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MACD DIGITAL MEDIA

The digital revolution in fabrication.

Description of the tools, platforms and strategies to make
anything by yourself

ABSTRACT

“It could be a revolutionary age.” - New Scientist

Simonite, Tom., 2010, Rise of the replicators. *New Scientist*, [internet] June 02.

Available at: <http://www.newscientist.com/article/mg20627621.200-rise-of-the-replicators.html?full=true> [Accessed May 2010]

“It has been called the invention that will bring down global capitalism, start a second industrial revolution and save the environment - and it might just put Santa out of a job too.” - Guardian

Randerson, James., 2006. Put your feet up, Santa, the Christmas machine has arrived. *The Guardian*, [internet] November 25. Available at: <http://www.guardian.co.uk/science/2006/nov/25/frontpagenews.christmas2006>

[Accessed March 2010]

“Objects are print-outs.” - Bruce Sterling

Sterling, Bruce., 2009. *Reboot 11 Closing session* [Internet] from a talk

Available at: <http://video.reboot.dk/photo/486788> [Accessed May 2010]

“In the Next Industrial Revolution, Atoms Are the New Bits”

“Welcome to the next Industrial Revolution.” - Wired, Chris Anderson

Anderson, Chris., 2010. In the Next Industrial Revolution, Atoms Are the New Bits. *Wired.*

com Magazine, [internet] January 25. Available at: http://www.wired.com/magazine/2010/01/ff_newrevolution/all/1

[Accessed March 2010]

In 1973, the philosopher Ivan Illich said: *“Paradoxically, a society of simple tools that allows men to achieve purposes with energy fully under their own control is now difficult to imagine.”*

In 2010 communities of makers are aiming to create this society. They develop new tools and new structures with the web 2.0

The dissertation will explain how these communities are trying to change our economy and fulfill our creativity, and how it could be the next revolution.

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INTRODUCTION

Background

In 1848 ,Karl Marx and Frederick Engels published in the Communist Manifesto that, «*By proletariat is meant the class of modern wage labourers who, having no means of production of their own, are reduced to selling their labour power in order to live.*»

Marx, Karl & Engel, Frierich.,1848,The Communist Manifesto.[online PDF] English edition of 1888 from the Marxists Internet Archive.

Marx suggested that the individual who cannot afford the tool of production would be crowded out of the ruling class.

After the industrial Age and the rise of the factory, the marketplace became increasingly dominated by mass production. With goods designed for everyone, this implied limited diversity and choice for the consumer, although the economies of scale of industrial production allowed lower prices and better products.

During the information age of post-industrial society, individuals had the ability to transfer information freely, and with the internet, instant access to knowledge that would have been difficult or impossible to find

previously.

In addition, in the previous decade «web 2.0» has improved the web as a platform of participation that encourages users to add value to the application as they use it. The internet is now a tool of communication allowing everyone to publish and access content, However the revolution is only digital, individuals still don't have the mean of production and we are still consuming food, technology and all kind of things we don't usually make by ourselves.

The beginning of my dissertation is to consider if we could have those means of productions, which kind of tools it would be, and what could it bring to our society and us.

«*Here's the history of two decades in one sentence: If the past 10 years have been about discovering post-institutional social models on the Web, then the next 10 years will be about applying them to the real world.*»

Anderson, Chris.,2010. In the Next Industrial Revolution, Atoms Are the New Bits. *Wired.com Magazine*,[internet] January 25. Available at: http://www.wired.com/magazine/2010/01/ff_newrevolution/all/1 [Accessed 17 March 2007]

claimed Chris Andersen the chief director of Wired.

Personal interest

My interest in this subject came from the frustration of using new technologies only the way it's sold and designed by a brand.

Instead of using mass-produced impersonalized technologies, I was always interested in finding a way to make the object I have been always dreaming of. For my practical work I tried to understand and to acquire the tools to physically make what I want.

I began to be influenced by the DIY web trends while I learned with free online resources how to make design related activities. I developed an interest for doing projects that «left the screen.» My aim was to go beyond only digital work, to try making things physically.

It was also about trying to do crafts including digital technologies, to combine new media with traditional making processes that I liked.

During summer 2010, I had the opportunity to work with a community of makers in Brooklyn, New York. There, I met independent artists working in fine art, computer science, electronics, architecture, and biology. Everyone was sharing high-skill techniques and trying to bring social progress with their creativity. This immersion period was inspiring

for my dissertation and personal work. I was able to think of strategies that would enable anyone to make what they dream of, the same way those artist were able to.

Plan

My dissertation is about the means and the tools to make things. It is about how to make and not about what to make.

I've tried to consider which tools people might need to be able to make anything. One of the most promising is named "RepRap", the project is a DIY, open-source rapid-prototyper able to print out physical three dimensional objects. This project is the most convincing introducing an eventual new era of personal fabrication. I will describe it in the first part of the dissertation. In the second part I will describe the platform allowing this revolution.

Thirdly, I will explain the philosophy and the spirit around this new way of making things, inspired by the DIY culture. Finally, I will try to build on the perspective of this movement with the instance of the FabLab initiative.

PART 1

The Reprap, personal technology to “print-out” objects

Personal Rapid Prototyper

«We can imagine if rather than downloading software, you could download products. Real objects like furniture, tools, and even electrical goods. In other words, a multitude of man made objects which would usually be produced in a factory somewhere in China.»

Mead, Nicholas.,2009, Is RepRap the future for downloading?. *onSoftware*,[internet] August 6th.
Available at: <http://en.onsoftware.com/is-reprap-the-future-for-downloading/>[Accessed April 2010]

This is the initial concept from the developers of the “self-replicating rapid prototyper” or “RepRap”».

«RepRap is a free desktop 3D printer capable of printing plastic objects. Since many parts of RepRap are made from plastic and RepRap can print those parts, RepRap is a self-replicating machine - one that anyone can build given time and materials. It also means that - if you’ve got a RepRap

- you can print lots of useful stuff, and you can print another RepRap for a friend...»

RepRap.org Main page, [internet] Available at: http://reprap.org/wiki/Main_Page [Accessed April 2010]

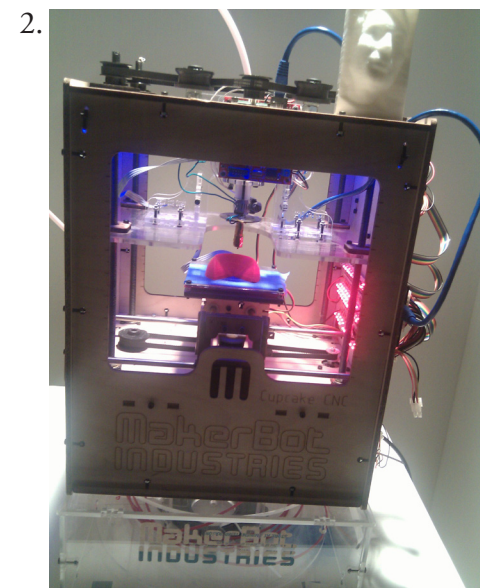
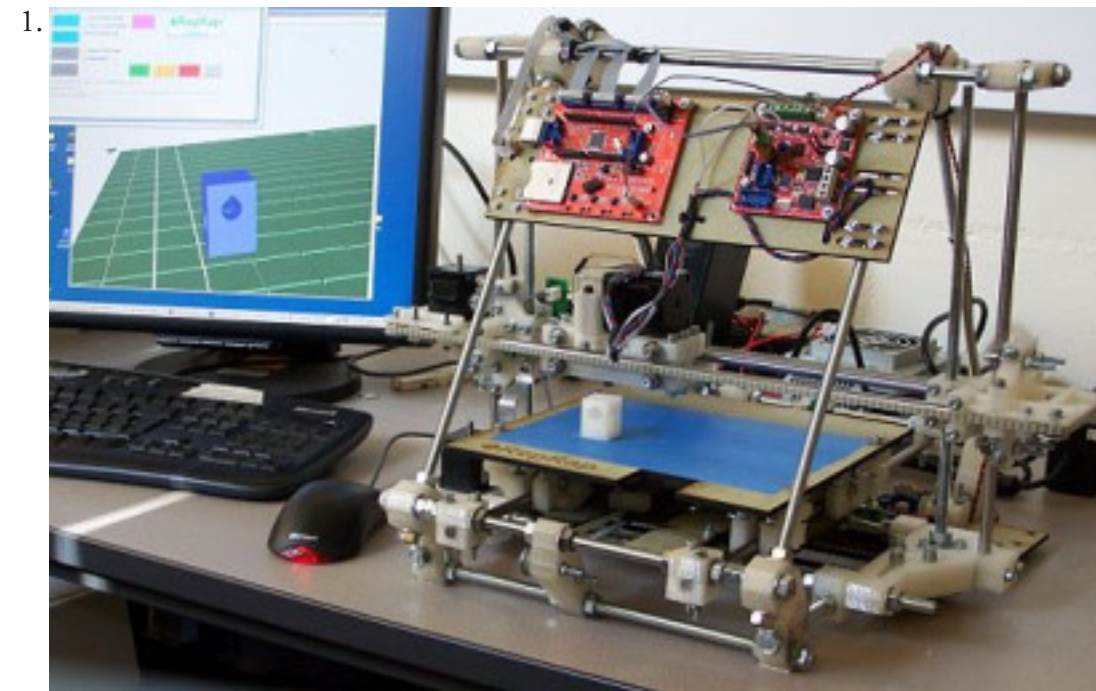
The project was initiated by Adrian Bowyer, a British engineer and mathematician, currently an academic at the university of Bath. RepRap is short for «replicating rapid prototyper». «The RepRap project aims to put RP technology into the home. It attempts to do this by designing an assisted self-Replicating Rapid Prototyping machine»

Sells, Edward Anthony.,2009,Towards a Self-Manufacturing Rapid Prototyping Machine. Ph. D. Bath:University of Bath, Department of Mechanical Engineering.

Rapid Prototypers are not new, but it has always been a technology too expensive for the home. *« So-called rapid prototyping machines that manufacture objects from digital designs have been around since the 1980s, although they still cost upwards of £20,000 and mostly have specialised industrial applications.»*

Sells, Edward Anthony.,2009,Towards a Self-Manufacturing Rapid Prototyping Machine. Ph. D. Bath:University of Bath, Department of Mechanical Engineering.

The RepRap works like a printer, except rather than shooting ink out of



1. RepRap Mendel

Bowyer, Andrian. 2009 RepRap Mendel.[Photography] Available at:<http://futurismic.com/wp-content/uploads/2009/10/reprap-mendel-self-replicating-machine.jpg>
[Accessed November 2010].

2. CNC Cupcake

Personnal, 2010, Maker Bot Cupcake cnc.[Photography]

a moving nozzle it squirts molten plastic in layers. « *The Fused Filament Fabrication process is sufficiently versatile to make a self-manufacturing Rapid Prototyping machine.* » «RP (rapid prototyping) systems take information from a CAD solid model file via an STL file and convert it into a sliced model. They then use this information to drive an SFF process to physically build the layers. These layers are deposited on top of each other to form the final part. ».

Sells, Edward Anthony.,2009,*Towards a Self-Manufacturing Rapid Prototyping Machine*. Ph. D. Bath:University of Bath, Department of Mechanical Engineering.

To date the machine has made all kind of items like belt buckles, scale architectural models or shoes. Besides its cheap cost, it is the self-replication feature that distinguishes the RepRap Project from other 3d printers. Another famous popular personal 3d printer at the moment is the “CNC cupcake” from Maker Bot website.

MakerBot website, [internet] Available at: <http://www.makerbot.com/> [Accessed April 2010]

The “CNC Cupcake” printer is much easier to build, and contrary to the RepRap, it doesn't have the self-reproduction purpose and it's less accurate.

