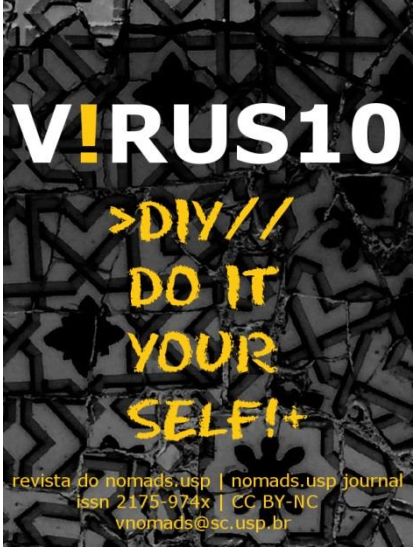

DIY lives!

Edison Uriel Rodríguez Cabeza, Mônica Moura

How to quote this text: Cabeza, E.U.R.; MOURA, M., 2015. DIY lives! *V!RUS,* 10. [e-journal] Available at: <http://www.nomads.usp.br/virus/virus10/?sec=4&item=8&lang=en> [Accessed dd mmm aaaa].

Edison Uriel Rodríguez Cabeza is master in design. He studies sustainable design, open code, open design, free design, innovation and creative communities.

Mônica Moura is PhD in Communication and Semiotic. Professor at *Faculdade de Arquitetura, Artes e Comunicação* (FAAC); and at *Universidade Estadual Paulista Júlio de Mesquita Filho* (UNESP). She coordinates research group "*Design Contemporâneo: sistemas, objetos e cultura*". She studies contemporary design, relations between design and art, technology and digital media.

Abstract

The following paper talks about the DIY (Do It Yourself) and the results of a digital fabrication workshop focused on Open Design culture and collaborative working. To develop this article, a bibliographic review on DIY was done, describing its origin, decay and subsequent rebirth with the information and communication technologies and digital manufacturing, that offer the possibility of emancipation of the individual facing of the current production model, recovering their ability to project their natural environment, and propose new ways of free or open production. At the end of this paper is presented an experience of a workshop on digital fabrication and DIY that took place at UNESP (Universidade Estadual Paulista - São Paulo State University), Bauru, SP, Brazil.

Keywords: DIY, digital fabrication, free design, commons based peer production.

V!RUS 10
>DIY//DO IT YOURSELF!+
revista do nomads.usp | nomads.usp jornal
issn 2175-974x | CC BY-NC
www.nomads.usp.br/virus| vnomads@sc.usp.br

1 Introduction

The DIY is a practice as old as the human capacity to transform their natural environment and adapt it to their own needs. This capacity was gradually lost in the industrialization, in the linear economy and technical specialization, limiting the common people to the role of a dependent consumer of industrial artifacts.

In the contemporary context, DIY comes taking force again with the progress of digital fabrication technologies and the boundary dilution between bits and atoms, giving rise to new kinds of communities that propose new forms of production. We can indicate the possibility that is taking place a mode of free production, based on free culture or open, and the commons based peer production.

This paper is developed into two parts: The first part talks about the hand-brain connection as inherent human characteristics to fabricate modify and design their natural environment and satisfy both their physical and psychological needs. This connection was getting lost in the industrialization and technical specialization that monopolized the world of artifacts degrades humans to the status of consumers, but was rescued by DIY movements in the course of the twentieth century until become into a new form of free production via information and communication technologies, digital manufacturing technologies and free culture.

The second part narrates the experience of a digital manufacturing workshop of DIY that took place at UNESP, Bauru, São Paulo, Brazil.

The visual results of the process that describing the first steps on new forms of production based in digital fabrication are presented. These news forms of production generate new relations between the designer, the manufacturer and the user

The aim of this paper is to inquire about DIY, aiming higher and better understanding of the concept as a proposed of free production in the contemporary context. Finally, we describe a DIY practice at UNESP Bauru with Sagui Lab group, supported by CADEP (Centro Avançado de Desenvolvimento de Produtos - Advanced Center for Product Development).

2. DIY

2.1 Men is a maker by nature

Unlike most natural species, humans are characterized by making artifacts for their benefit or adapt the natural environment to their needs. This feature generated a connection between hand and brain, between doing and thinking, inseparable from the human condition, which has allowed man, in the course of its existence, transform, recreate, design, reflect on, explain and constantly transform his reality, challenging their own intelligence.

