The Making of An Hackable Biology: How Do Make:Magazine and Maker Faires Contribute In Constituting Biology As a Personal Technology?

Author

Sara Tocchetti

Abstract

Drawing on primary and secondary literature sources, preliminary participant observations and interviews, this article explores Make:Magazine and Maker Faires early contribution in constituting biology as a personal technology. It shows that first, several elements of the practicable representation of technology that the editors of Make:magazine are promoting, can be traced to the tradition of the Whole Earth Catalog as well as to a let version of the American 'digital generation' ideology. Secondly this editorial legacy is strengthened by being combined to the cultural resurrection of the "maker", as a figure capturing the endless entrepreneurial opportunities of homemade innovation. While Maker Faires fairs are quickly becoming a 'forums of production' for the 'makers'. Lastly this paper describes how these influences, shaped the inscription of life science activities in Make:magazine resulting in the production of early representations and practices of biology as an 'hackable' and a personal technology; and motivated the progressive identification of members of the DIYbio network to Make;Magazine and Maker Faires culture.

Key words
Personal biology, counterculture, maker, culture, hack, homemade innovation, small scale technology

1. Introduction

In 2006 O'Reilly Media Inc., one of the largest computer book publishers launched Make:magazine, a

quarterly promoting the vision of a ‘modern DIY’ focused on small scale electro-mechanical and digital technologies. One year later, in an issue entitled Backyard Biology, the magazine featured several practices involving living entities such as snails, DNA, plants and mushrooms, as mediated by small scale technologies. The same year the editors organized the first Maker Faire, a two day fair dedicated to the celebration of the ‘maker’ culture. Finally since 2009 an increasing number of DIYbio members 'An institution for the Do It Yourself Biologist'[1], became regular participants of different Maker Faires.

Due to the very recent emergence of the DIYbio network, the only attempt to describe the relation between Make:magazine and Maker Faires and the DIYbio network in the academic literature, is limited to a phrase indicating that the member of the DIYbio network uses Make.magazine as a 'communication tool' and that they like to call themselves ‘makers’[2]. Yet as this paper attempt to show, this relation is crucial to understand how biology, not only is increasingly understood and practiced as ‘hackable’ but also, in a specific way, as personal. For this reason our theoretical approach is not based on the review, critique and expansion of precedent academic literature on the subject. Instead prominence is given to the presentation of primary and secondary literature sources highlighting the cultural significance of the relation between Make:magazine, Maker Faires and the DIYbio network. Field work observations and interview transcripts are in particular crucial to qualitatively investigate the identification of DIYbio members with Make:magazine editorial culture and Maker Faires community culture.

In this context the theoretical approach informing these interpretations draws from two

[1] Although this work is part of a larger effort to describe the emergence of the DIYbio network, for the purpose of this paper I will refer to the official definition of DIYbio as found on their website: 'DIYbio.org is an organization dedicated to making biology an accessible pursuit for citizen scientists, amateur biologists and biological engineers who value openness and safety. This will require mechanisms for amateurs to increase their knowledge and skills, access to a community of experts, the development of a code of ethics, responsible oversight, and leadership on issues that are unique to doing biology outside of traditional professional settings'. View on December 2011 <http://diybio.org/>

[2] A. Delfanti, ‘Genome hackers, rebel biology, open source and science ethics’, PhD Thesis, Universita delgi Studi di Milano, 2011, p 113

explicitly limited areas of the academic literature broadly referred at the interdisciplinary field of science and technology studies. By coining the expression *personal biology* in reference to Fred Turner's cultural history of the personal computer, this works extend elements of Fred Turner's analysis to describe the relation between Make:magazine, Maker Faires and the DIYbio network[3]. While to interpret the representation and practices of biology as hackable, this work engages with Donna Haraway and Evelyn Fox Keller works on the 'implosion' of communication sciences and biology[4].

The constitution of biology as a personal technology is a contemporary broad phenomenon far exceeding the purpose of this article; this work focuses in analyzing three limited case studies with the intent to trace a possible genealogy of the 'expanding frontiers of hacking'. While to reflect the mobile contingencies qualitative research projects attempt to capture while describing the contemporary, these case studies are referred as 'snapshots'. By analyzing crucial biographical elements of Make:magazine editorial board's leading figures, the first snapshot attempts to place Make:magazine's editorial culture as part of 'digital generation', that is, a part of a specific media and technology tradition. The second snapshot proposes a preliminary content analysis of Make:magazine Backyard Biology issue in particular how in it biology was redefined as a personal technology and linked it to Make:magazine mythical figure of the 'maker'. Finally the third snapshot, informed by interviews and participants observations, discusses the increasing presence of members of the DIYbio network to Maker Faires and in Make:magazine blog and how their identification to the *maker* figure, allowed them to exercise their vision of biology as a personal technology.