Evolution

The RepRap self-replication ability is ambitious. RepRap is able to autonomously construct much of its mechanical components in the near future using fairly low-level resources, though it would still require an external supply of several currently non-replicable components such as sensors, stepper motors or micro-controllers. A certain percentage of such devices will have to be produced independently of the RepRap self-replicating process. The goal is, however, to asymptotically approach a 100% replication over a series of evolutionary generations. However, this ability has led to a veritable ecosystem of RepRap-type machines - an estimated 3000 exist for the New Scientist article published in June .

Tom Simonite, Tom., 2010, Rise of the replicators. *New Scientist*, [internet] June 02. Available at: <http://www.newscientist.com/article/mg20627621.200-rise-of-the-replicators.html?full=true> [Accessed July 2010]

To date, the RepRap project has released three version of the 3D printing machines: "Darwin", was the first, it was released in March 2007. «Mendel», was released in October 2009 it is smaller and more reliable. «*Mendel can, if you discount nuts and bolts, print 50 per cent of the*

machine's parts in under three days,» says Bowyer.

Tom Simonite, Tom., 2010, Rise of the replicators. *New Scientist*, [internet] June 02. Available at: <http://www.newscientist.com/article/mg20627621.200-rise-of-the-replicators.html?full=true> [Accessed July 2010]

It can also make much larger things than Darwin can. In 2010, the third generation design, «Huxley» is officially named. Regularly the contributors are updating the «Things to do» for this new version directly on the wiki page. At the moment, the version is in progress. There are substantial improvements since the beginning of the project. Printing electronics is a major goal of the RepRap project. Priya Ganapati report that this latest breakthrough was made with the first circuit made entirely automatically by the RepRap machine in April

Ganapati, Priya., 2009. Open Source Hardware Project RepRap Creates its First Circuit. *Wired.com Gadget Lab*, [internet] April 21. Available at: <http://www.wired.com/gadgetlab/2009/04/open-source-pro/> [Accessed March 2010]

This means more complex and technological objects will be printed and consequently that the self-replicating ability is improving «*though projections made later in this thesis (Section 9.2.8, page 159) estimate that the printer will be able to achieve 94% self-manufacture in the mid-future.*»

Sells, Edward Anthony.,2009,*Towards a Self-Manufacturing Rapid Prototyping Machine*. Ph. D. Bath:University of Bath, Department of Mechanical Engineering.

Now the RepRap prints out objects not only by creating layers of the melted plastic, but the machine is capable of building three-dimensional objects from both electrically insulating material and a conductor.

Moreover, by slightly modifying the printer and hooking up different parts it becomes possible to turn it into a laser-cutting machine for instance. The rewrap is using an X, Y, Z axis similarly to a CNC machine, then people tweaked it in order to make a cnc machine, a laser cutting machine, a printer or a plotter machine. Indeed, users from the community are invited to modify and improve the RepRap *«The poster, Frank Davies, based in Houston, Texas, is the proud owner of a RepRap ingeniously built using parts salvaged from a dot matrix printer and a Xerox photocopying machine, and he is now working on making his RepRap totally printable.» «Davies, by day a NASA engineer on the space shuttle programme, is effectively replacing RepRap's skeleton with one of his own making. In place of the tracks along which the print nozzle glides are plastic concertina-like mechanisms called Sarrus linkages, originally used to ensure steam pistons moved in straight lines in an era when reliably straight rods*

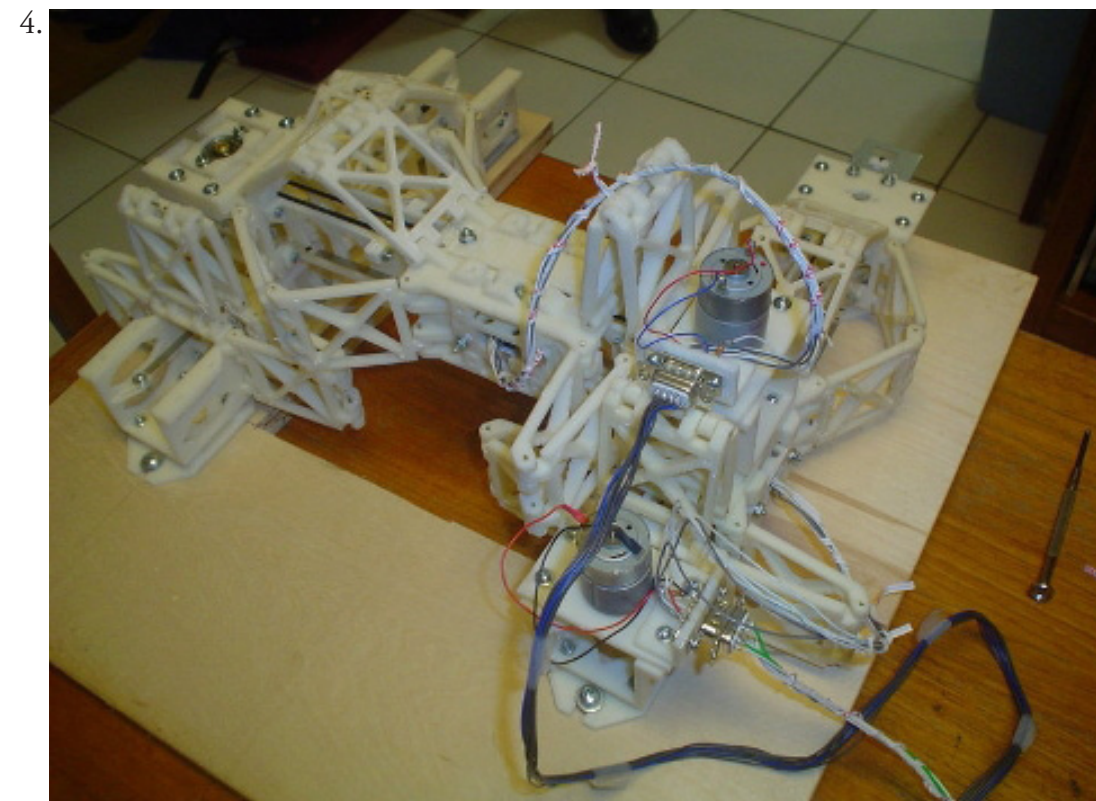
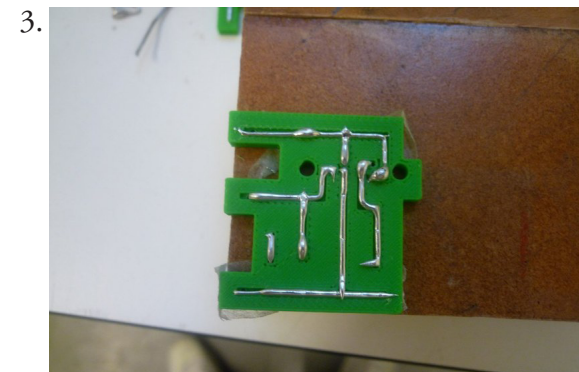
weren't available. Two perpendicular hinges connect the moving parts such that they can move only along the remaining, unrestricted axis.»

Simonite, Tom., 2010, Rise of the replicators. *New Scientist*,[internet] June 02. Available at: <http://www.newscientist.com/article/mg20627621.200-rise-of-the-replicators.html?full=true> [Accessed May 2010]

The design is available and adapted for everyone. The RepRap project is inspiring other similar projects and personalised tools. The MIT graduate Ilan Moyer created a machine similar to RepRap that he called “multiFab”, it's able to perform sequential operations - printing a structure, and then putting the finishing touches to its shape with a milling tool - and plans to add a laser cutting head. With all these tools users approach the idea of a micro desktop factory. Consequently more complex objects can be created at home. It is in the hand of the user to download, print and build what they dream of from a plastic cup to a spacecraft. *«Objects are print-outs.»* said Bruce Sterling in a talk .

Sterling, Bruce., 2009. Reboot 11 Closing session [Internet]online talk. Available at: <http://video.reboot.dk/photo/486788> [Accessed March 2010]

Hod Lipson, a robotics researcher at Cornell University in Ithaca, New York, is trying with his students to build a complete robot



3. Printed circuit with RepRap

Bowyer, Adrian. 2009 First Circuit made. [Photography] Available at: http://www.wired.com/images_blogs/photos/uncategorized/2009/04/21/reprap_circuit_2.jpg [Accessed November 2010].

4. Sarrus Linkage Printer

Unknown, 2009 Sarrus linkage printer. [Photography] Available at: <http://hackadaycom.files.wordpress.com/2009/12/sarrus-linkage-printer.jpg?w=470&h=353> [Accessed November 2010].

with a reRap; *«We're at the transition from printing parts to printing systems,» Creative and ingenious solution are provided for every problem, for instance: «Electrodes and wiring, for example, can be made using silver particles mixed into silicone, while the bulk of a battery can be made using a paste of zinc particles and liquid electrolyte.»*

Simonite, Tom., 2010, Rise of the replicators. *New Scientist*, [internet] June 02. Available at: <http://www.newscientist.com/article/mg20627621.200-rise-of-the-replicators.html?full=true> [Accessed May 2010]

Download and print physical goods

The RepRap aim is to be useful not only for researchers and education but also for consumer who wants to print goods they cannot afford or imaginary stuff. *«Instead of queueing for this year's equivalent of Buzz Lightyear, Robosapiens or TMX Elmo, parents will simply download the sought-after design off the internet and print it out.» «If people can make anything for themselves what's the point in going to the shops?»* said Adrian Bowyer in the Guardian article *“If Dr Bowyer's vision is realised there could be profound implications for the global economy. Instead of large companies manufacturing large numbers of consumer goods and distributing them to*

shops, consumers would buy or share designs on the internet, manufacturing items on their own replication machines. » Michael S. Hart founder of the project Guttenberg (which makes electronic books freely available via the Internet.)said «In 30 years replicators are going to be able to make things out of all sorts of stuff,» «Somewhere along this line the intellectual property people are going to come in and say ‘No we don’t want you all printing out Ferraris and we don’t want you printing out pizzas.’»

Randerson, James.,2006. Put your feet up, Santa, the Christmas machine has arrived. *The Guardian*,[internet] November 25. Available at: <http://www.guardian.co.uk/science/2006/nov/25/frontpagenews.christmas2006> [Accessed March 2010]

Degeneration

One downside of the project is how after long generations of use, machine error could be accumulated. *«Though the machines’ offspring may be perfectly functional for several generations, tiny errors will gradually accumulate so parts will periodically need to be replaced. And they will never be as precise as the originals. »*

But for Bowyer this is a problem easily solvable for the community.

“This by no means sounds the death knell for self-replicating machines. Every

5.



5. Printed Shoes

Unknown, 2008 Items made- Shoes.[Photography] Available at:[http://reprap.org/wiki/](http://reprap.org/wiki/File:ItemsMade-shoes-small.jpg#filehistory)

[File:ItemsMade-shoes-small.jpg#filehistory](http://reprap.org/wiki/File:ItemsMade-shoes-small.jpg#filehistory)

[Accessed May 2010].

living thing can be seen as a self-replicating machine that relies heavily on components and assistance from others, he says, so why should machines be any different? Plants, mosquitoes and viruses are all accepted as self-replicating but rely heavily on other species to achieve it. It would be churlish to expect replicators to be any different.».

Simonite, Tom., 2010, Rise of the replicators. *New Scientist*, [internet] June 02. Available at: <http://www.newscientist.com/article/mg20627621.200-rise-of-the-replicators.html?full=true> [Accessed May 2010]

Self-assembly and self-replication

A criticism of the reRap was that it's not really a replicating machine if it doesn't assemble the child machine by itself. But for bowyer and the RepRap this is not the aim. *«It is important to note that the idea behind the RepRap project is to demonstrate selfmanufacture, not self-assembly (as mention above, the RepRap printer will be put together by hand).»*

Sells, Edward Anthony., 2009, *Towards a Self-Manufacturing Rapid Prototyping Machine*. Ph. D. Bath: University of Bath, Department of Mechanical Engineering.

