Emancipatory technologies in computation and architecture
From PCs to personal fabrication

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> *There is and ecology of bad ideas,*
> *just as there is an ecology of weeds*
>
> Gregory Bateson. Introductory quote to Félix Guattari, 1989, *The Three Ecologies*

> *So, wherever we turn, there is the same nagging paradox: on the one hand, the continuous development of new techno-scientific means to potentially resolve the dominant ecological issues and reinstate socially useful activities on the surface of the planet, and, on the other hand, the inability of organized social forces and constituted subjective formations to take hold of these resources in order to make them work.*
>
> Félix Guattari [translation Ian Pindar and Paul Sutton, 2000], 1989, The Three Ecologies, The Athlone Press, London, pp: 30-31

Context and preliminary comments

The field of computational politics and architecture can be addressed in multiple ways. In this text I will address it from the perspective of individual and collective emancipation, empowerment, agency and autonomy. From my point of view this perspective is closely connected to that which has been denominated *the hacker ethic* [Himanen, 2002]. The hacker ethic was firstly discussed in relation to software [free open source software], but it has also developed in the fields of free networks and digital infrastructures, and then in the realms of free cultural production, – where some authors coined the concept of *reality hackers* -. More recently hacker principles are being applied in the emerging fields of open hardware and open design. The perspective of the hacker ethic not only addresses the actual free open source objects, - v.g. software itself -, but rather the ecology of ideas, practices and social relations that make them possible and that are generated by them.

In this text I will also consider an extended idea of architecture. As with hacker culture, I will neither limit the definition of architecture to the enclosed discipline that it has become since the Renaissance, nor to the material objects or environmental-symbolic assemblages that are conventionally described as architecture. I will extend the definition of architecture to the *dispositifs* or *machines* of knowledge-power related to the social production of space, as Henri Lefebvre would say, - or to the production of existential territories, as Félix Guattari could have said; including among other aspects the networks and flows of information and communication that today constitute an essential component of our forms of life.

The text proposes the *return* to the idea of science, technology and knowledge of the Enlightenment. This idea, that understands science and technology as a medium to address social problems and to improve life conditions of the population, has been overshadowed by the contemporary emphasis on technological and cultural industries, in a way that technological research and innovation are firstly driven by profit seeking purposes, and only secondarily by other pursuits. The contemporary situation in which the top 5% of the population owns more than the bottom 95% [Barnes, 2009: 27] shows the inadequacy of the model – from the perspective of any progressive political standpoint; of course not from other perspectives which ought to consider

today's status quo as extremely successful. This situation which is simultaneously enhancing social inequalities and exploitation, multiplying surveillance and control practices, and deeply deteriorating our physical-ecological environments can be described, using Gregory Bateson's expression, as *an ecology of bad ideas*.

Therefore, this text tries to put forward a cartography of contemporary experiments and practices that I consider as steps to an ecology of good ideas. In background of this piece stands a proposal for the substitution of the dominant protestant ethic, - as proposed by Weber -, that we could associate to the neoliberal market driven economy, by a balanced mix of *hacker-and-commons ethic*.

The final focus of attention of the text is digital design and fabrication. This realm shall be considered as part of a wider field, including material and energy metabolisms, and social and subjective production. Even if there is attention paid to ecological, social and subjective concerns, the text doesn't address relevant issues such as bodies or care. In other instances, our research team is working with these issues, trying to generate virtuous connections among them.

Emancipatory paradigms in ICT

Even if nowadays academic, media and public attention is focused on digital issues such as mobile devices, the cloud, pervasive computing, dataveillance or financial market bots, all of them driven by corporate machines, there is a strong tradition of *bottom up* emancipatory thinking, creativity and practices in computation and communication technologies. True to the facts, many of those originally emancipatory ideas have been captured by the postfordist market forces and lost part of their edge – as with the shift from free software to open source -, or have been completely subverted from its original designs. However these promises are still alive to various extents. And as Foucault would say, any state of power/knowledge relationships is a dynamic one; all fields of battle remain inexorably open.