---

[3] F. Turner, *From Cyberculture to Counterculture, Steward Brand, the Whole Earth Catalogue and the Rise of Digital Utopianism*, the University of Chicago Press, Chicago and London, 2006.

[4] J. D. Harraway 'A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century", in Haraway J. D. *Simians Cyborgs and Women the reinvention of nature.* New York, Routledge, 1991.
J. D. Harraway 'Gene: Maps and Portraits of Life Itself', in Haraway J. D. *Modest_Witness@Second_Millenium.FemaleMan©_Meets_Oncomouse™*, Routledge, 1997
E. Fox Keller, 'Making Sense of life: Explaining Biological Development, Models, Metaphors and Machines', Harvard Press, 2002, pp. 123-173.

2. First snapshot: Situating Make:magazine and the media legacy of its editorial board leading figures

Make:magazine's first issue was released in January 2005. According to new media commentator Rex Hammock[5], the start-up of the magazine was a 'benchmark for how the blogosphere can help provide buzz-magic for a magazine launch'. In this case, the use of ‘blogoshere’ as an advertising space was entirely ‘natural’ rather than ‘strategic’. Hammock explains that as Mark Frauenfeld, Editor in Chief of Make, had been previously known as a ‘superstar blogger’, ‘nothing about the use of blogs and bloggers in the launch of Make smacks of being “contrived” or “manufactured” or gimmicky’[6].

To understand what Hammock means by calling Mark Frauenfelder a ‘superstar blogger’ and how this contributed to Make:magazine editorial culture, it is important to trace some biographical elements of his life, including the moment when he joined Make as Editor in Chief.

2.1 Mark Frauenfelder: making as unplugging

[5] Rex Hammock is the founder of Hammock Inc. a 'content marketing, strategy and media company founded in 1991' his influencing blog covers the magazine industry and custom publishing.
Technocrati, the second leading blog ranking company, ranks Hammock blog 800'261 in the world with a Technocrati Authority of 443/1000, as comparison BoingBoing authority is ranked 829/1000 while Make authority is ranked 645/1000. Viewed on August 2011,
<http://technorati.com/blogs/www.rexblog.com#ixzz1akc4O5a2>

[6] Hammock, R, ‘Make and the secret of garnering magazine-launch media coverage in the blog age’, on Rex Hammox’s Blog, posted 17 March 2005, viewed on 11 September 2011,
<http://www.rexblog.com/2005/03/17/13762>

Mark Frauenfelder first became known among followers of the cyberpunk subculture as the founder, with his wife Clara, of the ‘zine’[7] BoingBoing. In an interview given in 1997, he recalls his former life as a specialized parts engineer, 'all the engineers knew each other by what parts they were designing. I was the motor guy. The engineer next to me was the flex lead guy'[8]. After several years he felt this situation was no longer bearable, 'I needed some kind of creative outlet, so Carla and I decided to start a zine. We decided to explore the coolest, wackiest stuff we could think of, and came up with the name bOING bOING. Bouncing through our crazy world'[9]. In 1988, he swapped his extremely specialized engineering job with the hectic world of freelance ‘zine’ writing and publishing, 'I love zines because one person can be responsible for all 100 parts'[10]. In less than four years BoingBoing grew into a zine with a 17,000 copies distribution. In 1996, an enlarged BoingBoing editorial team pioneered the blog boom by inaugurating a blog with the same name. In 1997 the publication of the ‘zine’ went over to being online only at ‘boingboing.net’. The ‘zine’ and the blog have influenced an entire generation by publishing articles and posts about self-publication, cryptography, nanotechnology, pirate radios, rocketry, bizarre forms of worships, cyberpunk literature and ‘a multitude of technology tricks to illuminate our daily life’[11]. Meanwhile, Mark Frauenfelder continued to develop his career as a freelance writer and illustrator working in particular for what Fred Turner would define as different stages of techno-libertarian media, such as Mondo2000, the Whole Earth Review, TheFeature, Wired, Wired Online and The Industry Standard[12]. As a result many funding members and core authors of

---

7 Common abbreviation for the term ‘magazine’ that became referential in the Californian independent publication scene in the 70s.

8 Rowe, C, ‘Mark Frauenfelder & Carla Sinclair, bOING bOING’, in The Book Of Zines, 1997, viewed on 22 August 2011, <http://www.zinebook.com/interv/boing.html>

9 Rowe, 1997

10 Rowe, 1997.

11 L. Courau, '*Mutations pop et Crash culture: une anthologie de la Spirale.org'*, Editions du Rouergue, 2004, p. 29-32.