Nevertheless Greg Chirikjian and his colleague Matt Moses are aiming to solve the self-assembling ability of the machine, with *«a kind of*

Lego set that doesn't need anyone to play with it.» «The pair have already demonstrated key parts of such a system, using around 100 plastic blocks. Although it cannot yet fabricate these blocks itself, the machine is able to move in 3D to pick up and bind them into larger structures. Moses is currently working on having it make a complete replica of its own structure using Lego-like bricks, though the machine still relies on conventional motors - which have to be installed by hand - to drive its activity.».

Simonite, Tom., 2010, Rise of the replicators. *New Scientist*, [internet] June 02. Available at: <http://www.newscientist.com/article/mg20627621.200-rise-of-the-replicators.html?full=true> [Accessed May 2010]

The self-replicating feature is originally from the Theory of Self-Reproducing Automata, which was defined by Neumann in 1966 *«Von Neumann's specification defined the machine as using 29 states, these states constituting means of signal carriage and logical operation, and acting upon signals represented as bit streams. A 'tape' of cells encodes the sequence of actions to be performed by the machine. Using a writing head (termed a construction arm) the machine can print out (construct) a new pattern of cells, allowing it to make a complete copy of itself, and the tape.»* .

Von Neumann universal constructor [Internet] Available at: <http://en.wikipedia.org/wiki/Von>

[Neumann universal constructor/](#)

[Accessed April 2010]

Self-reproduction for human made items solves their inherent problem of scarcity. «*The number of them in existence and the wealth they produce can grow exponentially,*» Bruce Sterling notices on his blog that«*Self-copying rapid-prototyping machines can multiply exponentially and so can the goods they produce. No technology other than self-copying can do this, and exponential production growth is the fastest that is mathematically possible (which is why all living organisms use it). At one machine per day, after one month there would be a machine for every man, woman, and child on the planet.*» Then he adds that accumulated errors won't appear on advanced generations of reppap "Children." On the contrary, it will be more likely to see improvements with new generations of reppap "kids". «*Thus the machines will improve; good designs will come to predominate, and the lesser ones will fall by the wayside. This is almost the same as Darwinian evolution, but with one important difference: in nature, mutations are random, and only a tiny fraction are improvements; but with self-copying rapid-prototyping machines, every mutation is a product of analytical thought. This means that the rate of improvement should be very rapid,*» Developers have

6.



6. RepRap printed parts

Unknown, 2008 RepRap parts [Photography] Available at:<http://www.genomicon.com/wp-content/uploads/2009/07/reppap1.jpg>

[Accessed November 2010].

named each RepRap after famous biologists, as «*the point of RepRap is replication and evolution*».

Sterling, Bruce.,2009 .Imaginary Gadgets 0003: The Reprap. *Wired.com Beyond the beyond*,[internet] February 18. Available at: http://www.wired.com/beyond_the_beyond/2009/02/imaginary-gad-2/ [Accessed March 2010]

The raw material to print is not scarce

Unfortunately the 6% of irreproducible RepRap child parts, as well as the raw material used to print objects appears to be still scarce. However the RepRap community is active and they are looking at how to solve the problem of the raw material scarcity. First, it could be possible to recycle printed object. Secondly, they found a solution which, in addition, is cleaning the atmosphere. «*However, there is also another route to the creation of raw materials, and that is to use polymers like polylactic acid that can be made by fermentation from biomass. Thus a person with a few tens of square meters of land on which to grow a starch-crop (like maize) could make their own polymer (the machine being able to make the fermenter, of course). Then not only would the machine be self-replicating, the material supply would be too. In addition, it would even take CO2 out of the atmosphere*

and lock it away in plastic goods, though polylactic acid is biodegradable.»

Sterling, Bruce.,2009 .Imaginary Gadgets 0003: The Reprap. *Wired.com Beyond the beyond*,[internet] February 18. Available at: http://www.wired.com/beyond_the_beyond/2009/02/imaginary-gad-2/ [Accessed March 2010]

Idealism

Sterling says the RepRap realizes a “*Darwinian Marxism*,” he says it «*will allow the revolutionary ownership, by the proletariat, of the means of production. But it will do so without all that messy and dangerous revolution stuff*».

Sterling, Bruce.,2009 .Imaginary Gadgets 0003: The Reprap. *Wired.com Beyond the beyond*,[internet] February 18. Available at: http://www.wired.com/beyond_the_beyond/2009/02/imaginary-gad-2/ [Accessed March 2010]

Reprap is a very idealist project in that it might sound utopian that everyone owns such a tool. In Tools for Conviviality essay, Ivan Illich said in 1974 “*a society of simple tools that allows men to achieve purposes with energy fully under their own control is now difficult to imagine.*»

What is missing in society for Illich is what he calls convivial tools. Illich uses “convivial” a French word meaning the friendly relationship between

a group of individuals. He explains *«I choose the term «conviviality» to designate the opposite of industrial productivity. I intend it to mean autonomous and creative intercourse among persons, and the intercourse of persons with their environment; and this in contrast with the conditioned response of persons to the demands made upon them by others, and by a man-made environment.»*

Illich, Ivan D., 1973, *Tools for Conviviality*. Case bound Edition. London: Calder & Boyars Ltd.

The reppap machine is allowing the creative exchange from the community, who then bypass the need of consuming scarce goods.

Following Illich point of view, the RepRap would be a convivial tool in opposition to the mass production tools, improving our way of living and creating well-being. *«A convivial society should be designed to allow all its members the most autonomous action by means of tools least controlled by others. People feel joy, as opposed to mere pleasure, to the extent that their activities are creative; while the growth of tools beyond a certain point increases regimentation, dependence, exploitation, and impotence.»*

Illich, Ivan D., 1973, *Tools for Conviviality*. Case bound Edition. London: Calder & Boyars Ltd.

PART 2

Open structures.

Broadcasting the project on the web 2.0

The RepRap project uses Wikipedia and other websites to provide information to the community. The “Wiki” page is storing all the information, from the history of the project to technical instructions on how to build the machine. Wikipedia is an open-source Encyclopedia born in 2000, now counting 16 million articles.

Wikipedia, Wikipedia [Internet] Available at: <http://en.wikipedia.org/wiki/wikipedia> [Accessed February 2010]

It's one of the new web platforms allowing social learning. Thanks to such a platform, born in the 2000 decade, the RepRap project community grew with ease all over the world. Building a complex machine such as a 3d printer becomes accessible for everyone who has access to the internet. Opening-up Education by Toru Iiyoshi and M. S. Vijay Kumar explains the new mechanisms of learning based on the

Internet open platforms. It explains, how we can easily publish and access content. *“In the digital age, communities self-organize around the Internet, which has created a global «platform» that has vastly expanded access to all sorts of resources including formal and informal educational materials. The Internet has also fostered a new culture of sharing, in which content is freely contributed and distributed with few restrictions.” The hierarchy on the virtual space is a new paradigm, allowing everyone to create and access to contents. “the so-called Web 2.0 has blurred the line between producers and consumers of content and has shifted attention from access to information toward access to other people.”*

Iiyoshi, Toru & Vijay Kumar, M.S., 2010, *Opening Up Education, The Collective Advancement of Education through Open Technology, Open Content, and Open Knowledge*. Paper, Cambridge, Massachusetts: The MIT Press.

Unofficial tools and content

However, the legitimacy of Wikipedia, and other open source systems, is prone to criticism, because anyone can add content. For officials quoting a Wikipedia page is considered not serious. Illich in Tools for Conviviality and Shadow Work explains how education, health and

governance became paradoxical institutions of “progress” by creating hierarchy, guild and official institutions. For instance he reminds us how health care was institutionalised through the nineteenth century and how the medical profession insisted on a monopoly of their application. With industrialization, came victims of industrial violence and new sickening jobs appeared. Huge amounts of money were invested in professional medicine, trying to extend sick life. *«more people survived longer months with their lives hanging on a plastic tube, imprisoned in iron lungs, or hooked onto kidney machines. New sickness was defined and institutionalized.»*

Illich, Ivan D., 1973, *Tools for Conviviality*. Case bound Edition. London: Calder & Boyars Ltd.

Since then the traditional health-care by non-official practitioners such as “shamans and herb doctors” or family members became obsolete for society. He says new specializations were created in order to **“keep the tools under the control of the guild”**. All unqualified people are still put aside from official “guilds” and institutions in our society nowadays. Something revolutionary with the web is that it puts forward the mass. They are communities with their sensibilities but now everyone can

be part of it. With web 2.0, open-source projects are open to everyone who wants to get involved. There are no selections, getting involved in online communities does not require any official qualifications. Moreover, there are now open-source projects about all kinds of areas; agriculture, health, science, technology, government, media, education, innovation communities, recreation and art. Shirky is dealing with open media in Here Come Everybody, he says: *“Everyone can become a media outlet”* to understand the phenomenon it is necessary to understand that at the roots, the internet gives freely the appropriate tools to the users *«our social tools remove older obstacles to public expression, and thus remove the bottlenecks that characterized mass media. The result is the mass amateurization of efforts previously reserved for media professionals.»*

Shirky, Clay., 2008, *Here Come Everybody -How change happens when people come together*. Paperback. London: Penguin Group.

Amateurization and enthusiasm

A problem to consider is if there is a downside to making media amateur.

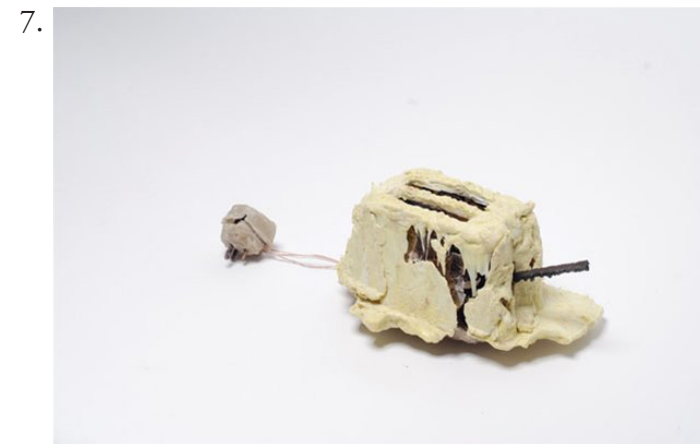
Is it losing quality? On one hand, the content scattered on the web

would lack professionalism, but, on the other hand it would not lack enthusiasm and involvement from the participants by becoming more “convivial”.

Professionalism is creating technical progress and shaping our high-tech society. Our objects and surroundings have reached a level of complexity that often goes beyond common thinking. Thomas Thwaites for The Toaster Project tried to make an electric toaster, from scratch, it was an active work of one year. Beginning with mining the raw materials, then extracting oil to make plastic and even processing his own copper, iron, mica and nickel. The end result is a fully functioning toaster like the Argos' £ 3.99 one. He says about his project: *«It's about scale, the total inter-reliance of people and societies, the triviality of some (anti-)globalisation discourse, what we have to lose, and DIY.»*

Thwaites, Thomas., The toaster project homepage, [Internet] Available at: <http://www.thetoasterproject.org/> [Accessed April 2010]

Then on human-scale, technical progress can be considered as a drawback. Especially when the technology becomes alienating for the individuals who use it. Following Emerson's thinking in the chapter



7. Thomas Thwaites finished Toaster

Alexander, Daniel, 2009 The Toaster Photo.[Photography] Available at: <http://s3files.core77.com/blog/images/Toaster-Project-mosaic.jpg>

[Accessed November 2010].

8. Material for the toaster

Ballon, Nick, 2009 The Toaster Project.[Photography] Available at: http://s3files.core77.com/blog/images/theToasterProject_PhotoCredit-Daniel_Alexander-763641.jpg

[Accessed November 2010].

