

digital fabrication in hci

Anastasia Bezerianos

Inspired by: D. Mellis, S. Follmer, B. Hartmann, L. Buechley, and M.D. Gross. (2013). FAB at CHI: digital fabrication tools, design, and community. In CHI '13 Extended Abstracts on Human Factors in Computing Systems (CHI EA '13). Some slides come from Lora Oehlberg

who likes to make stuff?

- Soldering?
- Electronics?
- Cooking?
- Knitting? Crochet?
- Sewing?
- Woodworking?
- Welding?
- Casting?
- Ceramics?
- Glass-blowing?

traditional vs. digital fabrication



<http://www.browardtrailer.net/>



Flickr user matthewvenn

digital fab at different scales



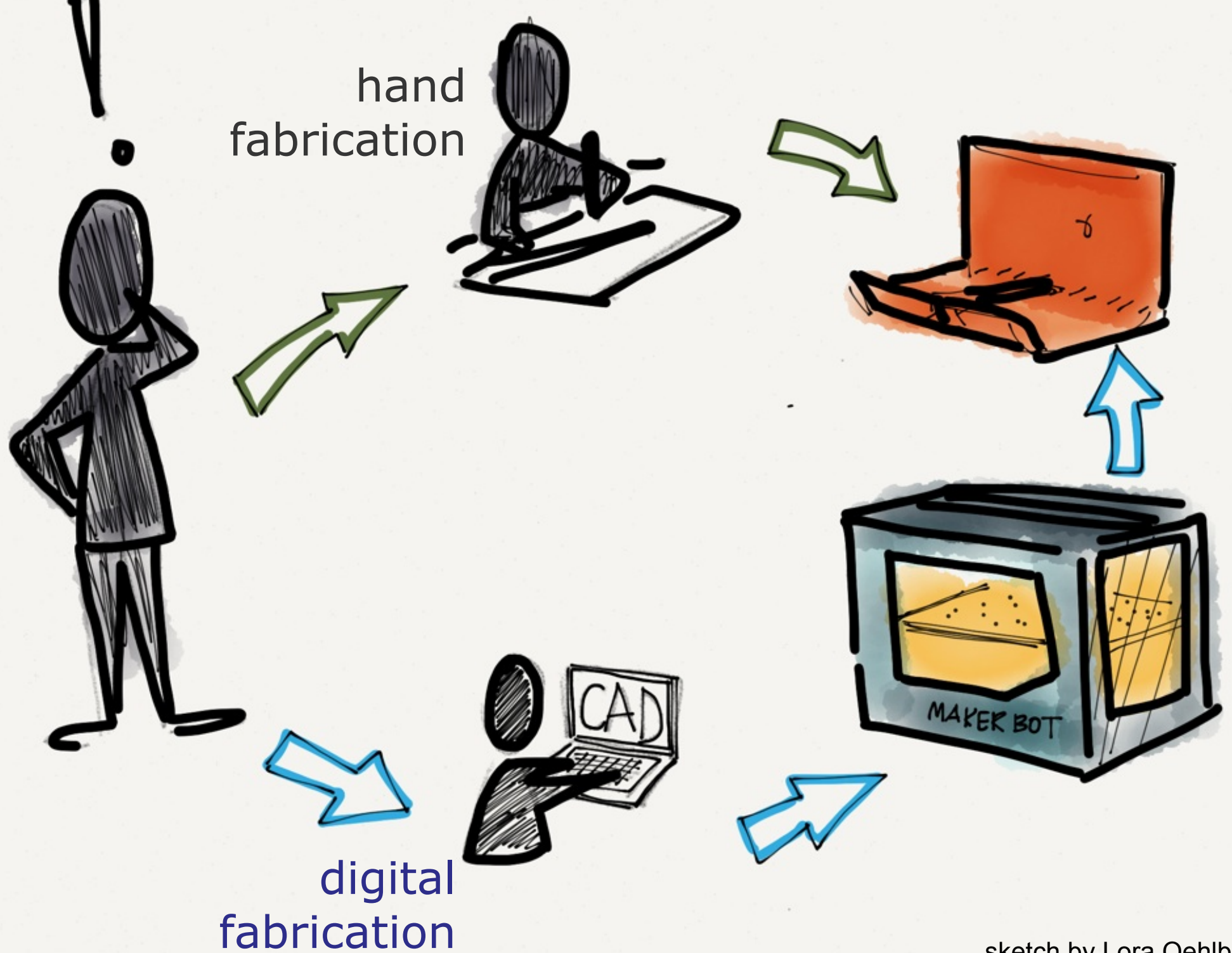
BanQ restaurant



www.creativeapplications.net



TinyDruino



sketch by Lora Oehlberg

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When should I use...