The intellectual work to change the natural environment or to satisfy both physical and symbolic needs, that is, the hand-brain connection, can be understood as design. Papanek (1985, p. 3) says that "All men are designers. All that we do, almost all the time, is design, for design is basic to all human activity". Cross (2005, p. 19) proposes that "design things is inherent in human beings, and design is not something that was always been regarded as needing special abilities."

V!RUS 10
>DIY//DO IT YOURSELF!+
revista do nomads.usp | nomads.usp jornal
issn 2175-974x | CC BY-NC
www.nomads.usp.br/virus| vnomads@sc.usp.br

According to him, before the modern industrial societies in which design and manufacturing activities were separated, making and design were connected.

In fact, humans have always practiced DIY. People made or charged to make to artisan artifacts according to their personal preferences, physical characteristics and needs. The findings, techniques, knowledge, technology and skills were transmitted from generation to generation.

However, the DIY was losing in the industrialization and technical expertise, in the monopoly of the great industrial companies, in the manufacturing technologies that decide what is produced and how, in the limits of the costs of large-scale production, in the hyper-specialization knowledge and the complex economy. As described by Van Abel (2012, p. 2):

> "The fabrication and making of products has moved away from our local environments into the outskirts of our cities, or even to other continents. The complexity of our economies, and the complexity of our products, has distanced us from the physicality of the products around us, the visible matter that is an essential part of the environment we live in."

A common person was deprived of its ability to transform their natural environment during the industrialization process and specialization generated by the two industrial revolutions. In the Charlie Chaplin's film, Modern Times (1936), we can observe a critic to this phenomenon, where the man is limited to carry out simple and mechanical operations without any control over what he makes, disconnecting his brain of the ability to project their natural environment. The industrialized modern world appropriated to objectual world. Leaving the man at the mercy of industrial products. Thus, according to Illich (1973, p. 17) human "are degraded to the status of mere consumers."

To keep the overproduction and hyper-consumption that implies linear economic growth are used strategies as advertising tricks, planned obsolescence, the impossibility to repair, modify or adapt products because of patents, copyrights or loss of warranty. As result, the waste of energy and materials occurs, fact that is generating serious environmental the crisis, threatens the sustainability of the planet and the survival of the human species.

Beyond the environmental crisis, occurs a serious social crisis caused by the dependence between man and technology, hyper-specialized knowledge and energy production. For Illich (1973, p. 17), machines slave men, he has not been able to escape the dominion of constantly expanding industrial tools. Illich proposes that man needs to learn to invert the present deep structure of tools because this must serve man to guarantee their right to work with high, independent efficiency and freedom thus simultaneously eliminating the need for either slaves or masters, make the most of the energy and imagination that each has. In addition, people need not only get things, but also they need, above all, the freedom to do things, shape them according to their likes, use them, and care for them, among other things.

2.2 DIY and its resurgence

According to Buechley et al (2009, p. n.d.) "DIY involves an array of creative activities in which people use, repurpose and modify existing materials to produce something. These techniques are sometimes codified and shared so that others can reproduce, reinterpret or extend them". Kuznetsov e Paulos (2010, p. 1), they define DIY " as any creation, modification or repair of objects without the aid of

V!RUS 10
>DIY//DO IT YOURSELF!+
revista do nomads.usp | nomads.usp jornal
issn 2175-974x | CC BY-NC
www.nomads.usp.br/virus! vnomads@sc.usp.br

paid professionals". Other motivations for practicing DIY are saving money, customize artifacts, meet needs and interests of users, gain independence from the State, the production, and political, economic and cultural systems to promote open or free culture; to question the monopoly of knowledge, techniques and technologies by institutions, specialists and experts; encourage non-expert people to learn to do things, or merely the pleasure of developing an idea, make it reality and share it with other people.Notwithstanding mortally wounded of industrialization to DIY, groups of people of all kinds keep this culture alive even with ups and downs, between the subversive, underground and marginal and institutionalization, new industries generation and the capture by the prevailing economic model.