‘Work and Days’, highly-complex systems and machines are “unteaching” us. The philosopher expressed that there are no benefits in progress that does not embody the person and when individuals cannot understand the tools they use. *“Then the political economist thinks it is doubtful if all the mechanical inventions that ever existed have lightened the day’s toil of one human being.” The machine unmakes the man. Now that the machine is so perfect, the engineer is nobody. Every new step in improving the engine restricts one more act of the engineer,-unteaches him. Once it took Archimedes; now it only needs a fireman, and a boy to know the coppers, to pull up the handles or mind the water-tank. But when the engine breaks, they can do nothing.»*

Emerson, Ralph Waldo., 1870, *Society and Solitude* . 2005 Paperback. New York: Cosimo.

Orginally published by Houghton, Mifflin.

Emerson is dealing with alienating machines from the industrial age.

However, nowadays Emerson’s thinking is still true for consumption goods. For instance our cars or phones are supposed to be smart with the new tools and the essentials “apps”. Though their high-level of complexity disables most people’s ability to fix it when it breaks, or to

“hack” it for another more personal purpose.

Consumption strategies

The iPhone from Apple is a product formatted to forbid hacking. The first line about the iPhone on the website is *«we were busy creating amazing new features that make iPhone more powerful, easier to use, and more indispensable than ever.»*

Apple Home page, [Internet] Available at: <http://www.apple.com> [Accessed November 2010]

This implies that their strategy is to think for the user of what he might need, to create a dependency with the object and to create a tool that increase productiveness. For commercial purposes, massive brands use diverse strategies to increase their business. For example, planned obsolescence defined by Vance Packard is an obvious way to increase consumption; it is the planning of the end of a product before it is launched.

Packard, Vance.,1960. *The Waste Makers*. First Thus edition 1963,Simon & Schuster Inc.

These Strategies often aims to make the consumer dependent on the object they use.

Open-source structures can cope with this dependence created by mass

production goods. An everyday life example is coffee, which is basically an “open-source” resource. Every one always used it the way they wanted or liked to. But when Nespresso decided to make capsules with a patented format, they aimed to take control over the consumption of coffee by imposing a way to drink coffee. It doesn’t allow any other way to brew coffee, and if Nespresso decides to stop emitting the capsule, the user can throw away the coffee machine. On the other hand those capsules appear to be convenient for many people who don’t need to waste time wondering how to make their coffee, and just make it.

Hacking it to own it

The policy of most of the High-Tech corporations is to forbid the user to “hack” their device. Eric Von Hippel exemplify the state of mind of big companies in Democratizing Innovation with Sony example: *«Some companies encourage their customers to modify their merchandise. Others, however, do not: when a devoted user of Aibo, Sony’s robot dog, wrote applications that would allow the Aibo to dance to music, Sony threatened the man with a lawsuit.»*

von Hippel, Eric., 2005, Democratizing Innovation. Paper 2006, Cambridge, Massachusetts: The MIT Press.

Companies like Sony indeed are providing a low level of personalisation of their products. For Apple, for instance, the design does not allow personalisation. Every tool or “apps” they make becomes simple to use but the common user is never able to access to the source of the machine or to see how it works. Their products are not made to be modified on a low level (there is a personalization possible, but not at the origin of the product). Make magazine, a leading proponent of the DIY community and hacking methodologies gives the consumer a simple test to gauge the actual degree to which they are in control: *“If you can’t open it, you don’t own it.”*

«Mister Jalopy», Vol. 04: Owner’s Manifesto [Internet] Available at: <http://makezine.com/04/ownyourown/> [Accessed September 2010]

It is ironical that, for example Apple, Steve Jobs and Steve Wozniak started the company by doing “phone phreaking, a telephone frequency hack that John Draper taught to them. Scott Burhnam in Finding the truth in systems: in praise of design-hacking wrote *“If you trace the iPhone, the iPod, the Mac and the first personal computer back to their*

source, you’ll find a hacker.” Burhnam explains that the term «hack» is infamous, he assumes that it’s an activism and way of self-expression. He gives as an exemple the project Flamma from Helmut Smits, the artist decide to hack an IKEA object, he bought several items from Ikea and hacked their original purpose by using them to create a fire. his intention was the following *«FLAMMA harks back to one of humanity’s basic needs: making fire. I thought it would be interesting to go into IKEA as if I was a primitive human being and make fire using products found there. The project also fits the back-to-basics image of IKEA and the Swedish lifestyle. IKEA does not, however, sell lighters or matches.»*

Smits, Helmut., FLAMMA [Internet] Available at: <http://helmutsmits.nl/design/flamma> [Accessed November 2010]

Thus Smits with this performance makes fun of predetermined purpose of objects defined by the brands.

“Lead-users” and “user-centered” innovations

Companies do market studies in order to define lead-users, somehow a stereotype of their clients. Consequently there are never any objects

produced for one single person but always for a fictional user supposed to encompass the characteristics of a group. Consequently innovations are created for this fictional lead-user. However other kinds of techniques leads to innovation. In the book Democratizing Innovation Eric von Hippel explain how innovations are rapidly becoming democratized. Users, aided by improvements in computer and communications technology, increasingly can develop their own new products and services. These innovating users who are individuals often freely share their innovations with others, creating user-innovation communities and a rich intellectual commons. Eric von Hippel looks closely at this emerging system of user-centered innovation. He argues that manufacturers should redesign their innovation processes and that they should systematically seek out innovations developed by users. For example, a solution for business is to provide toolkits for developing new products to help the users. He shows that user innovation has a positive impact on social welfare. User finds it profitable to develop new products and services for themselves, it often pays for them to reveal their innovations freely for the use of all.

Tools and structures to innovate

The cause of change is, at the roots, the increase of tools and structures that offer possibilities for everyone to innovate. Those tools can be both physical and virtual. They can be electronic components, social learning database, online service, or open source software. What these tools all have in common is that they are open-source and provide a large documentation about their functions, thus everyone can learn it by himself for free. *“OEC (open educational content) and OSS (open-source software) have generated a culture The members of those cultures have discovered new efficiencies, new opportunities for productivity («social production»), new forms of organization («coopetition»), new markets («the long tail»), new pathways to learning, and new models for engaging with their colleagues and others around the sharing and collaborative construction of intellectual property.»*

Iiyoshi, Toru & Vijay Kumar, M.S.,2010,*Opening Up Education, The Collective Advancement of Education through Open Technology, Open Content, and Open Knowledge*. Paper, Cambridge,Massachusetts: The MIT Press.

Now all the tools allowing you to make anything are available with the

help of the community *«Hence, much information that was previously only available from the lectern or through the eyes and ears of a well-worn traveller is now freely available at your fingertips from whatever location you may happen to be on this great planet of ours at any given time.»* says danny do something, a musician praising new kinds of social interaction.

«Danny Do Something».,2009,Defining the New D.I.Y..*Ghost Town Records Articles*[internet] November 25. Available at: <http://iamthemusicindustry.com/ghosttownrecords/?p=234> [Accessed May 2010]

If the user wants to create something with electronics and interaction, Arduino is a micro-controller that could be used to build a RepRap for instance. *«Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.»*.

Arduino Home page, [Internet] Available at: <http://www.arduino.cc/> [Accessed July 2010]

All kinds of electronic components and sensors are available through website like coolcomponents.co.uk, sparkfun.com, ladyada.com . Hobbyist enthusiasts or professional designers will do a prototype of a project on breadboard. Next, when their prototype works they can draw

the circuit on FreeCad, or to ask <http://www.4pcb.com> to print it. If they need to make a 3d model for a RepRap or another 3d printer they can do it with free Google SketchUp. After they can share their idea, and provide a « how to » on a personal blog, or through DIY community website such as Makezine.com or instructable.com . Those website are a never-ending source of creative projects from How to build a solar powered trike to How To Measure the Speed of Light using Chocolate. Dale Dougherty founder of make describe it: *“MAKE Magazine brings the do-it-yourself mindset to all the technology in your life. MAKE is loaded with exciting projects that help you make the most of your technology at home and away from home. We celebrate your right to tweak, hack, and bend any technology to your own will.»*

Dougherty, Dale., About makezine.com[internet] Available at: <http://makezine.com/about/> [Accessed July 2010]

The founder of instructables is from MIT media Lab Eric J.Wilhelm, Ph.D. says about his website: *«Instructables is a web-based documentation platform where passionate people share what they do and how they do it, and learn from and collaborate with others.»*

About Instructables[Internet] Available at: <http://www.instructables.com/about/> [November 2010]

From their computer the makers can even create wealth from their creation. With the website Etsy people can sell their handmade goods: *“Our mission is to enable people to make a living making things, and to reconnect makers with buyers. Our vision is to build a new economy and present a better choice: Buy, Sell, and Live Handmade.”*

Etsy About, [Internet] Available at: http://www.etsy.com/about?ref=ft_about [Accessed July 2010]

Human-scale projects

This summer I was involved in a DIY, low-cost project with the artist/ researcher Zachary Lieberman. The project is named the « eye-writer ». Lieberman created a low budget eye-tracking device for less than 200 US dollars. At first it was a new creative way of interaction (for example to play Super Mario games with eye-movement only). But the real aim was much more serious; it was to help a paralysed graffiti artist from Los Angeles. This artist is Tony Quan, “Tempt1,” he was sadly diagnosed with Amyotrophic Lateral Sclerosis in 2003. The goal was to create a low budget eye-tracking device, and then Tempt1 would be able to make art again, with his eyes, despite his disease. The first step was to do a

prototype on a breadboard with an Arduino, a webcam, IR LED and with the open-source programming environment. Openframeworks. Openframeworks is a c++ library designed to assist the creative process by providing a simple and intuitive framework for experimentation. Other artist use Processing, which is also a platform to learn, prototype and produce interaction. In our case for the eye-writer, Zachary Lieberman already knew how to do all the programming and he had the help from Ito Takayuki, a Japanese artist who was enthusiast with the project and came from Japan to help. In the end the eye writer prototype was more accurate than all the more expensive official medical tracking devices. Zach Lieberman, and the small community working on the project, wanted to find funding for Tempt1 art work made by eyes. An objective was to spread Tempt1’s new artwork over the world. An internet website was the tool that allowed this. They used the website Kickstarter.com, *«Kickstarter is the largest funding platform for creative projects in the world. Every month, tens of thousands of amazing people pledge millions of dollars to projects from the worlds of music, film, art, technology, design, food, publishing and other creative fields. A new form of commerce and patronage.*

All or nothing funding. Each and every project is the independent creation of someone like you.»

What is Kickstarter?! [Internet] available at: <http://www.kickstarter.com/help/faq> [Accessed July 2010]

After two weeks 15,000 dollars was raised for the project. Now drawing with his eyes from his hospital bed, Tempt1 can still spread his style and artwork all over the world. Lieberman and the people involved in the project worked on a second improved version of the eye-writer, and a full documentation to build an eye-writer was provided online. The project became popular on blogs and now other paralysed people are willing to use the low-cost device all over the world. Enthusiasm for the projects led to sharing and generosity from the communities. It was encouraging to see this generosity probably created from the human-scale of the project.

Communities behaviors

Of course knowledge in programming and electronics were required to build the eye-writer, but this knowledge could be found through the internet. For someone who needs the knowledge, it's helpful to be part

of the community. John Seely Brown does in the forward of Opening-up Education says: «*The challenge becomes how to share the cast simulations and data bases that already exist and share them in a way that others can extend, remix and compose them in order to expand their reach and scope.*» «*by entering into this community, you are required to assimilate the sensibillites and ways of seeing the world embodied within that community.*»

Consequently, immersion is the key in learning those systems. «*Consider, for example, how every one of us has learned the immensely complex system that is our own native language. We learn language through immersion and desire. Immersion comes from being surrounded by others talking and interacting with us and is furthered facilitated by our deep desire to interact*»

Iiyoshi, Toru & Vijay Kumar, M.S.,2010,*Opening Up Education, The Collective Advancement of Education trough Open Technology, Open Content, and Open Knowledge*. Paper, Cambridge,Massachusetts: The MIT Press.