... hand fabrication?

- You are more expressive by hand than using computer tools (CAD, Vector Graphics)
- It's a one-off object, not worth bothering with CAD
- It's faster to just make it, and not over-think

... digital fabrication?

- I want to create a data-driven object
- I want to make small batches (4+)
- I will eventually make VERY large batches (1000+)
- I *need* something more precise than I can produce by hand

“fab lab”

Machine shop

fab lab (fabrication laboratory)

small-scale workshop for (personal) digital fabrication,
accessible to the public

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fab lab movement history:

2001: Grassroots Invention Group +
Center for Bits and Atoms (CBA) MIT Media Lab
Community outreach initiative
Maker culture (tec DIS movement)

around 2000 of fab-labs world-wide (and many in Paris)

a fabrication lab in our university (open to all of you and the public)

medium-scale fabrication



Lasercutter



Vinylcutter

2D VECTOR DRAWING



3D printer



CNC Milling

3D CAD MODEL

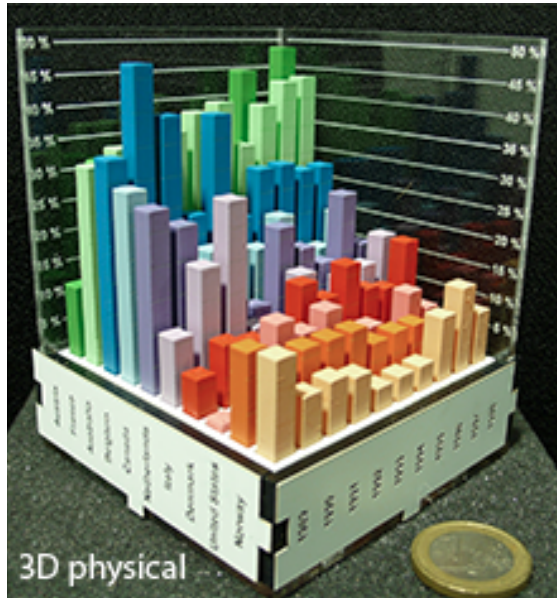
and many more ...

fab + hci

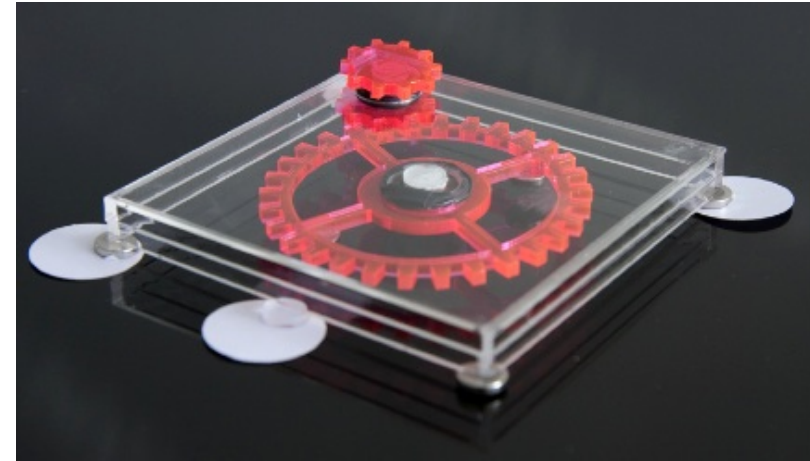
1. Fab for prototyping interaction and tangibles
2. HCI interfaces for design and Fab
3. Online communities and Fab collaboration

fabrication in service of hci ...

