for itself. I'm working on ...

1,674
views

"Physical content-reuse"

- **Arduino**
Popular open source microcontroller tool chain
- **Sanguino**
Arduino compatible system created for the RepRap project
- Now used in dozens of other projects!



MakerBot INDUSTRIES

Hybrid between project and company



Apple Acquires Makerbot

Its creator didn't define a release date or price for the iMake, but we see it hitting market sometime after 2015 at a Mac Pro-level price of about \$3,000 (or at whatever three grand is worth five years from now).

Introducing the:

iMake



Costing between \$19.99 to \$49.99 each, the iMake cartridges contain 6 ounces of high-impact thermoplastic resin. Tubs of CMYK resin allow you to custom-skin your objects—in

Mac Life



Apple Acquires Makerbot

Sorry, that hasn't happened (yet)

The story

[graph]

2008 sales of all additive manufacturing
entire market:

~ 5000 units

(Source: Wohlers Report 2009)

Half a years' sales of Makerbot:

~250 units

Run by ~ 3 people. Scaling very well.

User innovation in open source, commercial products

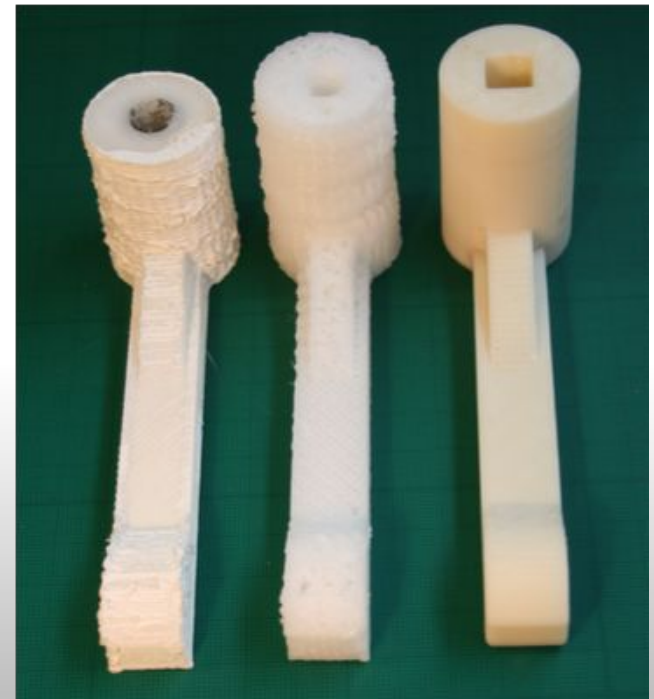
- Their 'customers' are modifying and improving 'their' product,
- adding extensions,
- making software tools,
- generating printable content,
- testing materials,
- trying out innovative applications

Conventional Making

- **Mostly inefficient.**
- **Quality is lacking! Non-replicable.**
- **Do's and Don't of Making!**

Conventional Making

- Mostly inefficient.
- Quality is lacking! Non-replicable.