The benefit of sharing, open-source model

«*He who does not live in some degree for others, hardly lives for himself.*»

Montaigne*. Many open-source projects are sucessful because of

their openness and their small-scale. For instance the article Free Beer for Geeks explains how a group of students at IT University of Copenhagen have produced what they claim is the first open-source beer.

«According to the site, Vores I created the beer «as an experiment in applying modern open-source ideas and methods on a traditional real-world product.»

While the idea of open-source beer has been around since 1998 as a joke, the students and Superflex decided to make it a reality. *«Their beer recipe under creative commons rights has become a model of success: “Brewtopia’s libations are a hit in the IT industry, with employees from Cisco Systems, Mitel and Alcatel all making it their choice of beer at company parties. Brewtopia even supplied the beer at Yahoo’s 10th anniversary party.»*

Cohn, David.,2005. Free Beer for Geeks. *Wired.com*,[internet] September 18. Available at: <http://www.wired.com/techbiz/media/news/2005/07/68144> [Accessed March 2010]

Open-source is now applied in a wide range of domains, the DIY can be as valuable and more technically efficient than commercial official goods, like for instance the eye-writer doing better than eye-tracking device that most hospitals cannot even afford.

Only a grid or a framework must be defined

Through many examples of successful open-source projects, we observe that making a structure, a shared platform, a framework or a construction grid is required in order to coordinate the collaboration of more than one maker. This is specifically useful when there is no special hierarchy in the maker’s organisation. In product design, Industrial Designer from Belgium, Thomas Lommée showed how open-structure works in product design. The key was to use a grid, somehow like Lego uses the modularity of a block. *“He is building a central database of plans that, at least theoretically, could be tapped to construct just about anything—even full-scale architecture. Called OpenStructures, or OS. One of the fundamentals of sustainability, he concluded, was modularity: if an object is made of standard parts, and one of those parts breaks, it should be easily replaced. Likewise, the product should be modified according to changing needs.»* We thought, What if we made a modular system that is designed by everybody who uses it?» OS invites designers from all over the world to upload 3-D drawings of basic parts to an online warehouse, where anyone can access them. From those plans, users then build components (a sink, for instance),

join components to form a system (a kitchen), and assemble systems into structures (a house). For all the pieces to fit together like lego bricks, they must conform to a standard geometrical template, a 4x4 - centimeter grid that acts as a common language or «open-source code.» «Designers tend to look at an object and judge it for what it is - we like it or we don't like it,» Lommée says. «In an open system, we look at an object and imagine what it could become, how we could make it better by adding, subtracting, replacing components.» That's a tall order in a society based on planned obsolescence. «We see an object not as an end result,» he says, «but as a version.»”

Lanks, Belinda., 2010 , KIT OF PARTS, *Metropolis Mag March 2010* [Internet] Available at: <http://www.brusselscooperation.be/buildingcasestudies/wp-content/uploads/2010/10/Metropolis.pdf> March 2010[Accessed November 2010]

In absence of hierarchy and organization, open-source projects do not have a linear process. Buxton describes in Sketching the User Experience the different phases of development. The first phase is research and development, the design the engineering and finally the sales.

Buxton Bill., 2007., *Sketching User Experiences: Getting the Design Right and the Right Design (Interactive Technologies)*. Paperback; Redmond: Microsoft Research

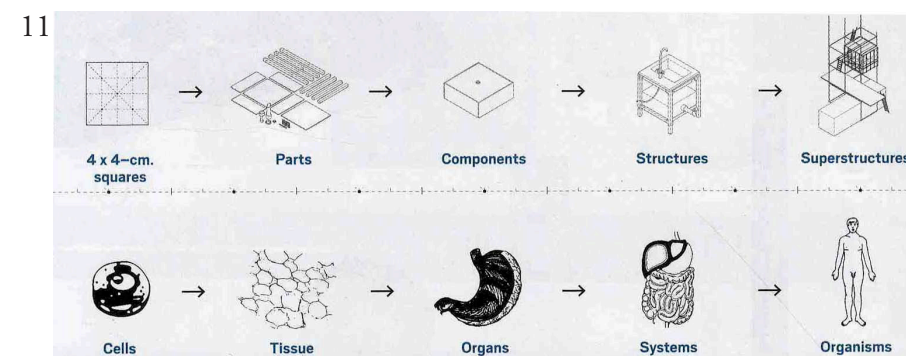
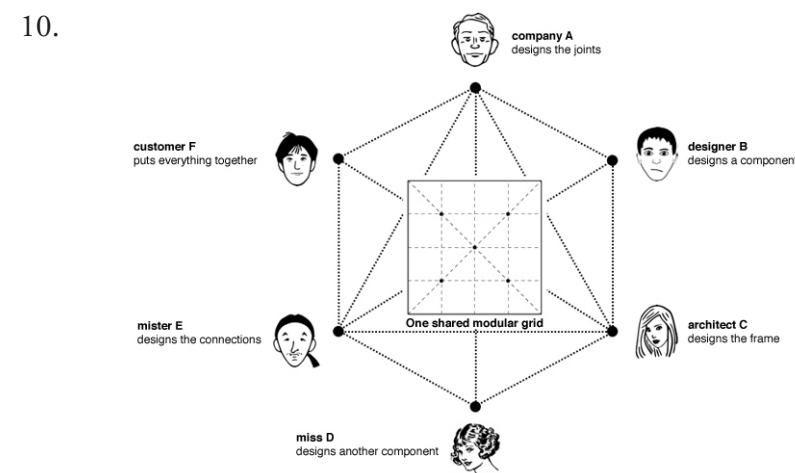
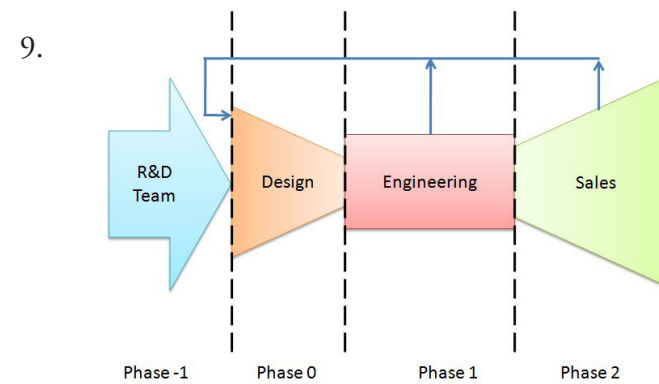
On the contrary it is more organic, people just need to respect the grid,

then they can add, modify, or take off parts.

For the RepRap machine Bowyer says RepRap machine are already a ‘living system’. He says *«every living thing can be seen as a self-replicating machine that relies heavily on components and assistance from others, so why should machines be any different? Plants, mosquitoes and viruses are all accepted as selfreplicating but rely heavily on other species to achieve it. It would be churlish to expect replicators to be any different.»*

Simonite, Tom., 2010, Rise of the replicators. *New Scientist*, [internet] June 02. Available at: <http://www.newscientist.com/article/mg20627621.200-rise-of-the-replicators.html?full=true> [Accessed May 2010]

Indeed for the RepRap there are two model of organic evolution going on in parallel. In the core team, we see what we can call a punctuated animal model of evolution while the larger RepRap community is a very vibrant bacterial model. In contrast to the linear making model in industry, RepRap proves that it can be created in a more organic and symbiotic way. In the structure of the machine we can observe the organic construction as well. RepRap can pretend it's not based on a mechanical and manufacturing process but a more organic process, like agriculture. And RepRap creators are like a farmer looking at the



9. Linear product development (with feedback)

Unknown, 2008 Production-development from Buxton [Photography] Available at: <http://www.thin-kgenealogy.com/wp-content/uploads/proddev.thumbnail.jpg> [Accessed May 2010].

10. Open-structure with a grid

Unknown, OS Illustration.[Graphic] Available at: <http://openstructures.net/pages/2#vraag-1a> [Accessed November 2010].

11. Superstructures

Unknown, 2008 Superstructures.[Scan] Metropolis Mag

concept to flourish. The machine itself is subject to the organic concept of repairing cells called “*distributed manufacture*” “*In micro-biology, distributed manufacture is a mechanism used frequently for growth and repair: if we cut ourselves blot clots are not made centrally within the body and sent to the wound, they are made on site from local proteins.*”

Sells, Edward Anthony.,2009,*Towards a Self-Manufacturing Rapid Prototyping Machine*. Ph. D. Bath:University of Bath, Department of Mechanical Engineering.

From elements based on the same grid or framework the community can add, modify, take off and even repair. They can build with many hands a “superstructure.”

PART 3

Do-It-Yourself-With-Others

DIY and crafts in the digital era

The RepRap and other projects quoted below come from enthusiasts and are not led by commercial interest, therefore they illustrate free culture

and the Do-It-Yourself spirit of today. When Sterling tries to answer why the RepRap project exists he says *“Also, for the sport, and to mess with the heads of intellectual-property owners.”* Indeed DIY is often considered as a sport, probably because it is often challenging. The DIY culture is a broad term that refers to elements in non-mainstream society, such as independent art, music and film. It is somehow tied to the Arts and Crafts philosophy. *«This movement of the 1900’s aimed to reconnect people with hand activities and the aesthetics associated with them. It was in direct opposition to the prevailing industrialization and modernization which was moving many aspects of the culture’s aesthetics away from the hand-made artisan created styles of the past and toward a mass-produced sleek modern vision of the future.»*

DIY culture, Wikipedia [Internet] Available at: http://en.wikipedia.org/wiki/DIY_culture [Accessed February 2010]

It evolved from a simple cost-saving activity of the 1940’s and 1950’s to an increasingly radical political activity which stood against the increasingly visible trends of mass-production. Betsy Greer coined the term Craftivism in 2003, which is defining a trend.

Carla Sinclair, Editor in Chief of Craft attempts to describe the DIY community: *«This DIY renaissance embraces crafts while pushing them beyond traditional boundaries, either through technology, irony, irreverence, and creative recycling, or by using innovating materials and processes...the new craft movement encourages people to make things themselves rather than buy what thousands of others already own. It provides new venues for crafters to show and sell their wares, and it offers original, unusual, alternative, and better-made goods to consumers who choose not to fall in step with mainstream commerce.»*

2006, Craft Magazine, Vol.1, Issue 1. O’Reilly Media.

Ellen Lupton embellishes these thoughts in her book D.I.Y. Design It Yourself: *«Around the world, people are making things themselves in order to save money, to customize goods to suit their exact needs and interests, and to feel less dependent on the corporations that manufacture and distribute most of the products and media we consume. On top of these practical and political motivations is the pleasure that comes from developing an idea, making it physically real, and sharing it with other people.»*

Lupton, Ellen.,2006, *D.I.Y. Design It Yourself*. Princeton: Architectural Press

The project l'artisan électronique is creating a meaningful analogy between digital technologies such as RepRap and the traditional craft of pottery. It was created by Unfold, and it uses a virtual pottery wheel. First, this pottery wheel gives visitors a chance to 'turn' their own forms. Secondly, their design is printed out with a RepRap machine. It shows how the RepRap is obviously more an extension of craft arts than a tool of mass production.

Unfold, l'artisan électronique, [Internet] Available at: <http://www.unfold.be/pages/projects/items/I%E2%80%99artisan-electroniqu> [Accessed November 2010]

Not about what we do, but how we do it

Opening up education reminds us about the importance of the learning process and the new form provided to individuals by the web. «*The focus is not so much on what we learn but on how we learn.*»

Iiyoshi, Toru & Vijay Kumar, M.S., 2010, *Opening Up Education, The Collective Advancement of Education through Open Technology, Open Content, and Open Knowledge*. Paper, Cambridge, Massachusetts: The MIT Press.

It is interesting to observe that DIY culture was developed through punk culture with bands such as Crass. In the documentary DIY or

die, Lydia Lunch says “*it's about survival*” The documentary shows how this is associated with the international alternative and independent music scenes, pirate radio stations, and the zine community. Now we have evolved it with ecology and “slow” culture, or differently with nerd culture.