The current version of DIY possibly began in the early decades of the twentieth century, when United States defenders of the Arts and Crafts movement promoted interest in the simple style of furniture and domestic architecture. Magazines such as Popular Mechanics and Popular Science were posted, with articles about how to make things in home and encouraging residents to undertake some of their renovations. In this dynamic, became widespread, from 1912, the expression Do It Yourself, encouraging homeowners to paint their homes themselves, rather than hire a professional painter. (Goldstein, 1998, p. 18)

The industry has also adopted the DIY as the main factor of competitiveness. According with Kuznetsov e Paulos (2010, p. 1), by radio amateurs, in the in the 1920s. They depended on amateur handbooks, which underlined the imagination, and an open mind, almost as much as the technical aspects of radio communication. In the 1960s, hackers appeared (not to be confused with crackers: hackers build things, crackers break them), who were responsible for the popularization of the Internet and other information and communication technologies beyond to military, government, large corporations and universities. Hackers created several journals and magazines, organized cooperative communities and founded clubs like the Homebrew Computer Club [1], to work on solving the technical problems of everyday life and the construction of a low cost personal computer, predecessor for what we know today as Personal Computers. (Anderson, 2012, p. 20; Hauben, n.d., p. n.d.) According with Kuznetsov e Paulos (2010, p. 1), by radio amateurs, in the in the 1920s. They depended on amateur handbooks, which underlined the imagination, and an open mind, almost as much as the technical aspects of radio communication. In the 1960s, hackers appeared (not to be confused with crackers: hackers build things, crackers break them), who were responsible for the popularization of the Internet and other information and communication technologies beyond to military, government, large corporations and universities. Hackers created several journals and magazines, organized cooperative communities and founded clubs like the Homebrew Computer Club [1], to work on solving the technical problems of everyday life and the construction of a low cost personal computer, predecessor for what we know today as Personal Computers. (Anderson, 2012, p. 20; Hauben, n.d., p. n.d.)

According to Castells (1999, p. 86), hackers emerged parallel with the work of the great scientists of the Pentagon and as a countercultural phenomenon of uncontrolled growth, almost always in intellectual association with the secondary effects of the 1960s movements in its most libertarian-utopian version. Hackers are based on values such as cooperation, voluntary mutual aid, sharing and freedom; they are opposed to authoritarianism, censorship, secrecy, control and the use of force. These values gave rise to the contemporary version of the free culture and open culture, which has its maximum expression in the culture of free software and open source software, which from their practice and theory, inspired other spheres, like Free Design.

V!RUS 10
>DIY//DO IT YOURSELF!+
revista do nomads.usp | nomads.usp jornal
issn 2175-974x | CC BY-NC
www.nomads.usp.br/virus| vnomads@sc.usp.br

In the 1970s, the punk movement emerges, born from bands who started their own fanzines, DIY magazines made on photocopies that could be distributed in stores, at concerts or by mail. Furthermore, they recorded their music on cassettes without the need for a professional studio, which were distributed by mail, in small shops, and from person to person. (Anderson, 2012, p. 11). Later, in the 1980s, the low cost of MIDI (Musical Instrument Digital Interface) equipment allowed people without formal training record electronic music, evolving into the rave culture of the 1990s (Kuznetsov and Paulos, 2010, p. 1)

In Brazil, there was an important DIY movement, the Tecnobrega, originated in the city of Belém, in Pará State. According to Lemos & Castro (2008), the Tecnobrega became a clear example of the diffusion of open business model, value creation and commercialization of cultural goods, alternative to the model of copyright. The community adept to Tecnobrega promotes festivals and concerts circuits, recordings in small studios, commercialization through street sellers, broadcasting on local radio and TV, enabling the sustainability of musicians and producers, capturing wider markets, while, at the same time, enabling free access and sharing their own artistic works.

In the contemporary times, DIY movements appear based on hacker culture and new technologies of information and communication, using digital tools, drawing on the computer screen, using personal digital fabrication machines and sharing theirs designs online. It is an approach and a combination of web 2.0 culture with collaboration process design and digital fabrication.