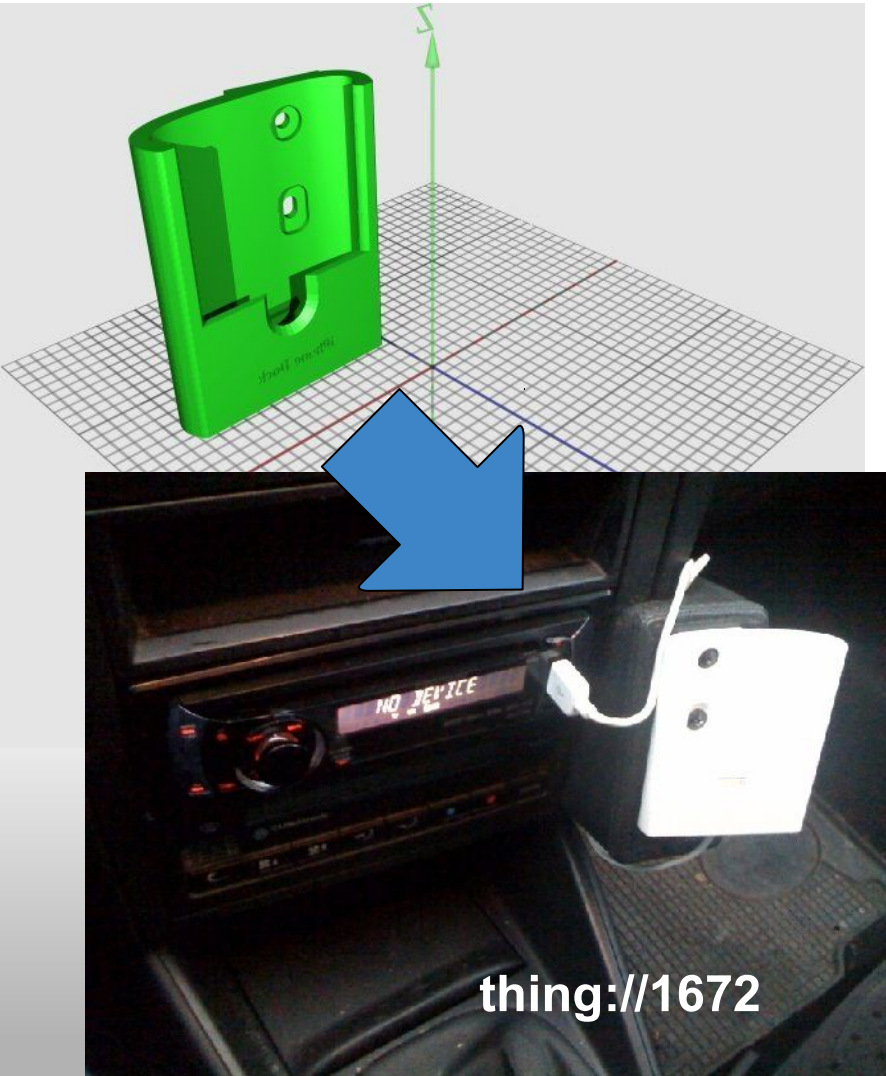
Do



Don't!



Do



Don't!



Making: Replacements or extensions



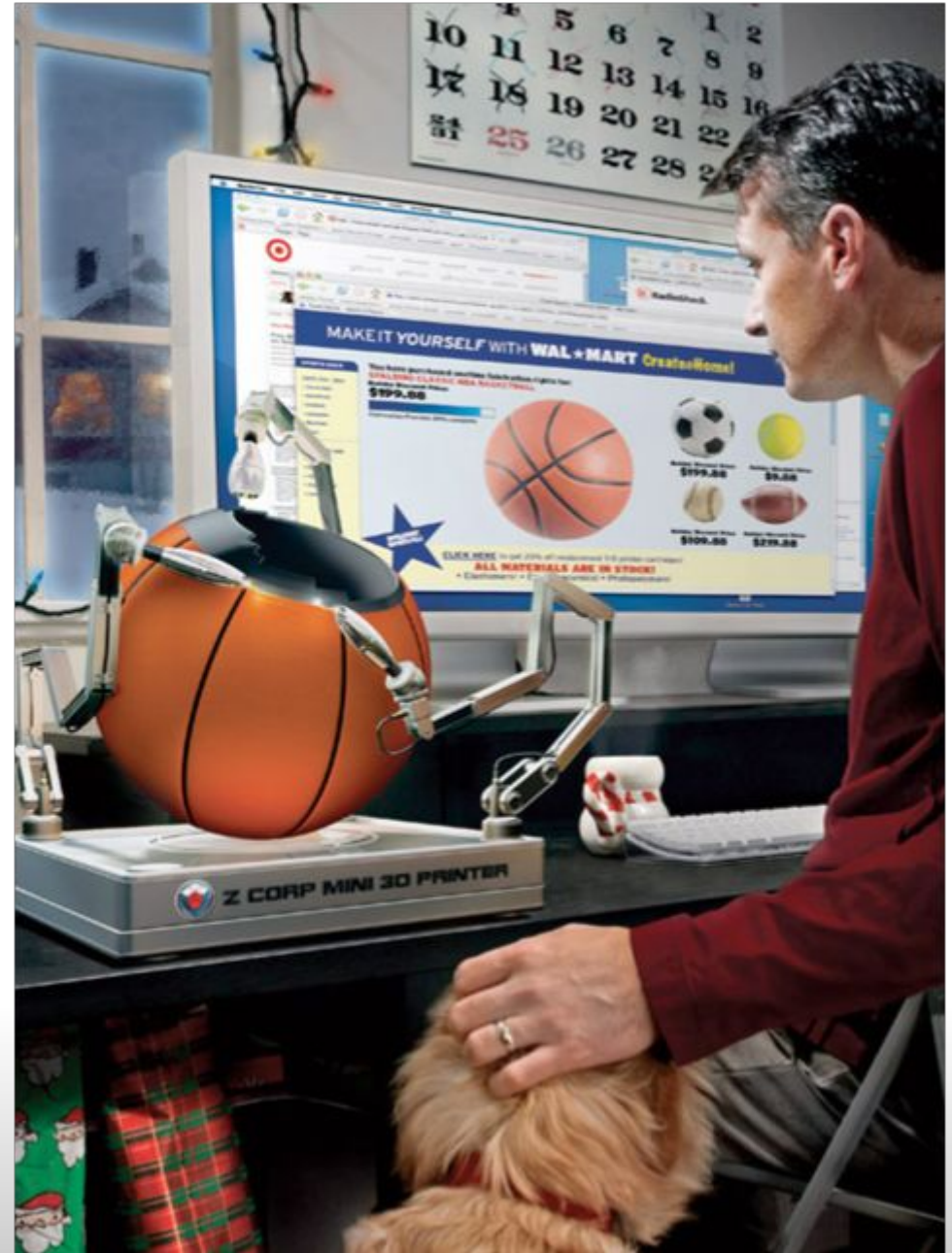
The image shows two white plastic keyboard key components, likely for a vintage computer keyboard, resting on a black keyboard. The components are disassembled, revealing internal parts like the key cap, stem, and base. The top component is a key cap with a small red circular mark on its left side. The bottom component is a key base with a small red circular mark on its left side. The background is a black keyboard with various keys visible, including 'Enter', 'Shift', and 'Alt'.

