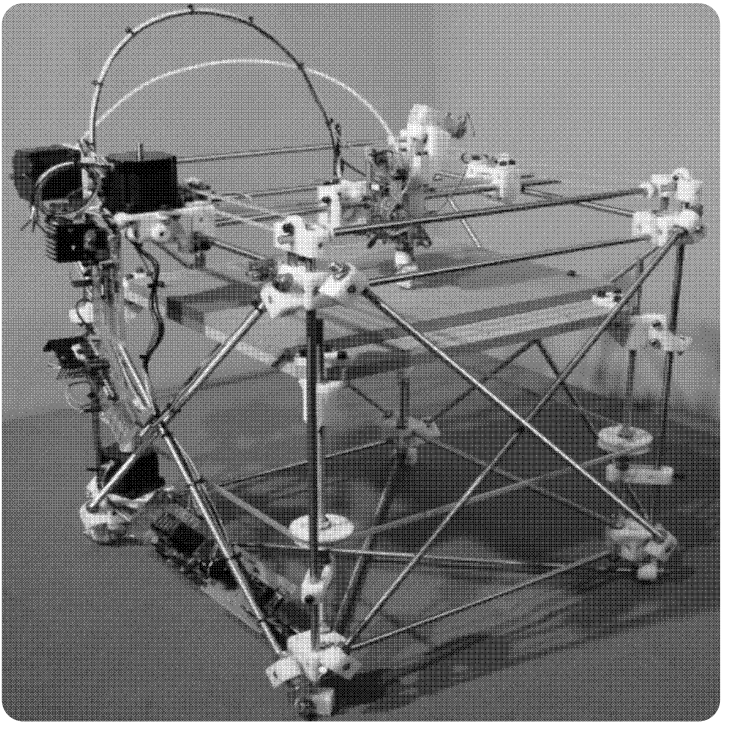
Beyond Graphics: On Participatory Design



Open collaborative design (151) applies principles from the free and open-source software movement to revolutionize the creation of physical objects, machines, and systems. All information, including text, drawings, photos, and 3D CAD models, is shared on the Internet, allowing others to recreate or contribute to its development. This model, more open and transparent than traditional scientific research, employs "copyleft" (152) to ensure that creative works can be freely used and built upon by anyone. Copyleft items, such as designs or code, are essentially gifted to humanity, contributing to a growing universal "commons". This approach has successfully transformed high-profile software projects (153) and has the potential to reshape how we design everything from personal items to global infrastructure components.

Open collaborative design is a nascent field that has huge potential to radically alter the way we create goods, machines and systems – not only for personal items but all the way up to components of national or global infrastructure.

"Open Source" Applied to the Physical World

There is no reason why open source development methods (154) currently used with many software projects cannot be applied to machines and systems in the physical world. In fact physical objects are much more intuitive to understand than abstract computer code especially when viewed using 3D CAD (155) that can show grouped sub-assemblies, exploded views, kinematics, cross-sections, supporting animations and notes. It is just that the freely available tools and infrastructure needed for this to be possible do not yet exist in a user-friendly and mature state needed for widespread adoption. All the technologies exist, they just need to be put to-

gether in the right way and refined. The simplest method is to share information through a website on how to make things using text, diagrams and photographs. A more sophisticated way to collaborate on complex machinery and products would be to share CAD assemblies much like project teams do in engineering and product design companies, knitted together with supporting information in an open and freely structured environment, much like a wiki *(156)*.

There are certain barriers to overcome for open design when compared to software development where there are mature and widely used tools available, and the duplication and distribution of code cost next to nothing. Creating, testing and modifying physical designs is not quite as straightforward because of the effort and time required to create the physical artifact. However the physical world is catching up fast *(157)* with the virtual world in this respect.

Why is this a Good Thing?