I will highlight four seams that I consider relevant to the object of this discussion; relevant as inspiration for present and future action; and relevant actually for the development of the emergent politics of digital fabrication.

[personal computing]

The first seam deals with the invention of the personal computer. This of course, was a collective development. In order to visualize it I focus on the Northern California *Homebrew Computer Club* and two of its original members, Lee Felsenstein and Steve Wozniak. Felsenstein's writings of the period are very clear about their pursuits, - or at least about his own. Inspired in Mexican social scientist and educator Ivan Illich, Felsenstein was seeking to socialize the use of computers, making out of them a *convivial* tool to be used by all the population, and not only, as happened in those days with mainframes, by elite scientists and military operations [Levy, 2010: 179-181]. The development of PC clones compatible with Microsoft operating systems – and later with Linux based systems – made possible even within a proprietary environment a real socialization of personal computers, allowing nowadays for a *mass intellectuality* of computer users, which was hardly imaginable back in the 1940's and 50's at the time of the creation of the first computers.

[diagram 01: emancipatory paradigms in computing and communication, Pérez de Lama and Fab Lab Sevilla, 2011]

[free open source software]

In the mid eighties Richard Stallman a programmer at MIT invented free software in reaction to the privatization of knowledge tools that had until then developed in free collaborative ways [Stallman, 2004; Kelty, 2008]. Free software is open source software with an ethical dimension. It is characterized by four freedoms, and an additional condition, that are made formal through the so called GPL [General Public License]: [0] freedom to run the software; [1] freedom to study how the program works, and change it so it does your computing as you wish; [3] freedom to redistribute copies so you can help your neighbor; [3] freedom to distribute copies of your modified versions to others; the additional condition, not compulsory but recommended by the Free Software Foundation, is that the new copies shall be distributed with a similar kind of license [Free Software Foundation, 2011]. The development in the early 90's of the GNU-Linux operating system, the Apache server software and a whole gamut of free libre open source software [FLOSS] tools has since generated a thriving collaborative economy [Benkler, 2006], and benefited millions of users

including states and businesses – mega-giant corporation Google notoriously among these beneficiaries.

The Arduino project [http://arduino.cc], integrated by a microcontroller board and a progamming language, is one of the first projects developed as free open source hardware. Followed by many other initiatives, as for example Ohanda or the DIY-Drones project, the open hardware movement should be considered as an extension and hybridization of the two previous seams, personal computing and free open source software. Arduino is a particularly successful enterprise. Initiated in 2005 by Massimo Banzi, David Cuartielles and colleagues, it has become the standard platform for prototyping interactive electronic devices in art and education, it has generated a vibrant community of developers and designers that share hardware improvements, code and designs, and eventually it has opened up a relevant economy of hardware producers, education and services [Banzi, 2009; Gibb, 2010; Troxler, 2011].

[Internet and the WWW]

The third seam refers to the creation of the Internet and the WWW. Again a set of technologies and infrastructures which were initially financed by military budgets in the U.S. [Hafner, 2006] where appropriated for scientific and then social activities. The creation of the World Wide Web protocols by Tim Berners-Lee and collaborators in 1989, piggybacking on the Internet, opened up the Net to intensive social use. Berners-Lee took the decision to license the WWW in the public domain, rather than applying a proprietary license [Berners-Lee, 2000]. In this way he significantly contributed to create a new open public space and a new collaborative production realm of a planetary scale. The Internet and the WWW were then composed with personal computing, and – to a certain extent with free software -, to create synergetic relationships between them with the results of radically transforming contemporary forms of life.