Question: Wikipedia

- Who of you ever created or edited a Wikipedia page?
- Who of you have ever read an article and used its information?

Disintermediation scenario

- Raw materials to homes
- Manufacturing at home
- Domestic level fabrication (fully distributed)
- Plausible?



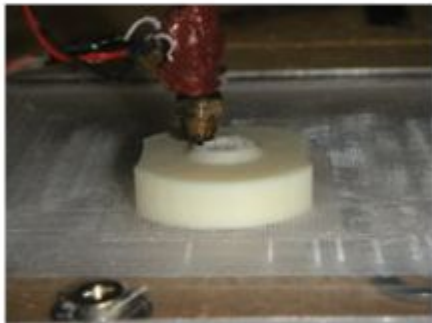
Spare parts

Threat or opportunity?

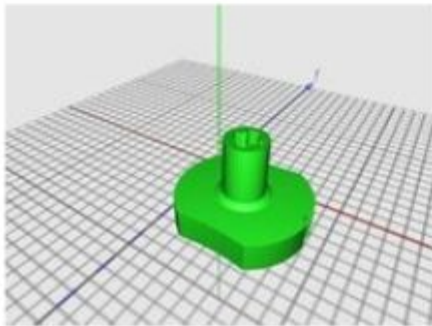


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Replacement Knob for a Dishwasher by [wizard23](#)



[Reprapping a Dishwasher Replacement Knob](#)



Description

A friend of mine broke the knob that controls his dishwasher. So he modeled a replacement part and today we printed it :)

TODO: find out type of dishwasher

Discussion

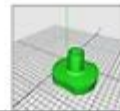
[Leave a comment](#) (Powered by JS-Kit)

Downloads



dishwasher sparepart.aoi

1 kb / 1 downloads



dishwasher sparepart.stl

1 kb / 2 downloads

download

download

3D print

I made one!

Creator



[wizard23](#)

11 days ago

Rating



Unrated

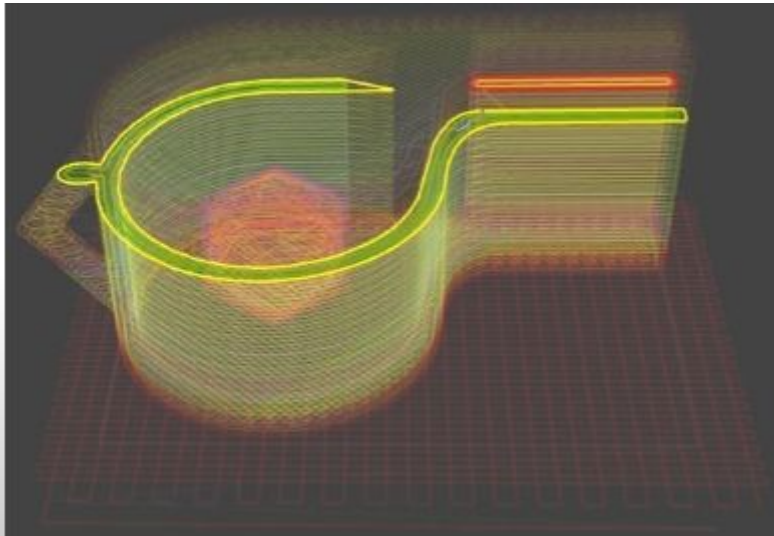
Likes

Replacement parts



Thingiverse.com

- **Sustainable source of innovative, user generated products**
- **Challenges**



The commons repositories

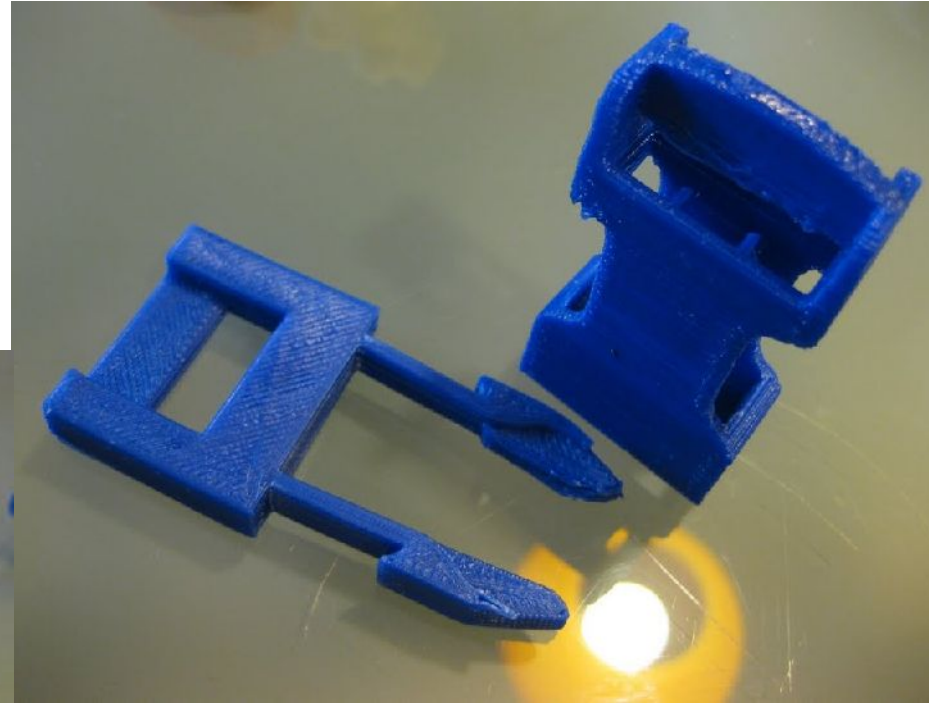
Examples:

- Wikipedia.org > **Knowledge**
- Youtube > Information and **entertainment**
- Thingiverse.com > **Things**

Features:

- User-generated
- Consolidation and codification of knowledge
- Reduces duplication of effort
- Non-restrictive nature maximizes value creation

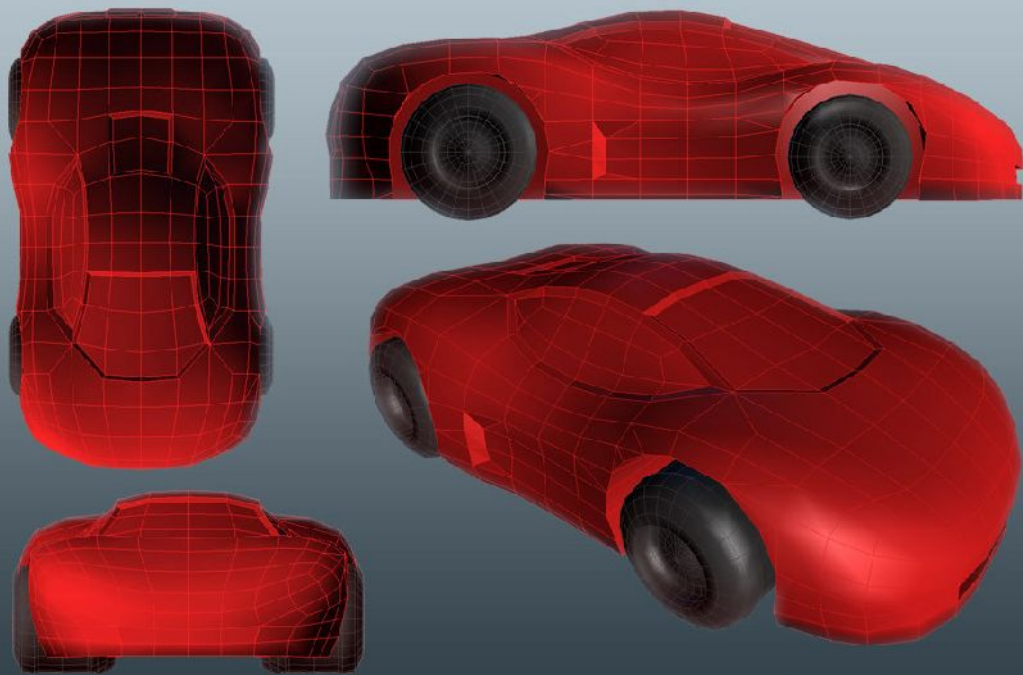
Content or innovations?



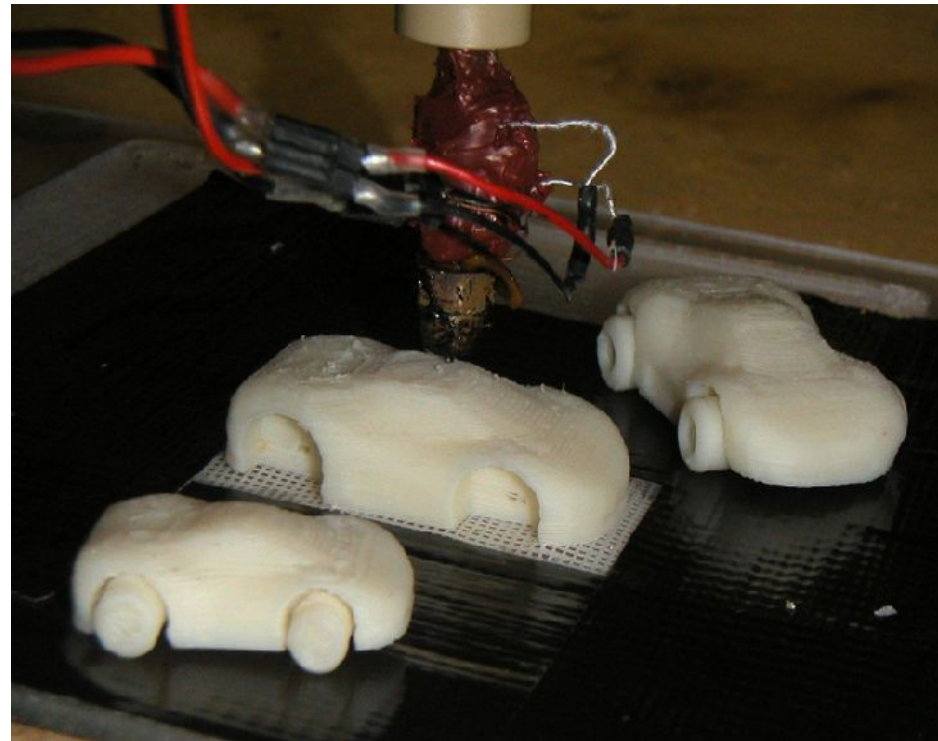
Content or innovations?