Open collaborative design, empowered by advanced open-source CAD software, allows anyone – not just designers and engineers – to easily create new designs of products. It provides a vast array of copylefted modules and artefacts for people to make use of in their designs. This not only means that people can customise things for their own needs and tastes, but makes the design process much more efficient and helps avoid the huge duplication of effort that occurs in design and engineering currently.

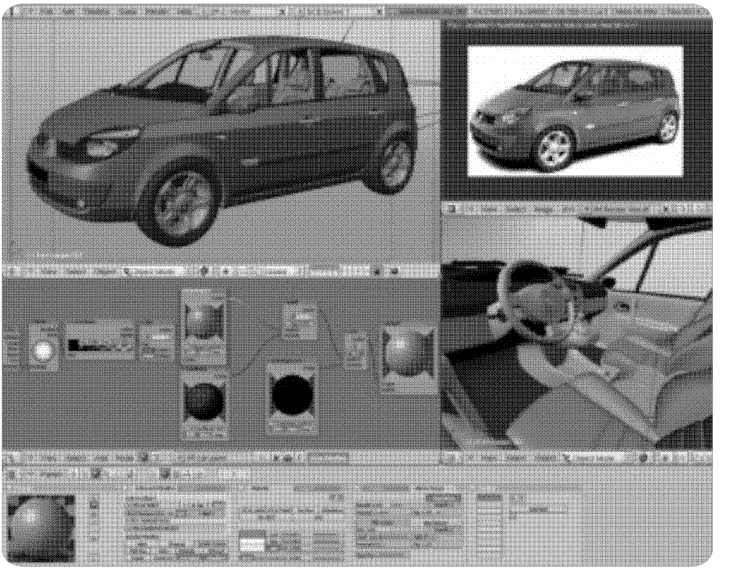
These principles can apply to designing the simplest things that can be made by individuals, solutions for communities in the developing world, all the way up to complex large-scale systems of national or global infrastructure involving thousands of people. Because the designs are not closed or proprietary, people are encouraged to contribute knowing

their involvement not only benefits themselves but anyone else might use the results of their efforts. It also means that designs will evolve far faster because of the huge amount of parallel development that is likely to occur.

Giving these designs physical form will become fast and easy due to emerging high-speed, flexible manufacturing techniques. As a result the open design ecosystem will effectively become an internet for physical items — and the impact on society is likely to be as great as the web has been with respect to information.

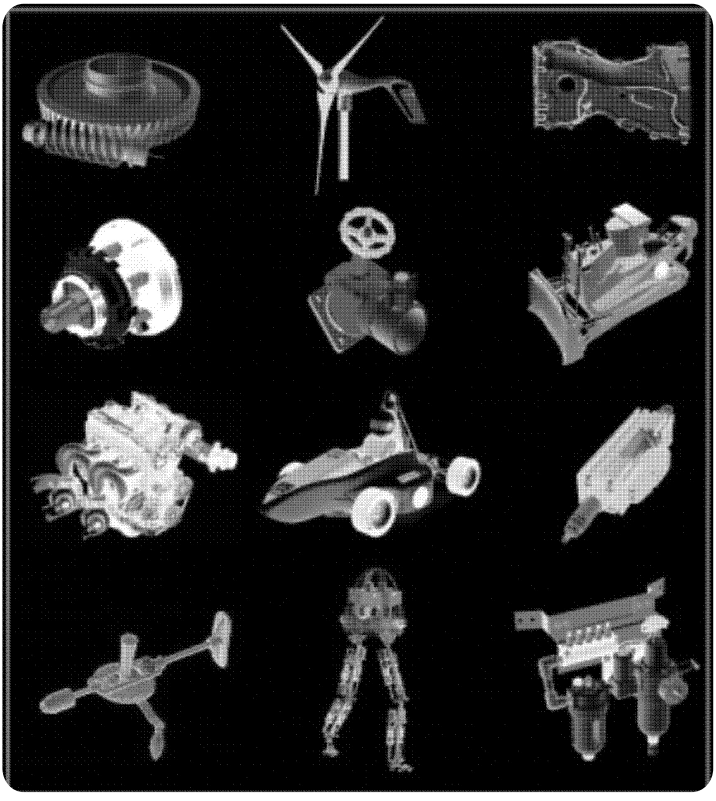
Economic realities discourage large corporations from being really innovative. Corporations are unlikely to risk spending money to develop anything for which there is not a proven market. However, enthusiasts and consumer/producers who make things for their own personal use are often highly innovative and willing to make very novel products. Music is a good example of this: corporate-produced pop music is repetitive and without imagination; innovative music only comes from amateurs who are doing it out of passion. Therefore an open collaborative economy allows faster and greater innovation than a profit-driven economy.