These movements are based on the "network effect": when we connect ideas and people, these grow up in a virtual circle where more people come together to create more value, which in turn attracts more people, and so on. This effect has led many online businesses to be successful, how Facebook, Twitter, Wikipedia, among others. "What makers are doing is taking the DIY movement online –'making in public'- which introduces network effects on a massive scale." (Anderson, 2012, p. 21)

According to Anderson (2012, p. 21), these manufacturers movement, which he called makers have three characteristics in common:

> "People using digital desktop tools to create designs for new products and prototype them ('DIY digital'). A cultural norm to share those designs and collaborate with others in online communities. The use of common design file standards that allow anyone, if they desire, to send their designs to commercial manufacturing services to be produced in any number, just as easily as they can fabricate them on their desktop. […]"

According to Anderson (2012, p. 20), the movement makers have at least seven years and may be associated with the launch of the journal Make Magazine, O 'Relly, and meetings of Maker Faire in Silicon Valley. Another important event that gave rise to this movement was the appearance of RepRap, the first 3-D home printer open source, released in 2007, which led to the creation of the MakerBot, a 3-D printer user-friendly, inspired in a generation of manufacturers with a hallucinatory vision, the future of desktop manufacturing, as did the first PC thirty years ago.

V!RUS 10
>DIY//DO IT YOURSELF!+
revista do nomads.usp | nomads.usp jornal
issn 2175-974x | CC BY-NC
www.nomads.usp.br/virus| vnomads@sc.usp.br

Among the information and communication technologies, life sciences have achieved great advances such as genetic manipulation, mapping of the human genome, among others. As you might expect, with these advances, emerges also a new movement Biopunks (Wohlsen, 2011), or DIY bio movement , life hackers (Ledford, 2010), "They're making lab equipment cheaper, more accessible, and modifiable but what they're producing with those tools is pretty much standard lab biology." (Anderson, 2012, p. 222)

The DIY, in the contemporary context, acts as a democratizing agent. According with Atkinson (2006, pp. 5–6), this happens in several ways: "offering people to independence and self-reliance, freedom from professional help, providing an opportunity to create meanings and personal identities in artifacts and in their own environments, facilitating the practice activities of all, previously linked to one gender or class". Atkin considers that any DIY activity can be seen as a democratization of the production process, allowing freedom in decision-making and control, providing self-sufficiency and financial independence.

The DIY implies a return to the world of sharing overlapping with individualism, the commons overlapping with the private property, distribution overlapping with accumulation, decentralization overlapping the centralized, the free competition overlapping with monopoly. The DIY implies the democratization of production, a battle against the dictatorship of industrial artifacts, a possibility for humans to assert themselves and projecting the world autonomously.

2.3 The merge between bits and atoms

The concept of "bits versus atoms" refers to a distinction between hardware and software or information technology and anything else. Thinkers from MIT Media Lab originated it, for its founder Nicholas Negroponte, and currently with Neal Gershenfeld at the Center for Bits and Atoms. Presently, to make a distinction between bits and atoms is more difficult because, with the advance of information and communication technologies, the line between these two worlds is diluted.

Gershenfeld (2005, p. 4) considers that there is no separation between computer science and physical science. Thus, it is possible, through programs; process both atoms as bits, digitizing manufacturing the same way as communications and computing were previously digitalized. Thus, the manufacturing devices may have the ability to do all through the assembling atoms.

In the context of the information revolution, the idea factory of the industrial revolution is changing. According with Anderson (2012, p. 14), "Just as the Web democratized innovation in bits, a new class of 'rapid prototyping' technologies, from 3-D printers to laser cutters, is democratizing innovation in atoms."

Digital manufacturing is more accessible to makers because of reduced costs, access to information, improving the processing capabilities of personal computers, advance and better access to CAD, CAM, CAE programs and every time have more people specialized in their handling. This changes the paradigm of unidirectional to multidirectional creation.

Thus, the dynamics of value creation allows each individual or corporation to develop exactly what they want. Instead they be limited by the options available in the market, the user has the ability to fabricate their own artifacts (DIY). "It is a return, if you will, to cottage industry model of production and consumption that

V!RUS 10
>DIY//DO IT YOURSELF!+
revista do nomads.usp | nomads.usp jornal
issn 2175-974x | CC BY-NC
www.nomads.usp.br/virus| vnomads@sc.usp.br

has not been seen since the earliest days of the Industrial Revolution" (Atkinson, 2011, p. 27).