Toys

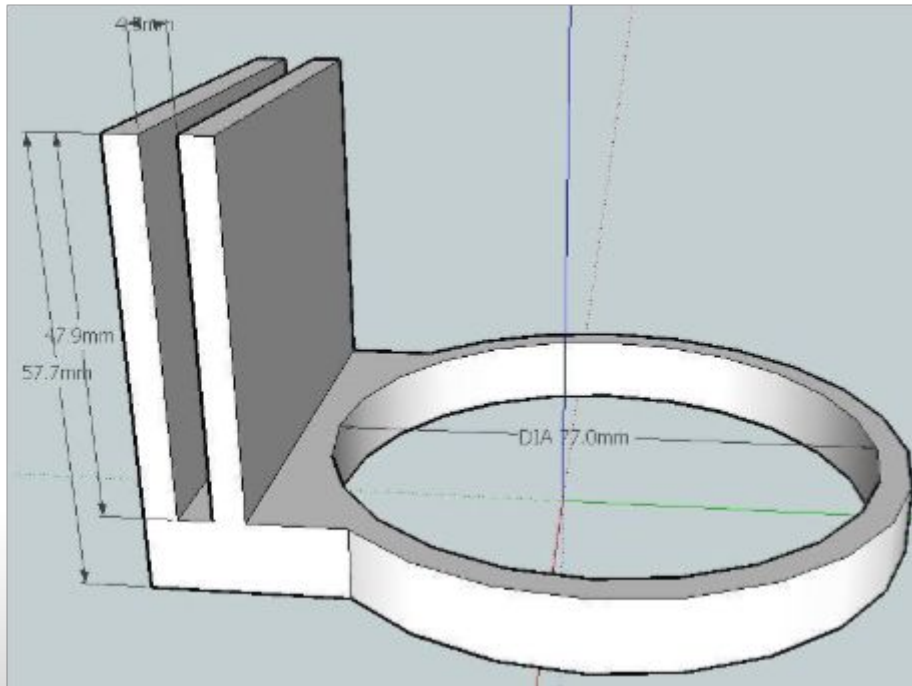


3D View of RepRapped „Action Car“



Content or innovations?