12 An exhaustive list of Mark Frauenfelder writings can be found on one of his personal websites, viewed on October 2011, <http://boingboing.net/markf.html>

these media became part of an interconnected social network to which Mark Fraunfelder gave a voice in Make:magazine.

As an example, in 2005 thanks to John Battelle friendship[13], Mark Frauenfelder became Editor in Chief of Make. In the introduction of his sixth and last book, entitled ‘Made by Hand: Searching for Meaning in a Throwaway World’, Mark Frauenfelder explains how the job offer coincided with a second major turning point in his life. In 2003, as the freelance-journalism market in California was hit by the dotcom recession, he and his wife decided to move out from the hectic and expensive life of Los Angeles[14]. They sold their house and car, and landed in Rarotonga, a 'in the middle of nowhere'[15] island in the South Pacific. During, what could be defined as a form of back-to-the-land experience, they learned 'how to slow down and to take more control over the systems that kept us alive and well'[16], to value how to bake their bread, pick up coconuts from the garden and spend entire days cooking with the family. Although they planned to stay for a year, only four and a half months later they moved back to Los Angeles[17]. Their life resumed in an 'over-caffeinated routine of school, work, driving, takeout meals and weekends filled with kiddie birthday parties'[18]. But as Mark was offered a job at Make, he progressively became involved with the ‘maker’ community, 'hanging out with people who do this not just with food but with everything'[19]. He started to keep bees and chickens, made his own yogurt, constructed guitars out of cigar boxes and got involved with ‘DIY education’ of his children[20]. How he

---

13 John Battelle is co-funding editor of Wired, CEO of the Industry Standard and funder of the Federated Media Publishing, the co-organizer of several O'Reilly Media Conferences. Viewed on 12 September 2011, <http://battellemedia.com/about-john>

14 M. Frauenfelder, *Made by Hand: Searching for Meaning in a Throwaway World*, Portofolio, 2004, pp. 1-2.

15 Metzger, 2010.

16 R Metzger,*’Boing Boing's Mark Frauenfelder: Made By Hand’, 2010* , viewed on 24 September 2011, <http://vimeo.com/12534051>

17 Frauenfelder, p. 3.

18 Frauenfelder, p. 3.

19 Metzter, 2010.

20 Metzger, 2010.

expressed in one of his New Year resolutions, these ‘analogue activities’ became his way to ‘unplug’, to 'cut through the absurd chaos of modern life and find a path that was simpler, direct and clear'[21].

What started as a family back-to-the-land experience shortly became what Sara Franklin has succinctly named a ‘back-to-the-tool’ experience. To escape from the ‘absurd chaos of modern life’ it was no more necessary go far away as part of a commune, or an island, the experience of being ‘unplugged’ could be lived within the walls of the familiar house and shared with wives and children[22].

While becoming Editor in Chief of Make, Mark Frauenfelder continued to write on Boing Boing. On the occasion of Make launch, he simultaneously mobilized Boing Boing readers with the network of IT professionals organized around Make publisher O'Reilly Media Inc.

On the 29th of July 2004, Mark Frauenfelder wrote a post on BoingBoing blog entitled ‘New O'Reilly magazine: Make’. As usually in his posts, Mark Frauenfelder spoke at the first person and reported how that same day he and Editor and Publisher Dale Dougherty announced Make premiere at the third edition of OSCON - O'Reilly Open Source Convention in Portland, Oregon[23].

Before describing the specific role of Editor and Publisher Dale Dougherty, some elements of the corporate culture O'Reilly Media Inc., Make:magazine publisher, and its CEO Tim O'Reilly will be introduced.

2.2 Tim O'Reilly: The Whole Earth Catalog legacy and the 'architecture of participation'

---

21 Frauenfelder, p.1.

22 The expression back-to-the-land is used in reference to Fred Turner history of the communes as 'communities of consciousness'. In a divided America of the 60's, the back-to-the-land movement was motivated by the belief that a new society could only emerged by the spiritual transformation of its individual members, organized in small communes. Small technologies, including personal computers were embraced as tool for 'individual consciousness'. Following the post-communal disillusion of the 80s, the ideal community survived symbolically embedded in the network of wired personal computers and became the media of the 'digital generation '.
F. Turner, *From Cyberculture to Counterculture, Steward Brand, The Whole Earth Catalogue and the Rise of Digital Utopianism*, The University of Chicago Press, Chicago and London, 2006, pp 73-78.