2.4 The knowledge and information

The merge between bits and atoms enables various expressions of social life are subject to digitalization, such as science, education, art, artifacts, machines, thoughts, ideas, news and points of views, and also these are instantly transmitted to any place in the interconnected world. This way, society and individuals have the possibility to access, create, modify, publish and distribute all information and digitized knowledge, while they collectively build more knowledge, enriching the global and the local culture. Thus, according to Anderson (2012, p. 14), " computers amplify human potential: they not only give people the power to create but can also spread their ideas quickly, creating communities, markets, even movements."

The knowledge converted into bit becomes in a productive action and, according Gorz (2005, p. 37)

> [2]Can manage the complex interactions between a large number of actors and variables; it can conceive and drive the machine, facilities and systems of flexible production; in other words, it play the role of a fixed capital, replacing the living, material or immaterial labor, by accumulated labor.

We are at a decisive moment in human history because information and knowledge are becoming the primary productive force, as well as oil, steam and electricity were the main productive forces for the two industrial revolutions. We are basing our economy on an abundant and inexhaustible asset, whose production cost tends to zero because it is a non-rival good, that is, an asset whose consumption by one person does not reduce its availability to others. Once this asset is produced, no need to invest more social resources to satisfy a new consumer, as with rival goods like an apple, for example.

Thus, information and knowledge, to be propagated, generate greater benefit and utility to humanity, while its cost tends to zero. This explains the interest of large corporations to create their artificial scarcity through intellectual property laws. Each time that any knowledge or information is restricted; this knowledge is being robbing of humanity for the benefit of the few.

Another peculiar feature of knowledge, according with Benkler (2006, p. 37) is both input and output of its own production process, this characteristic is known to economists as the "on the shoulders of giants" remembering, according to him, a statement attributed to Isaac Newton: "If I have seen farther it is because I stand on the shoulders of giants. This means that any new information or innovation made today is built on the existing knowledge and information so far. The higher free knowledge, greater the possibility of generating new knowledge by the common person.

Before the described overview, we are facing to the possibility of basing our economy on a common based peer production model, in a mode of production open and free. Everything now depends on the pressure capacity of social groups for the large corporate groups do not become scarce knowledge and information with the complicity of State power, the international control agencies and the mass media.

V!RUS 10
>DIY//DO IT YOURSELF!+
revista do nomads.usp | nomads.usp jornal
issn 2175-974x | CC BY-NC
www.nomads.usp.br/virus| vnomads@sc.usp.br

When we talk about commons, generally refers to "a resource shared by a group of people that is subject to social dilemmas" (Hess and Ostrom, 2007, p. 4) or a particular institutional form of structuring the rights to access, use and control of resources (Benkler, 2006, p. 60). We see these definitions, references of commons as a resource, or resources system, or as a regime of property rights. According with Benkler (2006, p. 61) "The salient characteristic of commons, as opposed to property, is that no single person has exclusive control over the use and disposition of any particular resource in the commons." That it is those consistent values of all the good of the community or of goods whose use cannot be excluded from any member of the community. With respect to the term peer production in the words of Benkler (2006, p. 62) "characterizes a subset of commons-based production practices. It refers to production systems that depend on individual action that is self-selected and decentralized, rather than hierarchically assigned."

We can indicate the possibility of being the gates of a free way of production, based on cooperative practices that, in addition to sharing knowledge and information, share artifacts to use, create, modify and apply to our own needs in their own socio-cultural contexts, ensuring freedom in a new "mix", integration or miscegenation between users, manufacturers and designers. A new era of innovation is emerging. Digital fabrication is the possibility of emancipation of the individual in front the job, in their physical, economic, social, political and cultural environment. "The past ten years have been about discovering new ways to create, invent, and work together on the Web. The next ten years will be about applying those lessons to the real world." (Anderson, 2012, p. 17)

3. The experience of digital fabrication and DIY at UNESP

CADEP and Sagui Lab [3] develop this experience of digital fabrication and free/open design, with the goal of making a digital campaign to promote the manufacturing technology of CADEP and manufacture furniture for the installations of Sagui Lab designed in a collaborative way and fabricated digitally. For this were programmed several workshops in digital fabrication, whose results can be seen in Figures 1, 2, 3, 4 and 5.