D.I.Y. OR DIE. Dean, Michael. 2002. [DVD] San Francisco: Intersection for the Arts

Now we have evolved it with ecology and “slow” culture, or differently with nerd culture.

DIY can be also associated to hacking. The word “hacking” has a relative infamy in popular culture and a large definition. Eric Raymond reminds us not to confuse hacker and cracker: “*hackers build things, crackers break them.*”

Raymond, Eric S., 1993. *The New Hacker's Dictionary* - 3rd Edition Paperback, Cambridge, Massachusetts: The MIT Press.

Many innovations came from hackers (cf: PART 2 -Hacking it to own it), when hacking happens in real and public life and becomes physical, those hackers are makers as well. The musician activist “Danny Do Something” at Ghost Town Records praises DIY in music. He says

that in the past people were choosing DIY solutions because they did not have enough money to buy the best instruments and tools, or the qualified individuals, but to his mind, now it's not the reason why they are choosing the DIY option. *«it has nothing to do with lack or deficiency of any kind, but is based on the principle that there is no one else who can sing your song or dance your dance quite like you. This priceless uniqueness is the foundation upon which the ethics of the new D.I.Y. are based.» «Since the new D.I.Y. has nothing to do with a lack of finances or anything else for that matter, and everything to do with an abundant supply of personality, ideas, and inspiration» «we may quickly see our focus change from what we don't have to what we do have, which is cutting edge creativity and fresh new perspectives.»*

«Danny Do Something».,2009,Defining the New D.I.Y..*Ghost Town Records Articles*[internet] November 25. Available at: <http://iamthemusicindustry.com/ghosttownrecords/?p=234> [Accessed May 2010]

Personal tools for personal outputs

In Danny Do Something's opinion, to choose DIY is to choose to increase creativity, and creative people have to beware of using such easy

tools. 'technology has provided us with tools constructed to levels of user-friendliness considered unimaginable only a few years ago. These devices have become our virtual body members, responding at the click of a button to the symphonies stirring inside our mighty brains.' then he adds *"A tool is useless without the proper knowledge to operate it"*. Tools have a wide implication in a sense that they become the extension of human creativity. In Society and Solitude Emerson supports this when he says; *«OUR nineteenth century is the age of tools. They grew out of our structure. « Man is the meter of all things,» said Aristotle; « the hand is the instrument of instruments, and the mind is the form of forms.» ' The human body is the magazine of inventions, the patent office, where are the models from which every hint was taken. All the tools and engines on earth are only extensions of its limbs and senses.»* then he adds *«Many facts concur to show that we must look deeper for our salvation than to steam, photo-graphs, balloons or astronomy.' These tools have some questionable properties. They are reagents. Machinery is aggressive. The weaver becomes a web, the machinist a machine. If you do not use the tools, they use you. All tools are in one sense edge-tools, and dangerous. A man builds a fine house; and now he has a master, and a*

task for life: he is to furnish, watch, show it, and keep it in repair, the rest of his days. A man has a reputation, and is no longer free, but must respect that. A man makes a picture or a book, and, if it succeeds, 't is often the worse for him. I saw a brave man the other day, hitherto as free as the hawk or the fox of the wilderness, constructing his cabinet of drawers for shells, eggs, minerals and mounted birds. It was easy to see that he was amusing himself with making pretty links for his own limbs.»

Emerson, Ralph Waldo., 1870, *Society and Solitude* . 2005 Paperback. New York: Cosimo.
Originally published by Houghton, Mifflin.

Mastering a tool becomes more than significant for the individual.

Emerson warns about the risk to become alienated by our tools, he says it is necessary to keep control over it. In various socio-professional environments we can see the consequences of using an instrument or another. Those consequences don't always look obvious, because most of the tools had been internalised by the environment and the official institutions that it belongs to. For example, in Design fields nowadays, we can see the influence of the tools used in the creation. In Graphic Design, their tools influence designers more or less consciously. If we

observe through history the development of graphic design style, in the 80's the style was not influenced only by trends, but the apparition of desktop publishing software gave a new aesthetic into the whole visual culture. On the contrary there are artists who stayed singular because they kept on using their own tools and creative process. Ed Fella, for example, kept on doing hand lettering with templates and graphics using knives, scissors and waxers. The overall landscape in graphic design would be different now if everyone were still using these tools and letter templates instead of Adobe Illustrator or other popular softwares. Fortunately, more and more tools still have a wide margin for improvisation and allow appropriation. The tools are not the same since Emerson times, it's not alienating the same way, it is sometimes more inconspicuous.

Freedom in the DIY

E.F Schumacher in the common-sense economics book Small is Beautiful says to be aware when power belongs to the few people who gives the alienating machine to the mass «*Every machine that helps every*

individual has a place,' he said, 'but there should be no place for machines that concentrate power in a few hands and turn the masses into mere machine minders, if indeed they do not make them unemployed.»

Schumacher, Ernst Friedrich.,1973, *Small is Beautiful: A Study of Economics As If People Mattered*. 25th anniversary edition. New York: Harper Perennial.

Thus, Schummarer is not against machine, he says that the machine shouldn't turn the user into a machine himself. The DIY movement aims on the contrary to fulfill creativity and to allow freedom of choice and action. Danny Do Something concludes his article by saying that DIY is about freedom *«In conclusion, what D.I.Y. means more than anything is that we can write all our own rules. So D.I.Y. can actually be restated as Define It Yourself. Write a new rulebook for your musical career and journey and free yourself from the mistakes and chains of the past. You have the power to define what an artist is. You have the power to define what a record label is. You can even define what music and life is to you, and no one can stand in judgment of it now or ever. The future belongs to those who are courageous enough to write their own rules and take control of their world.»*

«Danny Do Something».,2009,Defining the New D.I.Y..*Ghost Town Records Articles*[internet]

November 25. Available at: <http://iamthemusicindustry.com/ghosttownrecords/?p=234> [Accessed

May 2010]

DIY movement is appropriate for personal human fulfilment as Illich said *«People need not only to obtain things, they need above all the freedom to make things among which they can live, to give shape to them according to their own tastes, and to put them to use in caring for and about others.»*

«Suppose it becomes the acknowledged purpose of inventors and engineers, observed Aldous Huxley, to provide ordinary people with the means of doing profitable and intrinsically significant work, of helping men and women to achieve independence from bosses, so that they may become their own employers, or members of a self-governing, co-operative group working for subsistence and a local market ... this differently orientated technological progress (would result in) a progressive decentralisation of population, of accessibility of land, of ownership of the means of production, of political and economic power'. Other advantages, said Huxley, would be 'a more humanly satisfying life for more people, a greater measure of genuine self-governing democracy and a blessed freedom from the silly or pernicious adult education provided by the mass producers of consumer goods through the medium of advertisements'.»

Illich, Ivan D.,1973,*Tools for Conviviality*.Case bound Edition. London: Calder & Boyars Ltd

f everyone was living in a DIY way, it could indeed create a new world paradigm; it would bring down capitalism, which is only in search of profit. Many thinkers, such as R. H. Tawney, are assuming that well-being doesn't depend only on economic criteria. *"A reasonable estimate of economic organisation must allow for the fact that, unless industry is to be paralysed by recurrent revolts on the part of outraged human nature, it must satisfy criteria which are not purely economic."*

Tawney, R. H., 1926. *Religion and the Rise of Capitalism*. Second printing 2000, New Brunswick: Transaction publishers

Schumacher invoke 3 goals to accomplish an ideal for humanity. *«First: that universal prosperity is possible; Second: that its attainment is possible on the basis of the materialist philosophy of 'enrich yourselves'; Third: that this is the road to peace.»* This second aim could be accomplished with DIY. His main statement is to blame greediness in wealthy economies: *"What is 'enough'? Who can tell us? Certainly not the economist who pursues 'economic growth' as the highest of all values, and therefore has no concept of 'enough'.* *There are poor societies which have too little: but where is the rich society that says: 'Halt! We have enough'? There is none."*

Schumacher, Ernst Friedrich., 1973, *Small is Beautiful: A Study of Economics As If People Mattered*. 25th anniversary edition. New York: Harper Perennial.

In addition, DIY projects appear to be more sustainable than mass production operations. *"Small-scale operations, no matter how numerous, are always less likely to be harmful to the natural environment than large-scale ones, simply because their individual force is small in relation to the recuperative forces of nature. There is wisdom in smallness if only on account of the smallness and patchiness of human knowledge, which relies on experiment far more than on understanding"*

Schumacher, Ernst Friedrich., 1973, *Small is Beautiful: A Study of Economics As If People Mattered*. 25th anniversary edition. New York: Harper Perennial.

Even if DIY or hacking are unofficial ways of proceeding and lack the credibility of institution and politics, these projects show their utility for research and art in a positive and sustainable way. DIY is often centered on one creator's known user. The lack of professionalism and the intimate relationship to the creation can in fact be positive for the project, at least in how it implies an obvious human-scale dimension. Scott Burnham in the manifesto Finding the truth in systems: in praise of design-hacking said *"Victor Papanek argued that the professionalisation of design had*

separated it from the “real world”.g Design cannot be separated from everyday life, he wrote, and by elevating its trained practitioners as professionals from those who are not so trained (amateurs), design begins to reference only itself, and fails to address real problems faced by real people. In this process of professionalisation, trial-and-error creativity has been lost. Hacking puts it back into the equation.”

Burnham, Scott.,2010,*Finding the truth in systems: in praise of design-hacking.* . London: RSA Design & Society.

Increase awesomeness

In capitals from Europe, Asia and the US, Communitarian spaces for hacking and making stuff are popping up as independent platforms. For example, there is London Hackspace «*We provide a space where people who make things can come to share tools and knowledge.*»

London Hackspace Home page, [Internet] Available at: <http://london.hackspace.org.uk/> [Accessed November 2010]»

There is also the profit organisation Techshop in SF, San Jose, Detroit, a 15,000 square-foot membership-based workshop. In New York,

Eyebeam space mission is “*Think Make Share*”.

Eyebeam about, [Internet] Available at: <http://eyebeam.org/about/about> [Accessed November 2010]

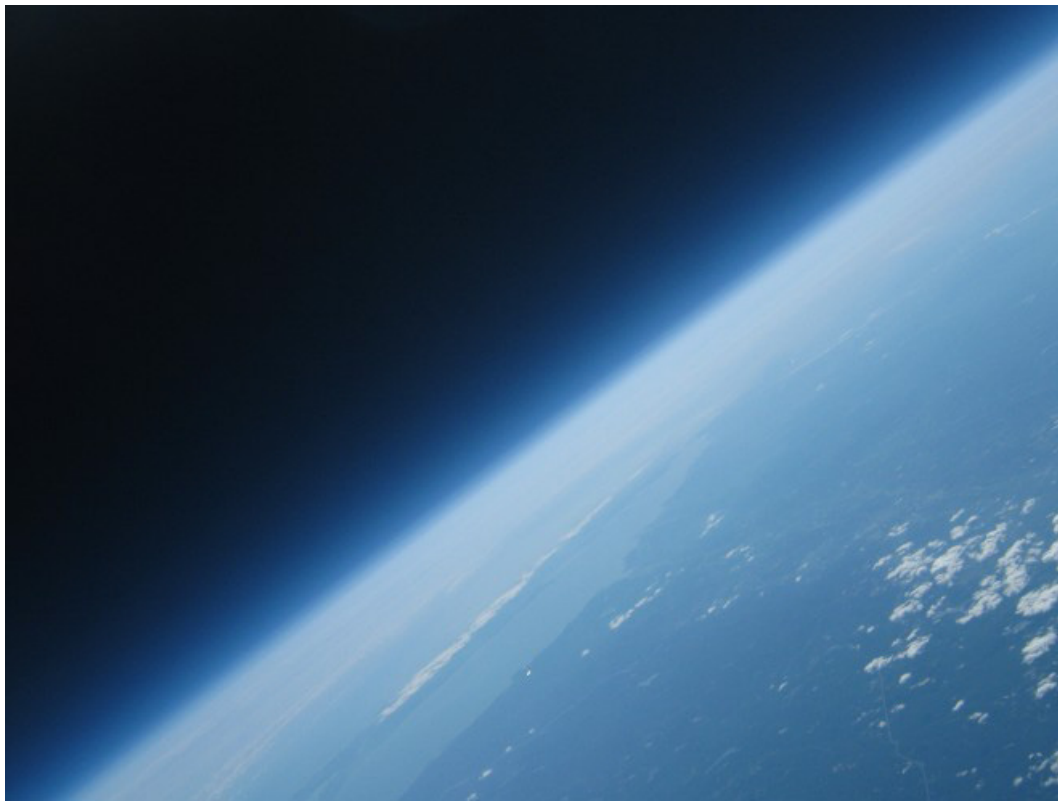
There is also space in Milan LOA hacklab. One of my favorite is NYC Resistor who have the vision to «*Build a group of hackers who work on projects together to increase awesomeness*»

NYC Resistor, about [Internet] Available at: <http://www.nycresistor.com/about/> [Accessed November 2010].

