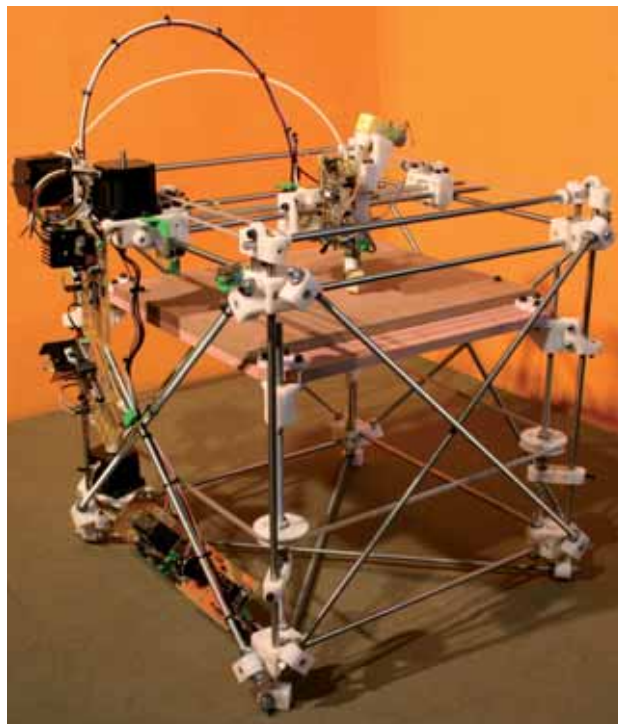


Rationale

The two most important phenomena in biology are self-assembly and self-replication. Self replication, in particular, is what allows both an individual and a population to grow at an exponential rate as long as resources are available. No current engineering manufacturing process is capable of exponentially-expanding production, because none use self-replication. Rapid prototyping (RP) is the collection of technologies that allow engineering components to be directly manufactured from descriptions of them held in a computer. Recent research in the RepRap project at Bath has developed a new additional technique that allows electrical conductors to be incorporated in rapid-prototyped components made on conventional RP machines much more simply and directly than before. This permits complete mechanisms to be created to which can be added control chips, electric motors, and sensors, all without any need for printed circuits. This prompts the intriguing idea that it should be possible to design an RP machine that is capable of making nearly all its own component parts. Those parts would then be assembled by hand and commissioned to make a new, and identical, RP machine. Such a machine would have a number of novel characteristics. For example, it does not matter how much the first machine costs – the second and all subsequent machines will only cost as much as their raw materials and their assembly. Also, the machines become subject to Darwinian selection. Self-replicating machines are called Universal Constructors, and were so named by John von Neumann in the middle of the last century, when he proved that they were theoretically possible.

Research Aims and Objectives

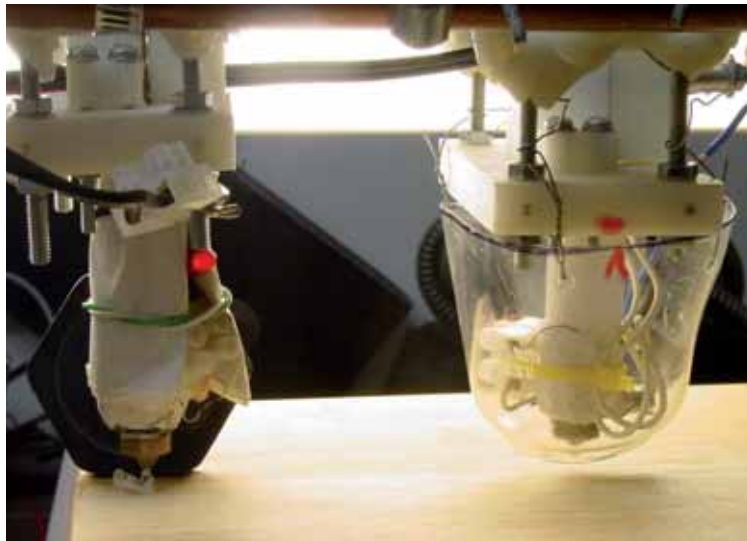
The RepRap project is working towards creating a universal constructor by using rapid prototyping, and then giving the results away free under the GNU General Public Licence to allow other investigators to work on the same idea. We are trying to prove the hypothesis: rapid prototyping and direct writing technologies are sufficiently versatile to allow them to be used to make a von Neumann Universal Constructor.



The replicating rapid prototyper, RepRap Version 1.0 "Darwin". This machine is designed to be able to manufacture the majority of its own component parts, as well as many other useful things. It is being given away free as an open-source project.

Research Outcomes

As mentioned above, the first stage of the project (incorporating electrical conductors in conventional rapid prototypes) is complete. This was done under a Nuffield grant, and not under the auspices of the IMRC. However, we now have an additional grant from the IMRC and have started the second two stages of the project: designing the servo movement system for the machine, and designing its material deposition heads. This work is 12 months underway, and we anticipate having a complete replicating rapid prototyping machine in two years' time. For more information please visit reprap.org.



An extruded extruder extrudes... The RepRap extruder write head on the right made the parts for the one on the left. That new extruder is shown starting to extrude for itself.



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