V!RUS 10
>DIY//DO IT YOURSELF!+
revista do nomads.usp | nomads.usp jornal
issn 2175-974x | CC BY-NC
www.nomads.usp.br/virus| vnomads@sc.usp.br

Fig. 1. Creative process. Source: Sagui.

Fig. 2. Creative process CADEP. Source: CADEP.

Fig. 3. Other projects developed. Source: the authors.

Fig. 4. The cloud fabrication. Source: Sagui Lab.

V!RUS 10
>DIY//DO IT YOURSELF!+
revista do nomads.usp | nomads.usp jornal
issn 2175-974x | CC BY-NC
www.nomads.usp.br/virus| vnomads@sc.usp.br

Fig. 5. Lab Sagui Space with furniture designed.

In addition to the furniture designed by the group that participated of digital fabrication workshop, it was decided to do some tests with Open Design projects globally recognized as SketchChair, an open source software that allows anyone to easily design, modify, adapt and build chairs digitally. SketchChair is a good example of designability and customization.

It is interesting to note that the free mode of production is not only a speech, but a reality in the maturation process. For example: a member of the Sagui Lab entered the SketchChair site, designed his chair with the provided software, downloaded the digital files, and had access to a CNC milling machine to produce his chair in a Makerspace like CADEP, how can be seen in Figure 6..

Fig. 6. Antler Chair made in the CADEP. Source**:** Sagui Lab.

Happy with the result of fabrication of the chair Antler, from SketchChair, we decided to visit another website called OpenDesk. This site is a community of designers and manufacturers that offer products, preferentially furniture, designed to be made digitally and on demand. This allows you to customize the objects according to user needs before they are manufactured. Open Desk (n.d., p. n.d) calls this Open Making. This process eliminates intermediaries, directly connecting designers, users and manufacturers. Thus, the designers get a global distribution channel, makers gain customers and designer's product. From this website was chosen one chair of Brazilian architect named Denis Fuzii, founder of Studio Dlux that released his design chair named Kuka and all the information needed to

V!RUS 10
>DIY//DO IT YOURSELF!+
revista do nomads.usp | nomads.usp jornal
issn 2175-974x | CC BY-NC
www.nomads.usp.br/virus| vnomads@sc.usp.br

fabricate it digitally. The result was very satisfactory. There is no difference between the Kuka chair shown on the website, and the chair made in the CADEP. (see Figure 7).

Fig. 7. Kuka chair made in the CADEP. Source: CADEP.

4. Final Considerations

In contemporary time, we are witnessing the beginning of a free mode of production configured by information and communication technologies and digital fabrication tools, which recovers the societal forms of production and creation commons-based peer production, first in the world of bits and now in the world of atoms.

The DIY and free design rescue the human and the community's capacity to adapt and transform their natural environment, controlled by the capitalist closed mode of production, individualistic, selfish and monopolistic. We are in the time to strengthen a free culture that promotes the collaboration, cooperation, sharing, sustainability and social harmony.

The DIY and free design are allowing a way for the emancipation of Community production,
liberating, transparent, open, based on the open, collaborative and cooperative work.

We saw in UNESP and more specifically with Sagui Lab project, in collaboration with the CADEP, in a short time, was possible to form a team, obtain a space and enjoy the culture of cooperation and shape the environment to our needs.

5. References

ANDERSON, C. **Makers:** the new industrial revolution. 1a. ed. Nova Iorque: Crown Business, 2012.

ATKINSON, P. Do It Yourself: Democracy and Design. **Journal of Design History**, v. 19, n. 1, p. 1–10, 20 mar. 2006.

V!RUS 10
>DIY//DO IT YOURSELF!+
revista do nomads.usp | nomads.usp jornal
issn 2175-974x | CC BY-NC
www.nomads.usp.br/virus| vnomads@sc.usp.br

ATKINSON, P. Orchestral Manoeuvres in Design. In: VANBAS, A. *et al.* (Orgs.). **Open design now:** Why Design Cannot Remain Exclusive. Amsterdam, The Netherlands: BIS publishers, 2011, p. 24-31.

BENKLER, Y. **The wealth of networks:** how social production transforms markets and freedom. New Haven: Yale University Press, 2006.