[digital fabrication and Fab Labs]

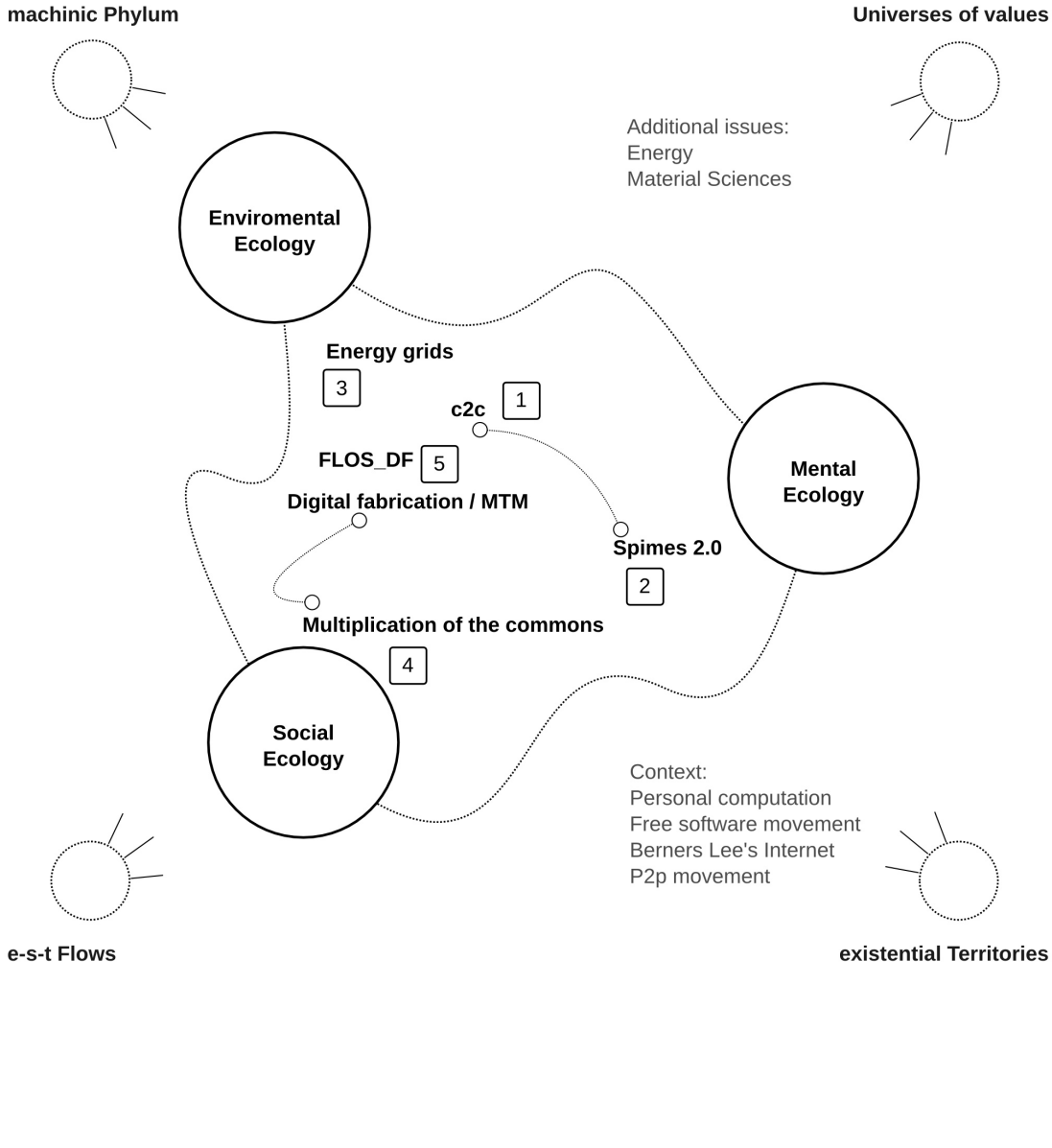
Eventually there is the new emerging seam of digital design and fabrication. One of the icons representing it would be Neil Gershenfeld the conceptualizer and initiator of the Fab Lab Network. This approach to digital fabrication proposes the extension of hacker and open source principles to the fabrication of digitally designed material goods, including buildings. The Fab Lab concept addresses on one hand the easy reproducibility and modifiability of digital designs, that come to be considered as source code. On the other hand it seeks to develop a concept of fabrication equipment – the Fab Lab itself – that could make a contribution to autonomy and personal empowerment analogous to that contributed by the personal computer in the realms of computing and communication. An eventual goal being that a Fab Lab – a set of machines and procedures able to make almost anything – could fabricate another Fab Lab, and in this way critically transforming social access to the means of material production; as the computer has already done to the means of immaterial production [Gershenfeld, 2005].