By awesomeness it express also the ambition to do cool art projects.

Furthermore, there is a culture around hacking and DIY. American popular culture has constructed the stereotype of the “nerd,” The comics hero Iron Man is one of them. The character is one of the cleverest super heroes, he studied at MIT and he built an “awesome” robotic armour from prototype to improved version in his garage. In real life today amazing projects appears, often between art performance and real research progress. There are DIY science <http://diybio.org/> or <http://hackteria.org/> are playing crazy scientist by making art with living organisms. Or, another example, ‘*the \$150 Edge-of-Space Camera: MIT Students Beat NASA On Beer-Money Budget*’ «*DIY is cheaper and often better, as Justin Lee and Oliver Yeh found out*

12.



13.



12. Photography from the space with the DIY spacecraft.

1337 Arts/Lee, Justin & Yeh, Oliver, 2009. Project Icarus, still from the space.[Photography] Available at:http://www.wired.com/images_blogs/gadgetlab/2009/09/thumb-660x495.jpg[Accessed May 2010].

13. ITP Workshop New York

Personnal, 2010, ITP School, New York.[Photography]

when they decided to send a camera into space.» Needless to say that the student posted the instruction for free on internet, and many home-made spacecrafts have taken pictures from the space these days.

Sorrel, Charlie.,2009. The \$150 Edge-of-Space Camera: MIT Students Beat NASA On Beer-Money Budget. *Wired.com Gadget Lab*,[internet] September 15. Available at: <http://www.wired.com/gadgetlab/2009/09/the-150-space-camera-mit-students-beat-nasa-on-beer-money-budget/> [Accessed March 2010]

PART 4

Perspectives for those who can make anything

Fablab model

“We’re now on the threshold of a digital revolution in fabrication” said Neil Gershenfeld. He is professor and head of MIT’s Center for Bits and Atoms(CBA), in 1998 he began to teach a class named How To Make (almost) Anything for the first time. The idea was to make a laboratory with all the machine required to *“make (almost) anything”*.

Gershenfeld, Neil., 2005, *Fab:The Coming Revolution on your desktop -from personal computers to personal fabrication*. New York: Basic Book.

CBA reassembled millions of dollars in machines for research in digital

fabrication, ultimately aiming at developing programmable molecular assemblers that will be able to make almost anything. *“I assembled an array of machines to make the machines that make machines. These tools used supersonic jets of water, or powerful lasers, or microscopic beams of atoms to make-well, almost anything.”*

Since the beginning a lot of students were interested to take the class and were really enthusiast about it. *“Virtually no one was doing this for research. Instead, they were motivated by the desire to make things they’d always wanted, but that didn’t exist.”* Neil Gershenfeld described the excitement from the class in his book, he found the students very creative, for instance *“an MIT student created something called «ScreamBody» -- a backpack-sized wearable air chamber into which someone can voice a muffled scream in a public place. The scream is recorded for subsequent «release» in private.”*

Jewell, Mark, 2005. Fab Labs unshackle imaginations. *USA Today* [Internet] Available at: http://www.usatoday.com/tech/news/techinnovations/2005-11-06-fab-lab_x.htm [Accessed March 2010]

Local design for local problems

The Fablab experiment became interesting when Gershenfeld decided to

create other labs outside the MIT campus. Individual Fablabs have been scattered from inner-city Boston to rural India, from South Africa to the North of Norway. The Fablab usefulness for every localization was manifestly different. People from Ghana used it as an instrumentation and a fabrication platform with people locally developing solutions to locals problems; for example a Ghanaian made steam turbines for energy conversion. In India they built instrumentation for agriculture. Here are other examples from the book Fab. *“In the village of Pabal in western India, there was interest in using the lab to develop measurement devices for applications ranging from milk safety to agricultural engine efficiency. In Bithoor, on the bank of the Ganges, local women wanted to do three-dimensional scanning and printing of the carved wooden blocks used for chikan, a local kind of embroidery. Sami herders in the Lyngen Alps of northern Norway wanted wireless networks and animal tags so that their data could be as nomadic as their animals. People in Ghana wanted to create machines directly powered from their abundant sunlight instead of scarce electricity. Children in inner-city Boston used their fab lab to turn scrap material into sellable jewelry.”*

Gershenfeld, Neil., 2005, *Fab: The Coming Revolution on your desktop -from personal computers to personal fabrication*. New York: Basic Book.

During a talk at TED, Gershenfeld describes two potential patterns for technological progress and invention:

-A small group 'highly skilled' people who provide communication, energy, computation solutions for the rest of the world.

-Local design to find solutions to local problems.

What Gershenfeld calls "Social engineering" is a main issue for the second possibility. However, the success of Fablab in Ghana or India shows that it's feasible. Gershenfeld describes what is necessary for a platform such as FabLab to develop and extend. The first step is the empowerment, that is to say to have a lab and the tools. Secondly comes the education, thirdly the problem solving, the job creation and finally inventions.

Gershenfeld, Neil, 2007. Neil Gershenfeld on Fab Labs [internet] from a TED talk. Available at: http://www.ted.com/talks/neil_gershenfeld_on_fab_labs.html [Accessed May 2010]

The Fablab experiments show how people from MIT FabLab or people from Ghana FabLab are not making the same use of the lab. For people at the MIT, you don't need personal fabrication in the home to buy what you can buy because you can buy it. You need it for what

makes you unique, so it's just like personalization. Personal expression in technology that touches a passion and it's product for a market of one person. You don't need it for the Supermarket, its to make you unique. For the student who did the screaming device Gershenfeld says *«personal screaming technology is unlikely to emerge as a product plan from a marketing meeting (even if the participants might secretly long for it).»*

Gershenfeld, Neil., 2005, *Fab: The Coming Revolution on your desktop -from personal computers to personal fabrication*. New York: Basic Book.

Indeed it's not the plan following «lead-users». This leads to the idea that if globalization could be replaced by localization and if we encourage access to the means for invention, governments won't be based on technocracy anymore. It would make possible to address the most basic human needs (creating jobs) to the most refined (creating art). *“Instead of spending vast sums to send computers around the world, it's possible to send the means to make them. Instead of trying to interest kids in science as received knowledge, it's possible to equip them to do science, giving them both the knowledge and the tools to discover it.”*

Gershenfeld, Neil., 2005, *Fab: The Coming Revolution on your desktop -from personal computers to personal fabrication*. New York: Basic Book.

14.



14. FabLab in Ghana

Unknown, Fab Lab Ghana.[Photography] Available at: <http://pisani.blog.lemonde.fr/files/cimg0171.thumbnail.JPG>

thumbnail.JPG

[Accessed October 2010].

Following Illich it's not surprising if Fablab is successful in the fulfilment of people who participate. Both the MIT students and people from Ghana felt passionate about the work they did in the Fablab. Such an initiative allows freedom in the work as Illich was thinking it «*The crisis can be solved only if we learn to invert the present deep structure of tools; if we give people tools that guarantee their right to work with high, independent efficiency, thus simultaneously eliminating the need for either slaves or masters and enhancing each person's range of freedom. People need new tools to work with rather than tools that «work» for them. They need technology to make the most of the energy and imagination each has, rather than more well-programmed energy slaves.*»

Illich, Ivan D., 1973, *Tools for Conviviality*. Case bound Edition. London: Calder & Boyars Ltd.

Obsolete technocracy

Fablab leads also to criticize high-education centralized platform. For Gershenfeld we need to reconsider the legitimacy of MIT. Gershenfeld published in Seed an article titled : Is MIT Obsolete? In the article

published in 2009 he admitted «*an implicit assumption of technological scarcity — advances in those technologies now allow these activities to expand far beyond the boundaries of a campus.*» *Instead of building a few big labs, it's now possible to build a network of many more-accessible smaller labs that can be used for technical empowerment, training, incubation, and invention.*»

Gershenfeld, Neil., 2009. Is MIT Obsolete. *Seed Magazine - on the future of invention*, [internet] February 3. Available at: http://seedmagazine.com/content/article/is_mit_obsolete/ [Accessed 17 March 2007]

Cory Doctorow, influential writer and contributor of the blog *boingboing* wrote a fictional book trying to predict the future if it's the end of globalization and if smart communities of makers take power «*The days of companies with names like 'General Electric' and 'General Mills' and 'General Motors' are over. The money on the table is like krill: a billion little entrepreneurial opportunities that can be discovered and exploited by smart, creative people.*» The book titled makers depicts the story of Lester and Perry, two genius nerds able to make money with junk while the economy collapse. «*Everywhere you look, there's devices for free that have everything you need to make anything do anything.*» "I get like that with

garbage: I see the pieces on the heaps and in roadside trash and I can just see how it can go together, like this.» The book conveys the feeling that a new era "of makers" is close and that it's becoming easy to make creative stuff «*So We can build anything out of interesting junk, with any shape, and then we can digitize the shape. Then we can do anything we like with the shape. Then we can output the shape.*»

Doctorow, Cory., 2009, *Makers*. UK hardcover edition, New York: HarperVoyager.

Never-ending creativity becomes the only valuable resource in Doctorow "makers" world. This new paradigm sounds idealist but it makes sense for a lot of activist "makers". Bowyer with the Reprap foresee the end of the big factories and "general" corporations like Doctorow. Bowyer said «*the economics are driven by logic — once a system can copy itself (with a bit of help) it costs very little, other than the raw materials to produce unlimited numbers of it, which makes the added value approach zero*». *This puts the technology within reach of a household budget, enabling people to manufacture goods very cheaply in their own home. Conversely, non-replicating centralised mass-manufacturing systems are dependant on high investment for refined, efficient, high-volume processes. The nature of these*

processes means that products are generally made in one location and then made available to the market via a distribution network. A significant drawback for a centralised manufacturing system is product transit.

Simonite, Tom., 2010, Rise of the replicators. *New Scientist*, [internet] June 02.

Available at: <http://www.newscientist.com/article/mg20627621.200-rise-of-the-replicators.html?full=true> [Accessed May 2010]

The next industrial Revolution?

The Chief Editor of Wired is also an enthusiast, he wrote this article titled “In the Next Industrial Revolution, Atoms Are the New Bits”.