BUECHLEY, L. et al. DIY for CHI: Methods, Communities, and Values of Reuse and Customization. In: CHI EA, 9., Nova Iorque, 2009. **Anais...** Nova Iorque,: ACM, 2009, p. 4823-4826. Disponível em: <http://doi.acm.org/10.1145/1520340.1520750>. Acesso em: 29 Jul. 2014.

CASTELLS, M. **A sociedade em rede.** Trad. Roneide Venancio Majer. 6a. ed. São Paulo: Paz e Terra, 1999. v. I. (A era da informação : economia, sociedade e cultura, v. 1)

CROSS, N. **Métodos de diseño:** estrategias para el diseño de productos. México D.F: Limusa Wiley, 2008.

GERSHENFELD, N. **Fab:** The Coming Revolution on Your Desktop--from Personal Computers to Personal Fabrication. Nova Iorque: Basic Books, 2005.

GOLDSTEIN, C.M. **Do it Yourself:** Home Improvement in 20th-century America. [s.l.]: Princeton Architectural Press, 1998.

GORZ, A. **O Imaterial:** conhecimento, valor e capital. Trad. Celso Azzan Junior. São Paulo: Annablume, 2005.

HAUBEN, M. **Participatory Democracy From the 1960s and SDS into the Future Online.** Disponível em: <http://www.columbia.edu/~hauben/CS/netdemocracy-60s.txt>.

HESS, C.; OSTROM, E. (Org.). **Understanding Knowledge as a Commons:** From Theory to Practice. Cambridge, MA: The MIT Press, 2007.

ILLICH, I. **Tools for conviviality.** [s.l.]: Harper & Row, 1973.

KUZNETSOV, S.; PAULOS, E. Rise of the Expert Amateur: DIY Projects, Communities, and Cultures. In: NordiCHI, 10., Nova Iorque, 2010. **Anais...** Nova Iorque: ACM, 2010, p. 295-304. Disponível em: <http://doi.acm.org/10.1145/1868914.1868950>. Acesso em: 29 Jul. 2014.

LEDFORD, H. Garage biotech: Life hackers. ***Nature News***, v. 467, n. 7316, p. 650-652, 10 jun. 2010. Acesso em: 30 Jul. 2014.

LEMOS, R. **Tecnobrega:** o Pará reinventando o negócio da música. Rio de Janeiro: Aeroplano, 2008. (Tramas urbanas, 9).

NORTON, M.I.; MOCHON, D.; ARIELY, D. The IKEA effect: When labor leads to love. **Journal of Consumer Psychology**, v. 22, n. 3, p. 453-460, jul. 2012.

OPENDESK. **OpenDesk - Studio dLux - Kuka Chair**. Disponível em: <https://www.opendesk.cc/studio-dlux/kuka-chair>. Acesso em: 13 Fev. 2014.

PAPANEK, V.J. **Disenar para el mundo real:** ecologia humana y cambio social. Trad. Luis Cortés. Madri: H. Blume, 1977.

VAN ABEL, B. **Se você não pode abri-lo, você não o possui.** Disponível em: <http://watershed.co.uk/opencity/wp-content/uploads/2012/03/Bas-van-Abel_Se-voc%C3%AA-n%C3%A3o-pode-abri-lo_Julo2012.pdf>. Acesso em: 20 Dez. 2013.

V!RUS 10
>DIY//DO IT YOURSELF!+
revista do nomads.usp | nomads.usp jornal
issn 2175-974x | CC BY-NC
www.nomads.usp.br/virus| vnomads@sc.usp.br

WOHLSEN, M. **Biopunk:** Solving Biotech's Biggest Problems in Kitchens and Garages. [s.l.]: Penguin, 2011.

[1] This club was a hybrid between elements of the radical student movement of the 1960s, and communities of Berkeley computing activists and electronics hobbyists and amateurs. Steven Wozniak founder of Apple was a member of this group.

[2] From the original in Portuguese: "pode gerir as interações complexas entre um grande número de atores e de variáveis; pode conceber e conduzir a máquina, as instalações e os sistemas de produção flexível; ou seja, desempenhar o papel de um capital fixo, substituindo o trabalho vivo,

[3] The Sagui Lab is a project developed by students of undergraduate and postgraduate studies in design at UNESP, whose purpose is to implement the collaborative creation, using digital fabrication techniques, the multidisciplinary, use of a shared space and the development of innovative projects in a digital platform.