In the next parts of the text I will extend the discussion about Fab Labs, which is again in various ways a continuation and amplification of the three previous seams.

Three ecologies; ecosophic machines

In order to analyze the state of the art of the Fab Lab movement and discuss a strategic map towards its evaluation and development I will present several conceptual tools. The first one is that of the three ecologies, after the proposal by Félix Guattari [1989]. Guattari proposed that in order to

achieve a truly sustainable environment, there should be a triple complementary approach, considering the technical-environmental ecology, the social ecology and the mental ecology that we are generating. Guattari coined the term ecosophy to describe the combination of these three ecologies. The concept of mental ecology is indebted to the works of Gregory Bateson, the epistemologist, biologist and cybernetician who worked in California from the 1950's until the end of the 1970's. One of Bateson's main ideas is that of the correspondence between environmental ecologies and ecologies of ideas – something that might seem obvious when enunciated, but that planetary modern and postmodern practices tenaciously have avoided to acknowledge. Conversely, this statement invites us to transform our ecologies of ideas in order to reorient the disastrous becomings of the natural-environmental ecologies.



[diagram.02: three ecologies, four ontological functions, - after Félix Guattari -, and digital fabrication; Pérez de Lama and Fab Lab Sevilla, 2011]

The idea of using the three ecologies as a design tool, that I have been testing for some years now in my academic and professional work, determines that we consider architectural and technological projects not as rather auto-referential processes leading towards the production of autonomous

objects, but as products, and, at the same time, generators of specific social and mental ecologies. In this way, as I advanced at the beginning of the text, architectural interventions, take the role of components of more complex and heterogeneous machines, that involve the organization of production, technological systems, material and energy flows, processes of production of subjectivity and social relations, etc. I believe this was, in certain ways well understood by the early Modern Movement that engaged the transformation of architecture and the city in a multi-level approach, - design, symbolic dimensions and technologies were relevant, but so were urban planning, financial and legal procedures, the organization of production and division of labor, etc. In contemporary Greek language, modernity is precisely denominated *biomechania*, acutely pointing to the production of a particular form of life associated to modern industrial metropolitan culture. I understand that the emancipating and subjecting dimensions of modernity had a more relevant connection to this complex dimension of urban and architectural practices as machines, and less to the specific stylistic productions.

Nevertheless, again in sync with Guattari, rather than excluding creativity, innovation and subjectivity from these kind of processes, numerous architects and scholars have been claiming this kind of work as the main object for contemporary artistic and experimental architectural production. A productive practice that would be engaged in the creation of new forms of life in all its complexity. Architects and Guattarian scholars Constantin Petcou and Doina Petresccu, members of Atelier D'Architecture Autogerée, characterize this practice as biopolitical creativity [Petcou and Petrescu, 2007]. This kind of attitude is how I interpret Felsenstein's, Stallman's and Berners-Lee's contribution to technological innovation, and what I think should be applied to the development of digital architecture. My own research group has been using the expression *ecosophic machines* to describe this kind of extended architectural designs engaging the production of technologically and socially sustainable living spaces with an emancipatory perspective.

Making the commons. Organizing self-organization

The development of the Internet has lead to rediscovering the relevance of collective intelligence, mass collaboration and communication in the production of wealth and social life. This has been particularly poignant in the so called web 2.0 economies, where users-producers are the fundamental labor-power generating contents, as can be paradigmatically observed in Google, Flickr or Facebook. Hardt and Negri [2009], among others, observe this centrality of the commons in the whole economic system of the postfordist-networked society, identifying the global metropolis as the privileged locus of the production of the commons, of the encounters that make up the commons, and of the conflicts generated around their control, modulation, enclosures and exploitation.

