RepRap - self-replicating production

Adrian Bowyer
Bath University, UK

How To Make Something That Makes (almost) Anything
MIT CBA 17-2-2009
Breeding
Advanced genetic engineering equipment
Symbiosis

nectar <> reproduction
Symbiosis

nectar <-> reproduction
Symbiosis

nectar ↔ reproduction  cake ↔ reproduction
Suppose we made a machine that:

- Self-replicated almost all its parts
- Existed symbiotically with people, giving them goods in return for being helped to replicate (like flowers)...
- RepRap - The Replicating Rapid Prototyper Project
Rapid Prototyping

David Jones - “Daedalus” - (New Scientist, 3 October 1974)


Now many different technologies.
FDM rapid prototyping

Fused Deposition Modelling
Rapid-prototyped write-head
Rapid-prototyped X, Y, Z robot
Does it work?

Testbed machine
Does it work?

Parent

Child

RepRap
Part count for component types used to build Darwin including one extruder, excluding fasteners

- RP: 112, 55%
- Rod/Studding: 39, 20%
- Electronics: 9, 5%
- Other: 32, 16%
- Moulded: 7, 4%
Hubris

What will happen if RepRap takes off?
Start by making RepRap open-source

Linux

Firefox
the browser, reloaded.

The Apache Software Foundation
http://www.apache.org/
Exponential growth

10,000 per hour

Say the RepRap machine takes one day to copy itself, and to make one comb...
Evolution

The design files (genotype) have to be available with the RepRap machine (phenotype) for it to be able to copy itself.

- People will improve the design.
- Some improvements will be posted back on the Web.
- Old machines can make new designs.
- Artificial selection – speed, simplicity, accuracy, fewer added parts...
Economics

It doesn't matter how much the first RepRap machine costs, all the rest will cost:

raw-materials + assembly-time.

- Once you have one, you can have any number.
- No one can make money by selling RepRap.
- Target cost of raw materials, motors, chips etc:

$450
Environment

- Material supply - biomass.
- Bringing manufacturing to the poorest people.
- Making manufacturing like agriculture.
- Recycling.
Rapid-prototyped electric circuits

John Sargrove
The Future?

Almost everyone in the developed world runs their own:

- CD pressing plant
The Future?

Almost everyone in the developed world runs their own:

- CD pressing plant
- Photographic laboratory
The Future?

Almost everyone in the developed world runs their own:

- CD pressing plant
- Photographic laboratory
- Printing press
Why not their own factory...
...that makes more factories?
"Money is a sign of poverty."


**Project website:**

http://reprap.org
Adrian's attempt at the assignment...
**Smart bricks**

2-D experiments floating on water. Forces: hydrophobic, hydrophilic. Tile size: 1 – 5 mm.

Self-assembling replicators; stir, warm, and cool...

Poly-(N-IsoPropyl-AcrylAmide) is hydrophobic above 37 C and hydrophilic below 32 C.

Melamine resins with a high concentration of secondary amino groups can cure at low temperature in acidic conditions.