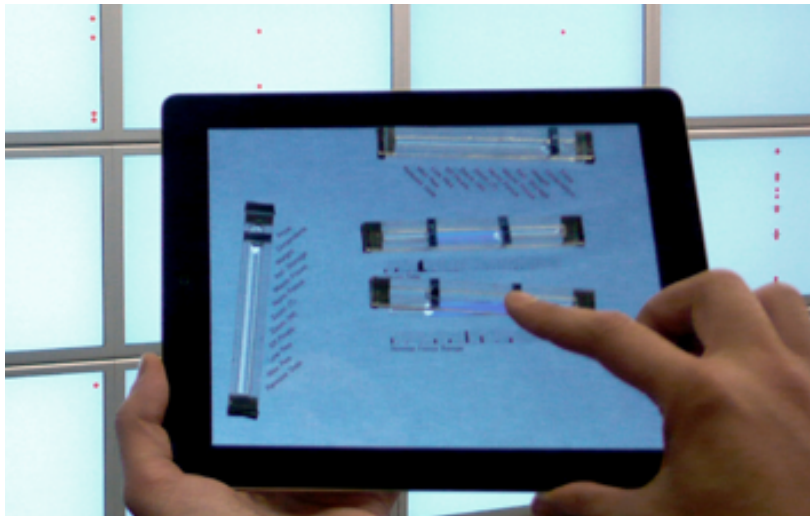
... remember tangibles?



[Jansen et al, 2012]



[Weiss et al., 2010]



[Jansen et al., 2010]



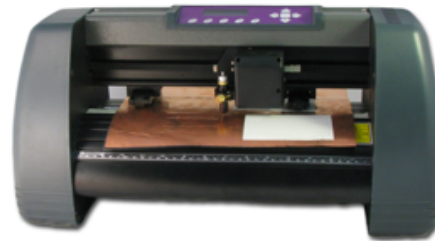
[Chan et al., 2012]

Midas [Savage et al., 2012]

Design
Touch Areas



Fabricate



Assemble



Run

Define Events



eecs.berkeley.edu

http://youtu.be/WHcQgtjD_zY

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Topogo [Raffle et al., 2004]

3D constructive assembly kit with « kinetic » memory

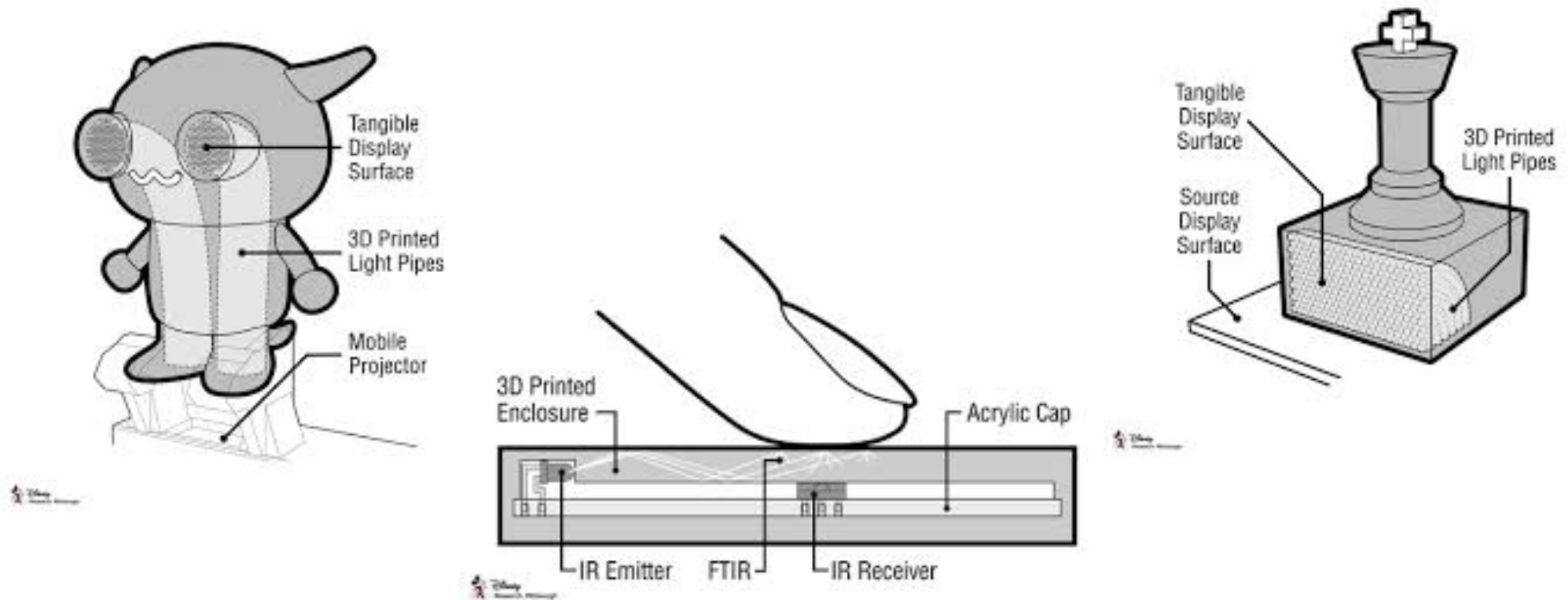


stuff.mit.edu

http://youtu.be/50JdK_K2NWk

Printed Optics [Willis et al., 2012]