> Contemporary forms of capitalist production and accumulation in fact, despite their continuing drive to privatize resources and wealth, paradoxically make possible and even require expansions of the common. Capital, of course, is not a pure form of command but a social relation, and it depends for its survival and development on productive subjectivities that are internal but antagonistic to it. Through the processes of globalization, capital not only brings together all the earth under its command but also creates, invests, and exploits social life in its entirety, ordering life according to the hierarchies of economic value. In the newly dominant forms of production that involve information, codes, knowledge, images, and affects, for example, producers increasingly require a high degree of freedom as well as open access to the common, especially in its social forms, such as communication networks, information banks, and cultural circuits. [Hardt and Negri, 2009: preface ix]

In the characteristic way of thinking of the so called Italian Post-operaista School, Hardt and Negri see a double paradoxical dimension to the centrality of the commons in the postfordist economy. On the one hand, capitalism needs the development of the commons as its main source for the

extraction of surplus value; on the other hand, the necessarily autonomous extension of the commons contains the potential to radically transform contemporary power relations.

Therefore, schemes have to be developed that allow for the extension of commons based production in which the profits-rents generated through collective action get distributed within the actual network of producers, rather than being extracted or expropriated by capital. Basic income schemes are one of the most frequently discussed in this context of renewed production relations; but there are multiple other alternatives, already existing or to be experimented [Barnes, 2006; Benkler, 2006; Bauwens, 2009].