An open collaborative project is always a work in progress. Wikipedia, for example, is always being expanded, streamlined and improved. With a lot of different people contributing to it, it continually gets better and better in small increments. Multiple versions can be developed in parallel acting like an evolutionary system. Many experimental improvements may not turn out to be better, but those adopted with further iteration develop from promising or successful examples. The community of developers and users act as the selection mechanism.



(CharlesC: Renault Blender)

One of the core components necessary for open collaborative design to truly take flight is an advanced free and open-source CAD program to allow anyone to easily generate new designs or customise existing ones. The program should include a special browser to enable finding and importing open-source components and machines from the universal commons as well as analytical tools and physics engines which allow a significant amount of simulation and testing to be done virtually, saving significant amounts of time when it comes to construction.



(CharlesC: Components)

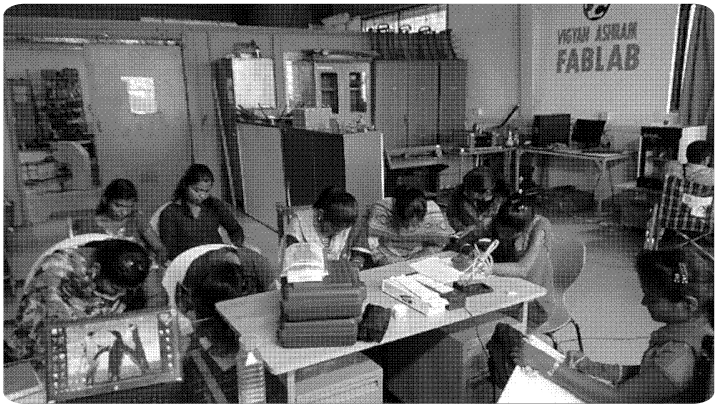
With many people contributing to open design projects, as happens currently with software, a universal commons will emerge made up of vast libraries of designs for everything from components and sub-assemblies through to complete artefacts, machines and complex systems, available for anyone to download and incorporate into their own designs, or help evolve as part of a wider project.