He gives the example of Local Motor, a new model of enterprise that began small, and which is now successful, with an open-source design and prototyping of a car. *«Today, Rogers’ grandson intends to do something even more radical — create a whole new way of making cars — on a shoestring budget. His company has raised roughly \$7 million, and he thinks that’s enough to take it to profitability. The difference between now and then? “They didn’t have resources back then to enter the market, because the manufacturing process was so tightly held,” he says. What’s changed is that the supply chain is opening to the little guys.»* For Anderson this is whole

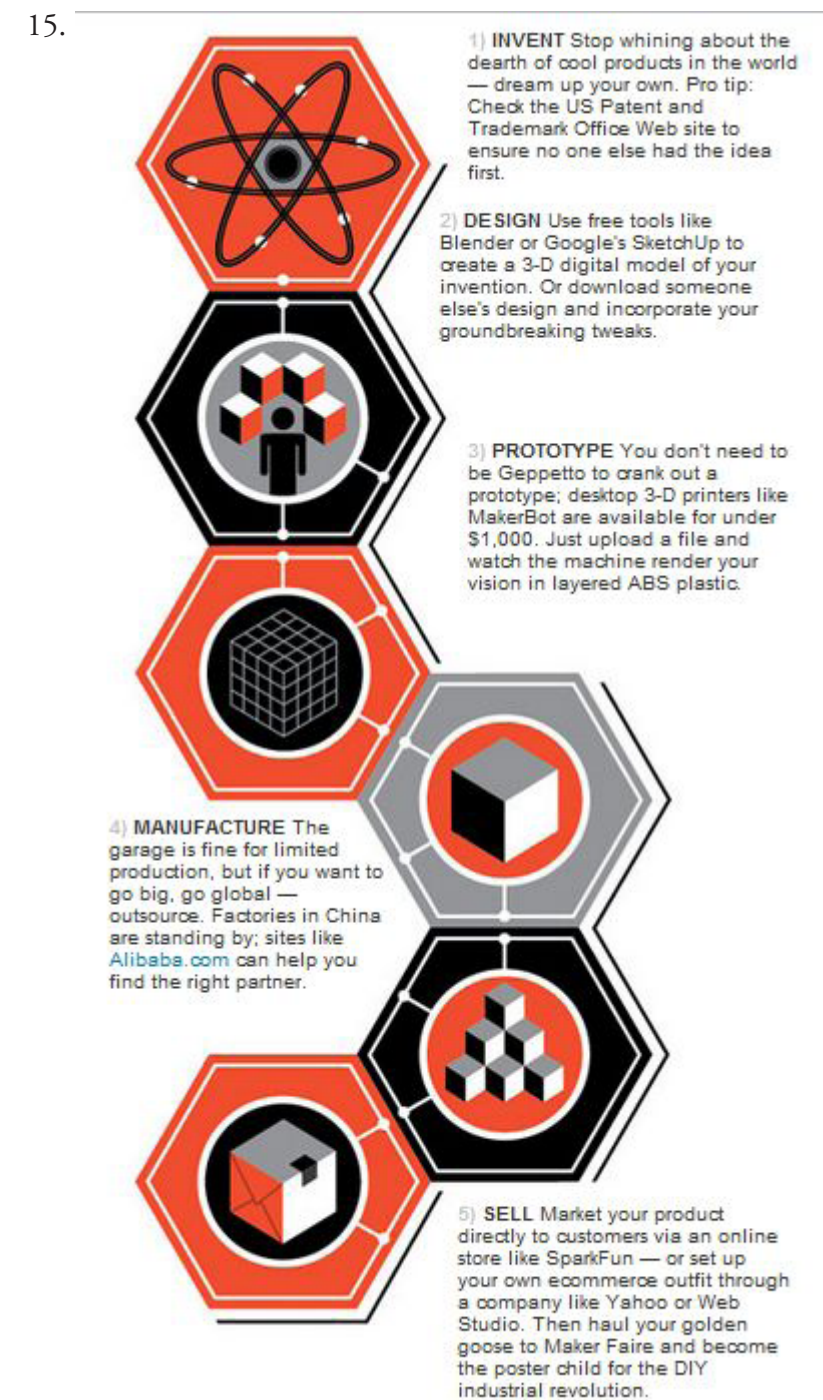
new process to become a micro-factory. He says the tools of factory production are now available to small enterprise, it’s becoming easier to make business with the world. *«Anybody with an idea and a little expertise can set assembly lines in China into motion with nothing more than some keystrokes on their laptop. A few days later, a prototype will be at their door, and once it all checks out, they can push a few more buttons and be in full production, making hundreds, thousands, or more. They can become a virtual micro-factory, able to design and sell goods without any infrastructure or even inventory; products can be assembled and drop-shipped by contractors who serve hundreds of such customers simultaneously.»* For Anderson the previous decade created a revolution with the Internet, it allowed anyone to create a web start-up, now this new revolution allows to create enterprise able to produce physical stuff. *«Today, micro-factories make everything from cars to bike components to bespoke furniture in any design you can imagine. The collective potential of a million garage tinkerers is about to be unleashed on the global markets, as ideas go straight into production, no financing or tooling required. “Three guys with laptops” used to describe a Web startup. Now it describes a hardware company, too.»*

Anderson, Chris.,2010. In the Next Industrial Revolution, Atoms Are the New Bits. Wired. com Magazine,[internet] January 25. Available at: http://www.wired.com/magazine/2010/01/ff_newrevolution/all/1 [Accessed March 2010]

Gizmodo.com, another blog dealing with new technologies, don't share the optimism, they disagree with Anderson, they assume that local motors is nothing new at all, for them it's not a micro-factory but only a small-entrepreneur *«But at best they're changing the way hobbyist and boutique manufacturing works. The future of mainstream industry remains about the same as it's been for the last thirty years.»* Thus atoms are maybe not the bits yet. We don't know if an economical revolution is really going on at the moment, but it's certain that there is a will for many individuals, activist and hobbyists to create change.

Johnson, Joel.,2010. Atoms Are Not Bits; Wired Is Not A Business Magazine. *Gizmodo.com*,[internet] January 26. Available at: <http://gizmodo.com/5457461/atoms-are-not-bits-wired-is-not-a-business-magazine> [Accessed March 2010]

The DIY and human-scale of those projects contributes to make our society more “convivial” by allowing people to pursue their project of life. *«What is fundamental to a convivial society is not the total absence of manipulative institutions and addictive goods and services, but the balance*



15. «How to Build Your Dream»

Unknown, 2010 In the Next Industrial Revolution, Atoms Are the New Bits.[Screen-Capture] Available at: http://www.wired.com/magazine/2010/01/ff_newrevolution/4/[Accessed November 2010].

between those tools which create the specific demands they are specialized to satisfy and those complementary, enabling tools which foster self-realization. The first set of tools produces according to abstract plans for men in general; the other set enhances the ability of people to pursue their own goals in their unique way.»

Illich, Ivan D., 1973, *Tools for Conviviality*. Case bound Edition. London: Calder & Boyars Ltd.

Intellectual-property

Another contradictory side of this eventual revolution is the problem of intellectual-property. Designer or engineer will have to find new design, objects and ideas all the time. One problem is that the community re-use the same ideas and can create wealth from ideas of others. This has become a speciality and is often named Shanzhai, in comparison to a Chinese habit. «*Shanzhai* (simplified Chinese: 山寨; pinyin: shānzhài) (alternative spelling shanzai or shan zhai) refers to Chinese imitation and pirated brands and goods, particularly electronics.[1] Literally «mountain village» or «mountain stronghold», the term refers to the mountain stockades of regional warlords or bandits, far away from official control. «Shanzhai» can also be stretched to refer to people who are lookalikes, low-quality or

improved goods, as well as things done in parody.»

Shanzhai, Wikipedia [Internet] Available at: <http://en.wikipedia.org/wiki/Shanzhai> [Accessed February 2010]

In the example from Anderson the design of the car from local motor was made by a student between many others who did the job for free.

Considering doing creative design as a job and not only as a hobby in a free culture is an unstable situation. In makers the hero has to find new ideas over and over.. «*So if you want to make a big profit, you've got to start over again, invent something new, and milk it for all you can before the first imitator shows up. The more this happens, the cheaper and better everything gets.»*

Doctorow, Cory., 2009, *Makers*. UK hardcover edition, New York: HarperVoyager.

Interest for creative practice is increasing. Future designers who still don't have a professional official status, are likely to get involved in working for free only because they are passionate about the job. If everyone has access to the tool, the market will shift when the professional won't have the technical knowledge or the material tools that's worth their incomes. The profession will shift and will maybe fade out if there is more demand than offer. Lessig discusses about these issues

in the book free culture. On one side he says that corporations and institutions are trying to avoid the free creativity *”we are less and less a free culture, more and more a permission culture. This change gets justified as necessary to protect commercial creativity. And indeed, protectionism is precisely its motivation.”* he says they “are using their power to get the law to protect them against this new, more efficient, more vibrant technology for building culture.”. But on the other side the former lawyer defends intellectual property, he says there are two sides “*To know which side to take in this war, most think that we need only decide whether we’re for property or against it.*”

Lessig, Lawrence., 2004, *Free Culture - The Nature and Future of Creativity*. Paperback
London:Penguin Group.

Inescapable evolution

Shirky in Here Comes Everybody explained how the scribe became useless when people had the tool to print books. *«now consider the position of the scribe at the end of the 1400s. «Johannes Gutenberg’s invention of movable type in the middle of the century had created a sudden and massive*

reduction in the difficulty of reproducing a written work» «But at the same time the very scarcity of literacy was what gave scribal effort its primacy, and the scribal way of life was based on this scarcity»

Shirky, Clay.,2008, *Here Come Everybody -How change happens when people come together*.
Paperback. London:Penguin Group.

Scarcity is indeed what defines our economy Lionel Robbins defined economics as *«the science which studies human behavior as a relationship between ends and scarce means which have alternative uses.»*

Robbins, Lord.,1932 , *An Essay on the Nature and Significance of Economic Science*.
3rd edition (August 1984), Basingstoke:Palgrave Macmillan;

When people have access to the tool and the knowledge scarce physical object and scarce propriety of the mind will become freely available. The social consequence could be important enough to call it a revolution.

CONCLUSION

The DIY and the craft are being revolutionized with the web. Thanks to new open-source platforms provided by the web 2.0 more people are getting involved in makers community and become able to make the goods they desire on their own. Those new platforms allow

a new perspective on innovations and imply more creative human-scale projects. Their success is based on sharing, creators are willing to transmit their knowledge to the community. Anyone has the possibility to improve or modify a project for their own purposes or for the community. This new way of making physical objects is not controlled by any mass corporation strategies, it represents a struggle against consumerism and Products designed following only lead-users features. The tools allowing users to innovate are online structures or DIY physical tools like the RepRap. The machine can print out physical goods and consequently create wealth for its owner. The raw material used and the RepRap machine itself can be reproduced at home, thus the machine is breaking economic scarcity rules. The machine becomes a means of production allowing with other DIY tools the idea of home-factories. The economic model of home-factories is not considered as a revolution for everyone, yet. However, following the model of localization instead of globalization the FabLab experiment showed the usefulness of localized technologies for all kinds of people. All those DIY new technologies and new DIY tools are currently mostly used by Hobbyist

and Enthusiast. Nevertheless, being able to produce personal goods can create wealth and fulfill creativity of the individuals, in addition it brings “conviviality” to the communities. Through my dissertation and personal work I am enthusiast about those new communities of makers. However, there are many obstacles before having a bigger revolution concerning larger part of the populations. The first one is that many people are not willing to make personal things, they prefer convenient things even if it’s made for a «lead-users» similar to their stereotype. They probably do not realize what they are really able to build by themselves or they think it is not worth the time and the energy to do it. However, I have tried to show the current personal means of fabrication and the benefit of owning it, that is to say being able to create art or wealth and to free oneself from consumerism. Localized economies and personified tools could help populations to develop in a more sustainable way of living. It is necessary to hope that those DIY will be used in a positive way.

In Makers by Doctorow 3-D printers are in the end used to run off AK-47s. Things could really improve or get really dark aswell. But instead of being Pessimistin, I hope more people will feel the desire to express their

personality through creative making. Learning how to use the tools and platforms is limiting many individuals at the moment but next generations will be more confident with new technologies and hopefully they might be inspired by the creativity of existing projects, and they will create better ones.

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