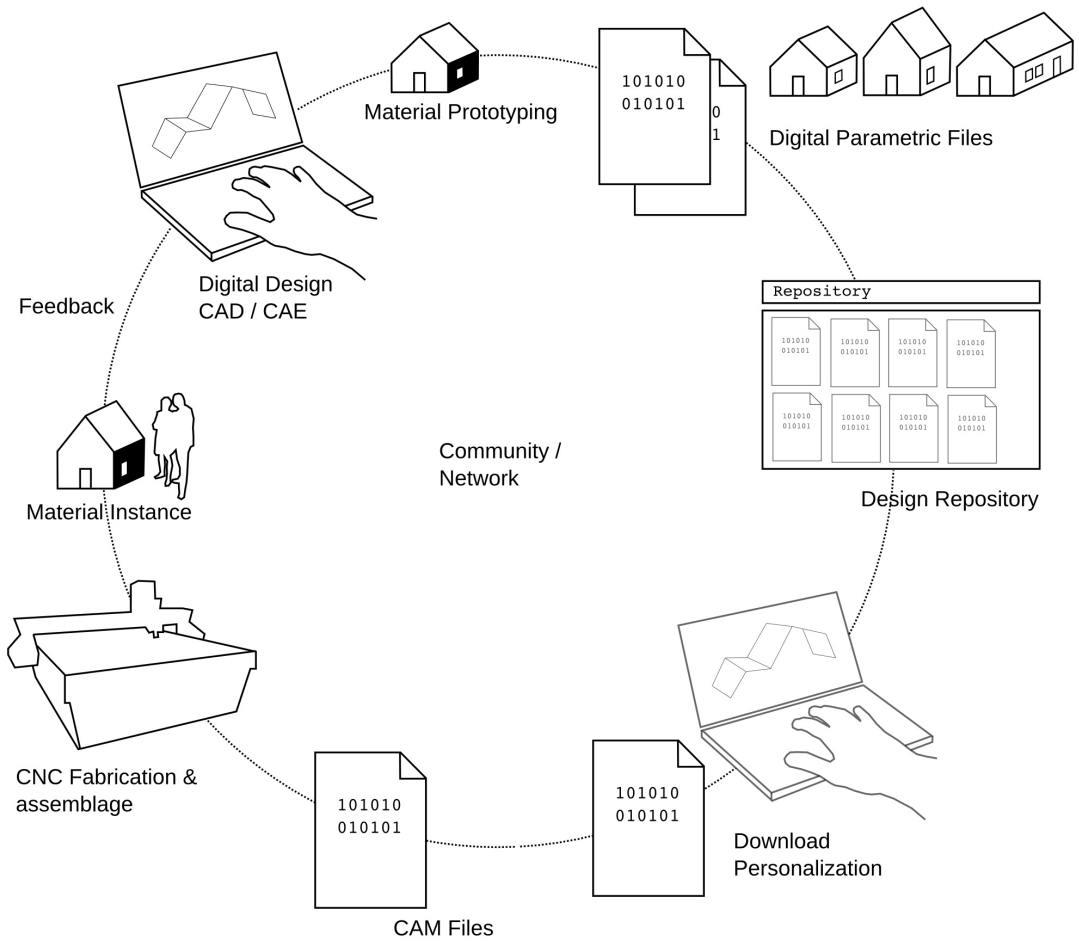
The *Promise* of digital fabrication

The most radical promise of digital fabrication is that of the socialization of the means for material production, including architecture [knowledge, machines, processes], its decentralization-distribution, and the generation of a commons ecology-economy around it. This would happen through an evolution analogous to those happened in computing and communication since the 1960's. MIT's Neil Gershenfeld calls this prospect the Third Digital Revolution [Gershenfeld, 2005].

However, all this is still a promise. In today's situation the most probable outcome would be something else, akin to exclusive forms of bio-nano-control-capitalism as, for example, that envisioned by Neal Stephenson in his 1995 novel *The Diamond Age*. As Guattari's quote at the beginning of this text suggests, the successive promises brought by techno-scientific developments since the times of the Enlightenment have become into ambivalent achievements. To fulfill what I am calling *the promise of digital fabrication* will take not only scientific, technical and artistic efforts, but also, most importantly, political efforts in the field described by Foucault as power/knowledge relations. It will take the development of intertwined ecologies of the technical and the environmental, the social and the mental.

In my own understanding, one of the models to be taken into account is that of the free/ libre open source software [FLOSS] ecosystem. The analysis of FLOSS ecosystems presented by Christopher Kelty in his book *Two Bits* [2008] shows the complexity of the task, as well as some guidelines to be considered by those interested in the unfolding of the virtualities here discussed. Indeed Kelty's analysis, presents what could be called a Foucaultian study of the emergence of todays FLOSS ecologies. He considers no inevitability to this emergence, but rather discusses it as the result of very determinate actions and strategies put into play by actual individuals and groups, that go beyond isolated maverick developments of code and bright ideas. The author organizes his discussion in five fields, that are as follows: [constructing a] movement; sharing code; conceiving open systems, writing copyright licenses; coordinating collaboration. As can be observed, non of them is purely a technical field, but all of them have a rather socio-technical, and subjective dimension. It can be observed, as well, that the economic dimension, an essential key to the sustainability of any productive project is still missing in his account.

Accordingly, it has to be inferred that the project of development of a free / libre open surce digital fabrication [FLOS-DF] ecology needs to be strategized in a similar networked multi-plateaux configuration, incorporating additional complexities derived of the material aspects of the new realm – vs the relatively immateriality of code.