Help 3D print items that allow sensing, display and illumination



disneyresearch.com

<http://youtu.be/eTeXtXA6-Y>

newer versions

<http://www.disneyresearch.com/project/papillon/>

PneUI [Yao et al., 2013]

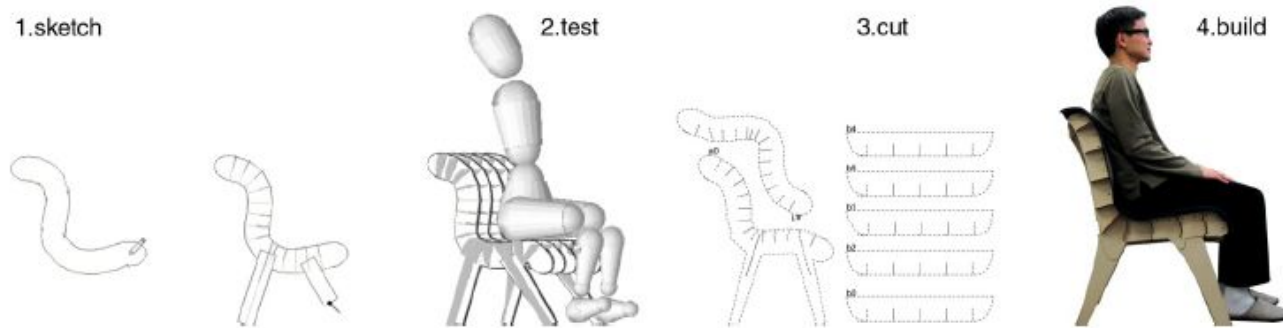
A way to build shape-changing interactive components



<http://tangible.media.mit.edu/project/193/>

hci in service of fabrication ...

Domain specific



SketchChair [Saul et al., 2011]

<http://www.jst.go.jp/erato/igarashi/en/projects/sketchchair/>



Plushie [Mori and Igarashi, 2007]

http://www.geocities.jp/igarashi_lab/plushie/index-e.html

Tangible interaction for fab



kidCAD [Follmer and Ishii, 2012]
uses the deFORM surface to capture 2+1/2D



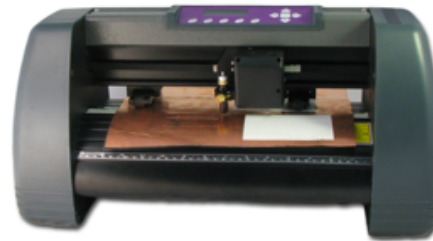
[Willis et al., 2010] Prototype devices
« sense » input to drive fabrication

Midas (again!) [Savage et al., 2012]

Design
Touch Areas



Fabricate



Assemble



Run

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Laser Origami [Mueller et al., 2013]