Coffee belt clip

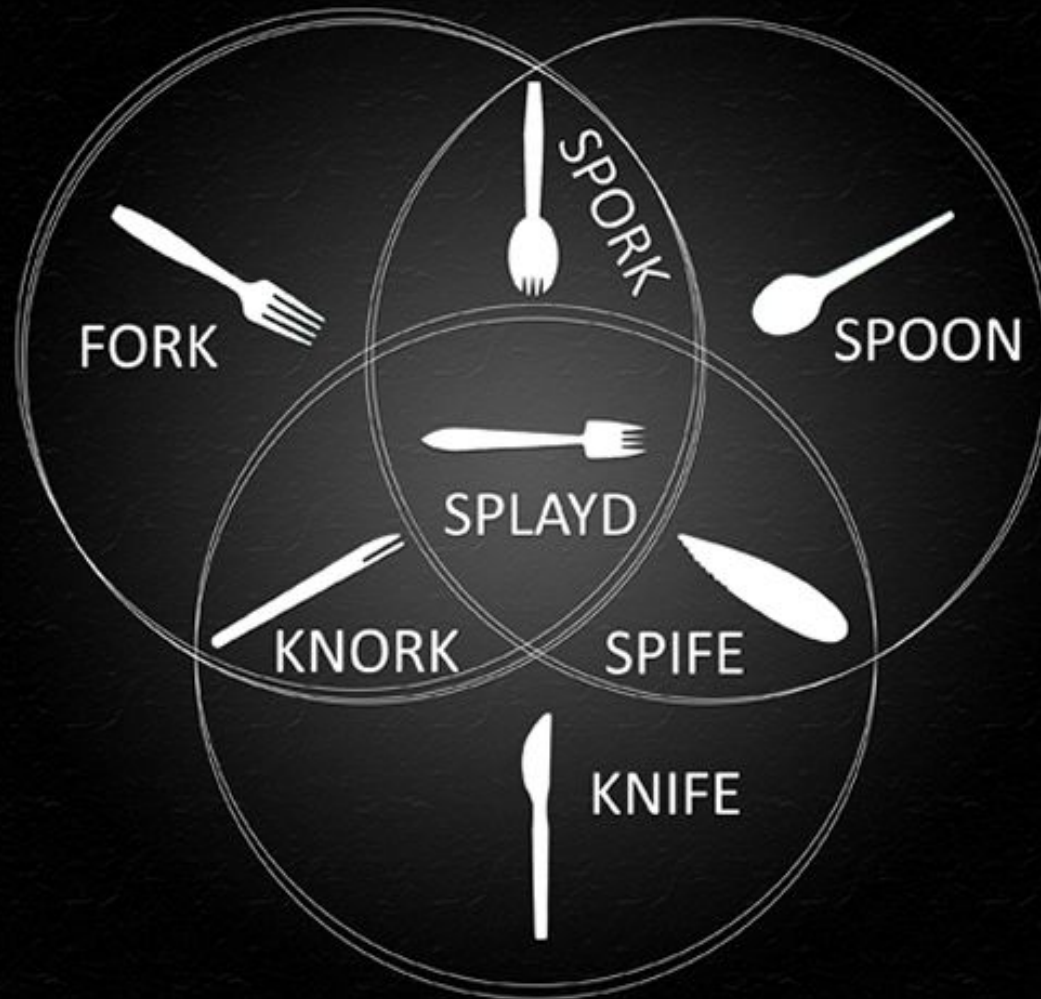


iPhone tripod mount



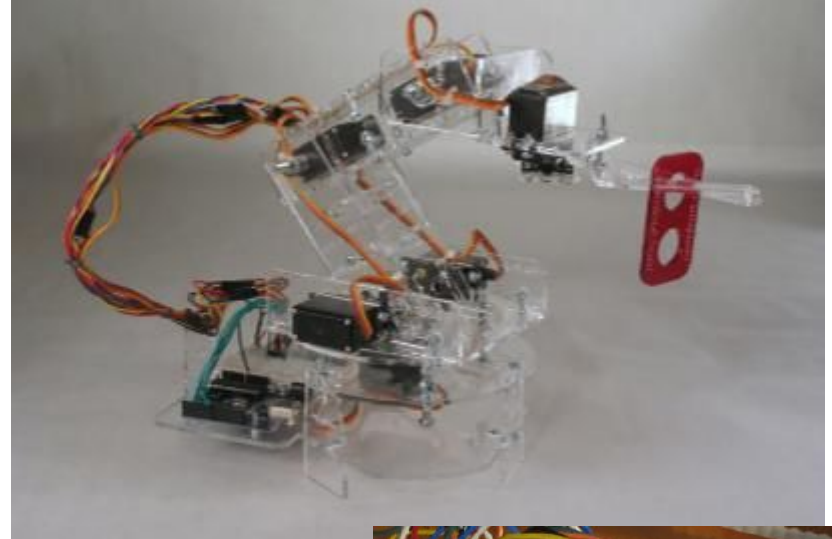
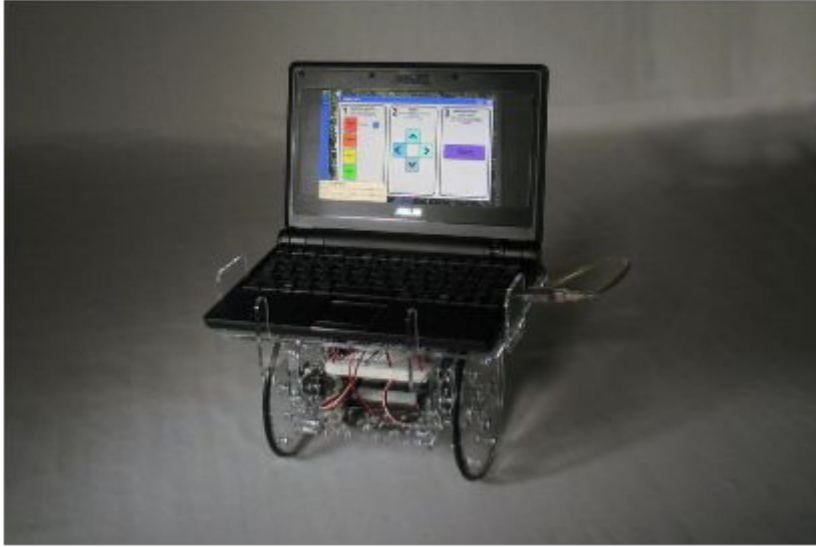
Web 2.0 Mashups are soo 2006!