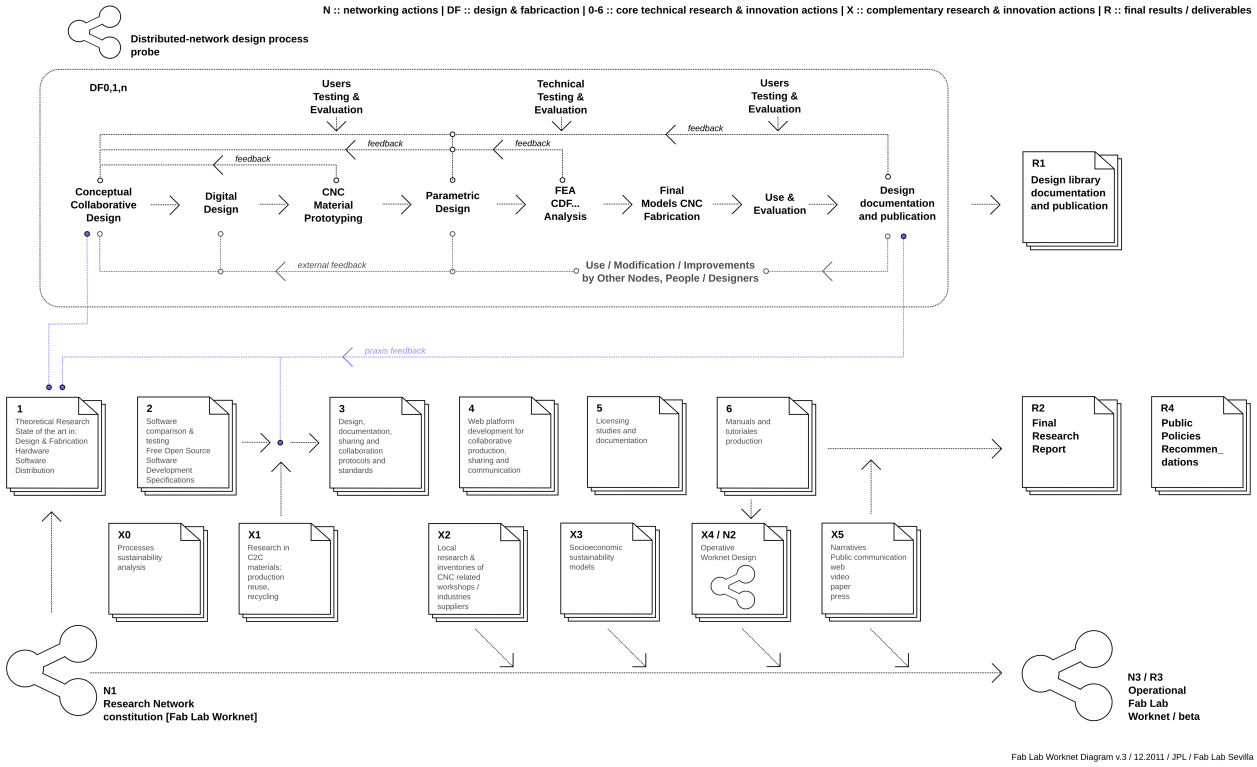


[diagram.03: a virtual commons based digital / material production cycle; Pérez de Lama and Fab Lab Sevilla, 2011]

In order to address additional complexities, there is the need to consider at least issues such as workshop spaces and CNC machinery distribution, materials, and energy. It is an extraordinary intellectual endeavor to think how to reproduce the *ecology of abundance* of code into material environments. However, there are already multiple research lines working in this direction.

Concerning workspaces and machinery, the Fab Lab Network and specifically the *Reprap* concept of self-replicating machines extended to the Fab Lab – that understands workshops as a self-replicating systems is well on its way [Gershenfeld, 2005]. Concerning materials, the *cradle 2 cradle* [c2c] reconceptualization of material production [McDonough and Braungart, 2006], coupled with the redefinition of objects as *spimes* proposed by Bruce Sterling [2005], devises a scenario where materials will be largely available in a sustainable way. Thirdly, concerning energy, the so called energy grids, promoted by Jeremy Rifkin [2008, 2011], that will be soon prototyped at an urban scale by Vicente Guallart in Barcelona [Guallart et ali, 2009, 2011], have the potential to significantly change the situation of intense dependency on oil and large scale centralized production schemes.

Moving forward this agenda throughout the next decades won't be an easy task. But I am sure it will also be a lot of fun. We might then close by now quoting Lee Felsenstein [Levy, 2010: 473]: “I have seen the future and it needs work!”. See you in the future!



[diagram 04: Fab Lab Worknet research project; route map towards the creation of a commons based digital fabrication network; Pérez de Lama and Fab Lab Sevilla, 2011]

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