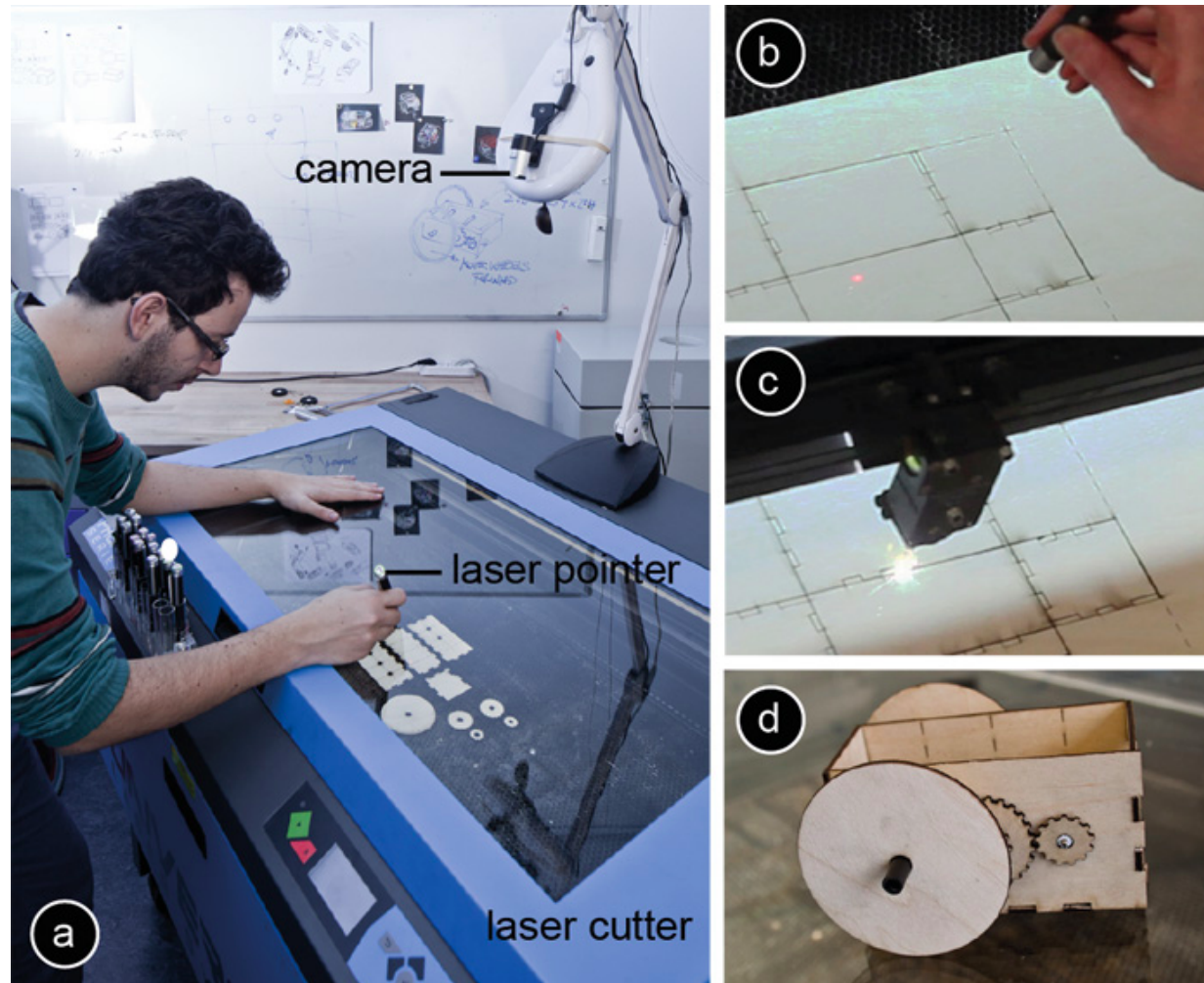
Using software to design and laser cut (some) 3D shapes



<http://stefaniemueller.org/>

Constructable [Mueller et al., 2012]

Removing CAD from the design process



<http://stefaniemueller.org/>

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ReForm [Weichel et al., 2015]

Stopped here

Rapid prototyping and iteration ...



<https://youtu.be/w4Q9JCObLM0>

hci and fab in service of collaboration



Opportunity to study and support a new form of CSCW

and more ...

Silk Pavilion, MIT media lab

Combine digital fabrication and biological fabrication (?)

polygonal silk structure using a CNC machine (Computer-Numerically Controlled)

+

real silkworms fill in the structure



<http://www.creativeapplications.net/environment/silk-pavillion-cnc-deposited-silk-silkworm-construction-at-the-mit-media-lab/>





Ninapaley.com

where is it all going?

Some claims:

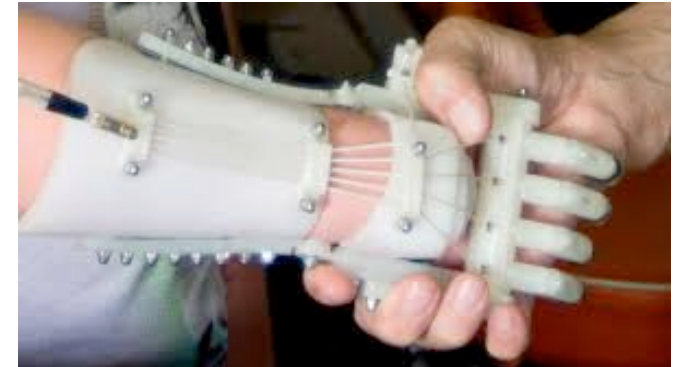
Personal fab will change manufacturing
Download blueprint instead of product



RepRap 3D printer



Urbee 3D printed car



3D printed prosthetics
robohand

and a more sinister side ...