The Concept of Fab Labs

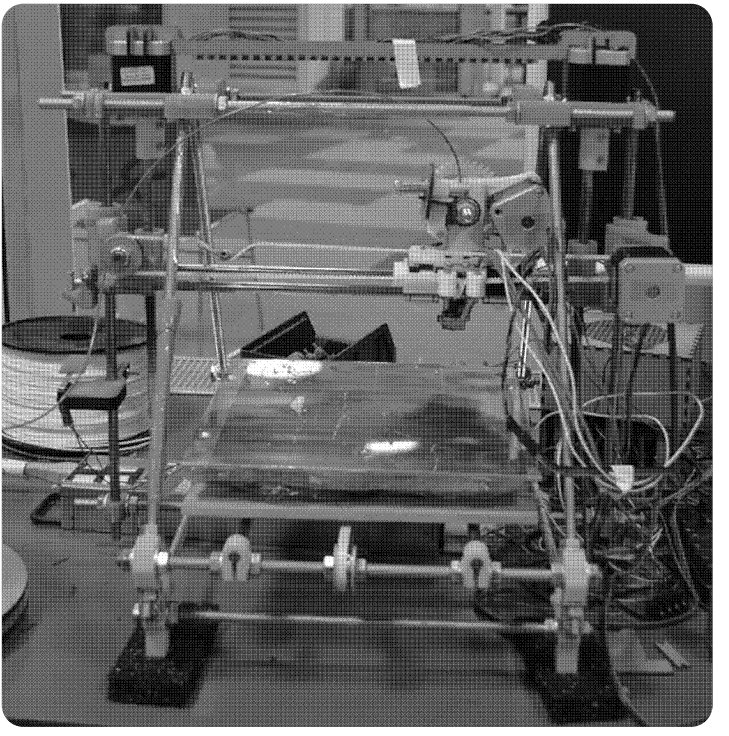
A fab lab *(158)*, short for fabrication laboratory, is a small-scale workshop offering digital fabrication. A fab lab is typically equipped with an array of flexible computer-controlled tools that cover several different length scales and various materials, with the aim to make "almost anything". This includes technology-enabled products generally perceived as limited to mass production. While fab labs have yet to compete with mass production and its associated economies of scale in fabricating widely distributed products, they have already shown the potential to empower individuals to create smart devices for themselves. These devices can be tailored to local or personal needs in ways that are not practical or economical using mass production. The fab lab movement is closely aligned with the DIY movement, open-source hardware, maker culture, and the free and open-source movement, and shares philosophy as well as technology with them.

The initiation of the fab lab program aimed to explore the correlation between the informational content and its physical manifestation, focusing on empowering underserved communities through grassroots-level technology. Launched in 2001 through a collaboration between the Grassroots Invention Group *(159)* and the Center for Bits and Atoms *(160)* at MIT's Media Lab, the program received initial funding from the National Science Foundation in Washington, D.C. The first fab lab outside MIT was established at Vigyan Ashram *(161)* in India in 2002, supported by capital equipment from NSF-USA and IITK.

Today the fab lab network *(162)* constitutes an open, creative community of fabricators, artists, scientists, educators, students, amateurs and professionals located in more than 100 countries and 1,750 fab labs across the globe.

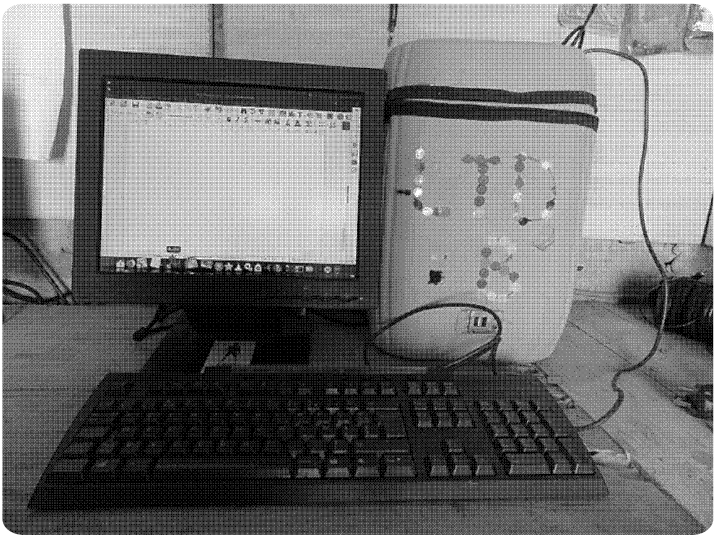


(सुप्रिया कदम: fab lab)
Digital Jewelery Making Workshop in the
Vigyan Ashram FabLab in Pune, India



(Prieur, Benoît: Imprimante 3D — cité des sciences — Fab Lab)

3D Printer in the Fab Lab and Living Lab workshops at the Cité des Sciences et de l'Industrie in Paris, France



(Senfablab: Jerry éducatif Senfablab.)

In Senegal not all children know how to use a computer. In Senfablab jerry cans are manufactured, they are transformed into computers with a free operating system