TOWARDS A GRAND UNIFICATION
OF CUTLERY

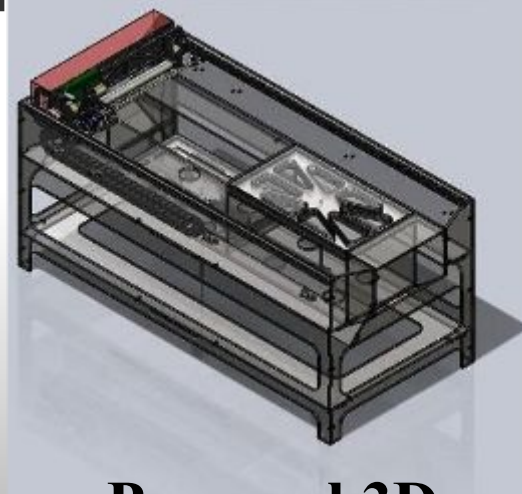
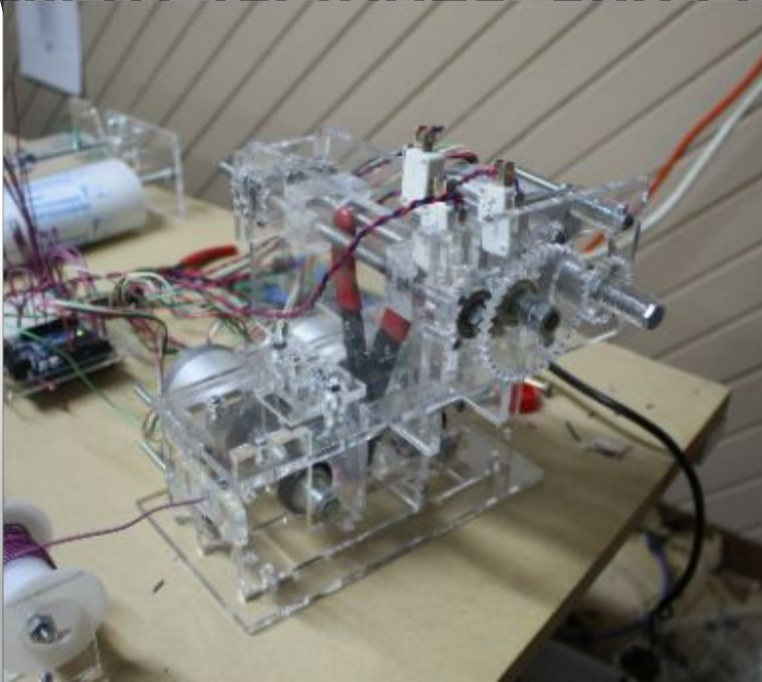


Content or innovations?

