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
Personal Fabrication (Fabbing)

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

lossless

fast

cheap
If you’re looking for a CNC solution for production that delivers high performance, high volume, speed and reliable power for all cutting tasks, ShopBot’s PRSalpha series of full-sized gantry tools will be your system of choice.

With enough production capability for a three-shift factory, ShopBot PRSalpha tools are our toughest, most sophisticated, gantry-based CNC routers. Using advanced technology for CNC cutting, drilling, carving and machining, the PRSalpha series tools deliver rapid transit speeds of 1800 inches per minute and cutting speeds of up to 600 inches per minute. Easy to configure and re-configure, learn and use, the PRSalpha CNC delivers affordable, full-production performance in digital fabrication of wood, plastic, aluminum, and other materials.

Traditional shop-size and larger.

ShopBot builds CNC gantry tools in many sizes to suit the varying needs of manufacturers: 96 x 48, 96 x 60, 120 x 60, 144 x 60. Give us a call to discuss your production needs. We’ll help you to choose the right tool to get the job done.

Call to order your Full Size Shopbot CNC router. 888-680-4466

fablab.rwth-aachen.de
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
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
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

Source: Gershenfeld 2010
Personal Fabrication Enables New HCI Design/Research/Teaching Practices

Personal Fabrication Requires New User Interfaces
Reprap 3D printer
$40,000 → $400

Altair: $397 (1975)
VisiCut

- The VisiCalc of LaserCutting
- Open-source, free
- [http://hci.rwth-aachen.de/visicut](http://hci.rwth-aachen.de/visicut)
FabScan (RWTH)
hci.rwth-aachen.de/fabscan

$150

FRONT: Sketching Furniture (2007)
Jan Borchers, RWTH Aachen University: Personal Design

Cassius Lamp
(AEC ’09)
Jan Borchers, RWTH Aachen University: Personal Design

Jan Borchers, RWTH Aachen University: Personal Design
**WHAT?**

- Furniture
- Food
- Consumer electronics
- Weapons
- Prosthetics
- Small-market gadgets

**Personal Design vs. Personal Fabrication**

<table>
<thead>
<tr>
<th>HOW?</th>
<th>Local Design</th>
<th>Outsourced Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D Scan</td>
<td>AI, Assistants, Templates</td>
<td></td>
</tr>
<tr>
<td>CAD</td>
<td>Parameterization</td>
<td></td>
</tr>
<tr>
<td>AI, Assistants</td>
<td>3D Scan</td>
<td></td>
</tr>
<tr>
<td>Templates</td>
<td>CAD</td>
<td></td>
</tr>
<tr>
<td>Parameterization</td>
<td>3D Scan</td>
<td></td>
</tr>
<tr>
<td>Local Design</td>
<td>CAD</td>
<td></td>
</tr>
<tr>
<td>Fabrication</td>
<td>Outourced Design</td>
<td></td>
</tr>
<tr>
<td>Outsourced</td>
<td>AutoCAD + RepRap</td>
<td>Thingiverse</td>
</tr>
<tr>
<td>Fabrication</td>
<td>Outsourced Fabrication</td>
<td>Shapeways</td>
</tr>
<tr>
<td>Local Design</td>
<td>Outsourced Fabrication</td>
<td>Traditional</td>
</tr>
<tr>
<td>Fabrication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outsourced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fabrication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fabrication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outsourced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fabrication</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sketch Chair**

*Greg Saul, 2010*
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

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