digital fabrication in hci

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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
hand fabrication

digital fabrication

sketch by Lora Oehlberg
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

3D printer

CNC Milling

2D VECTOR DRAWING

3D CAD MODEL

and many more ...
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
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/eTeXTbXA6-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]

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

Define Events
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/
ReForm [Weichel et al., 2015]

Rapid prototyping and iteration …

ReForm provides a more flexible design process by combining physical and digital modeling.

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

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 ...