Robot modules or even complete robots



Micro 'factories' and complete 3D printers

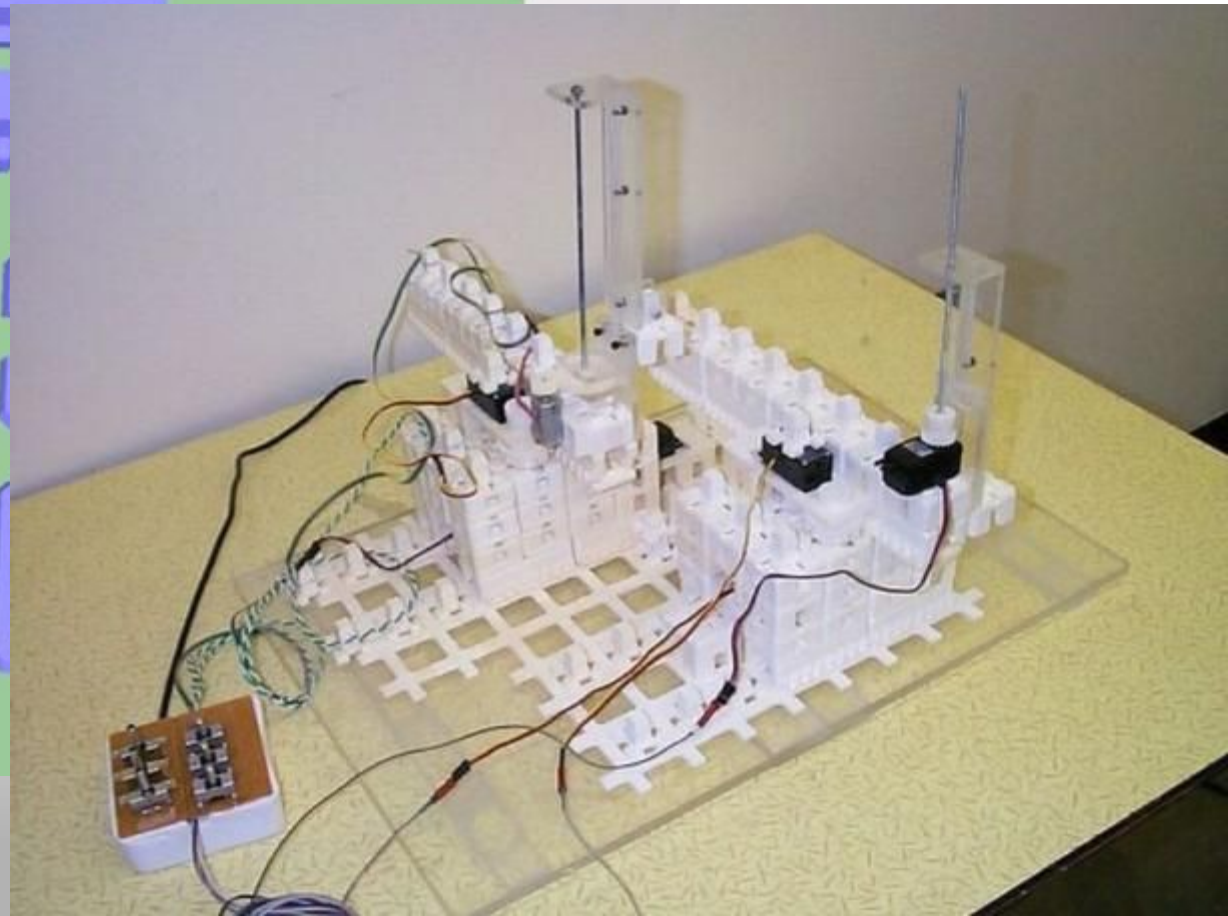
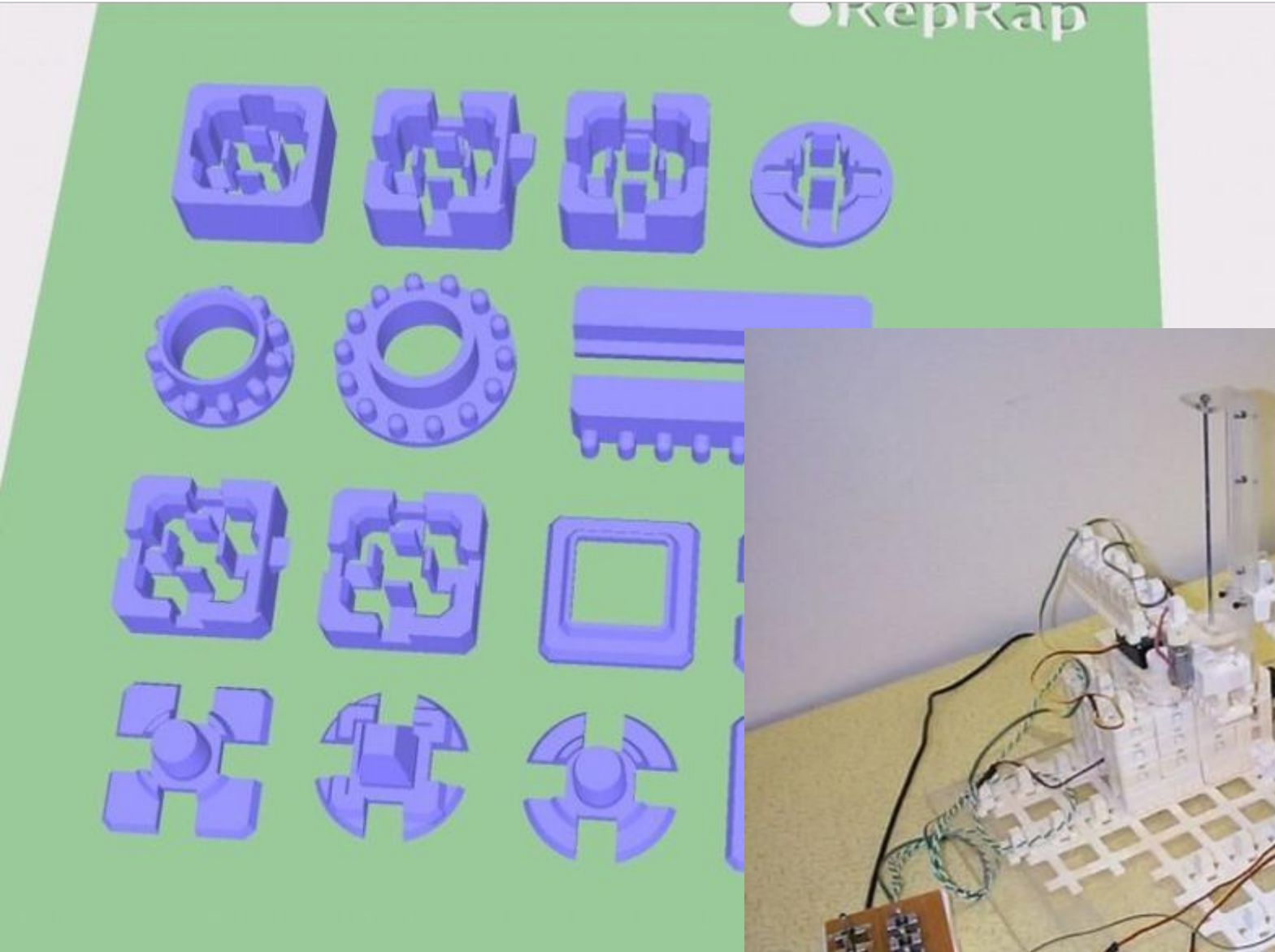


**Personal 3D
Printer**



Content or innovations?

Parts for self assembling systems that can be 3D printed



Open Source Fusion
powered by
3D printed parts





MakerBeam

- Online proposal for an open source standard construction kit
- Extruded aluminium beam
- Suitable for mass production: high up-front costs
- Crowdfunded by 132 people
- > 17k in pledges received in months



is it the bones and gristle of an open source revolution? Mini-T, by MakerBeam, is both.

\$17,922.42 PLEDGED

179% FUNDED

SUCCESSFUL

A **KICKSTARTER** PROJECT

Thank you!



References

- Discussion
- Further information
 - My blog: <http://erikdebruijn.nl>
 - p2pfoundation.org
 - RepRap project: www.RepRap.org
 - RepLab.org - creating open replicable FabLab's
 - Democratizing Innovation (By Eric von Hippel) and user innovation literature
 - Kerstin Balka - [On the open design of tangible goods](#)
 - Thingiverse objects:
 - Personal 3D printer (thing:815)

mail-me@ErikDeBruijn.nl



Modify

Sensing

Control

Life

Energy