23 M Frauenfelder, 'Make: O'Reilly New Magazine', in Boing Boing, 29 July 2004, viewed 12 September 2011, <http://boingboing.net/2004/07/29/new-oreilly-magazine.html>

Funded in Boston in 1978, O'Reilly Media Inc., has since become a leading company in computer books publishing, with a special culture of corporate community[24]. Dale Dougherty, who started his career as computer program book writer and early publisher of O'Reilly, recalls the atmosphere at O'Reilly Media Inc. as follows, 'it was a mix of kindergarten and grownups - We had an aversion to the business world, and Tim had this alternative perspective that was very attractive'[25].

As it will become more clear in the section dedicated to the Maker Faire', the organization of conferences as social forums of production rapidly became a core component of O'Reilly Media Inc.'s corporate culture and a platform where to test the first prototype of a Maker Faire. In 2001 O'Reilly Media Inc. organized four conferences exclusively in the United States, while ten years later; the number has grown to twenty two conferences organized worldwide[26].

Although OSCON is only one of the one-hundred worldwide conferences, organized by O'Reilly Media Inc., the event is among the most important conferences dedicated to the discussion and promotion of Open Sources practices within the IT professional community. The topic is symbolically bounded to the figure of Tim O'Reilly, whose leading understanding of the Open Source as a social technology is based on the 'architecture of participation'. Tim O'Reilly's principle is inspired by Mirch Kapor[27] maxim '[software] architecture is politics'. In a paper entitled 'Open Source Paradigm Shift' Tim O'Reilly wrote 'the architecture of participation describes the nature of systems that are designed for user contribution'[28]. As such Tim O'Reilly vision of valuable technology is dependent from its build in

[24] M Chafkin, 'The Oracle of The Silicon Valley, Inc.com, 1 May 2010, viewed 14 September 2011, http://allthingsd.com/voices/the-oracle-of-silicon-valley/

[25] Chafkin, 2010.

[26] On the company website the conferences are presented as an occasion to "create a collaborative space for alpha geeks and forward-thinking business leaders to come together to shape revolutionary ideas and translate the innovator's knowledge into useful skills and tools that can be applied to real world situations.". Viewed on 11 September 2011, <http://conferences.oreillynet.com/>

[27] Mirch Kapor is a leading software developer. Back in the 80s, his software Lotus 1-2-3 data sheet was the first billionaire sell software, as such Lotus 1-2-3 success participated in transforming the software sector in an independent industry and not as a subsidiary of the operating system and hardware industry, viewed on 11 September 2011, <http://www.kapor.com/bio/index.html>

[28] T. O'Reilly, 'Open Source Paradigm Shift', paragraph Network-enabled collaboration (as published as a blog entry not

possibility to gather a participative community around it.

On his Official Bio on O'Reilly Media Inc. website, CEO Tim O'Reilly is described as ‘a chronicler and catalyst of leading-edge development, honing in on the technology trends that really matter and galvanizing their adoption by amplifying "faint signals" from the “alpha geeks”’[29], while at the same time enjoying growing his own fruits and making his own jam.

His company first iconic success came with the publication of the Whole Internet User's Guide and Catalog. The book not only became a bestseller classic and designated as one of the New York Public Library’s 100 Books of the 20th Century, but also it symbolizes the first expression of Tim O'Reilly techno-libertarian legacy to Steward Brand's Whole Earth Catalog.

In 2006 in a post written on O'Reilly Radar blog, to publicize an upcoming event entitled, ‘From Counterculture to Cyberculture: The Legacy of the Whole Earth Catalog’, Tim O'Reilly suggested how such a legacy should be perpetuated: ‘and of course, the Whole Earth Catalog is one of the wellsprings of the modern DIY movement, for which Make: magazine is now carrying the torch’[30].

Even though overly simplified, Mark Frauenfelder and Tim O'Reilly contextual biographies shade some light on Make magazine editorial culture. Before reaching any conclusion, Editor and Publisher Dale Dougherty's role will be presented.

2.3 Dale Dougherty: The figure of the maker and the neo-tradition of 'grassroots American innovation'

In the welcoming editorial of Make:magazine first issue, entitled “The Making of Make”, Editor and Publisher Dale Dougherty explained:

---

possible to give pages), Tim O'Reilly Radar, 2004, viewed 6 October 2011, <http://tim.oreilly.com/articles/paradigmshift_0504.html#swcommod>

[29] In Tim O'Reilly News From the Future column, published in Make, “alpha geeks” are defined as “people who are comfortable pushing the boundaries of technology, researchers and the kind of people who are called “hacker” in the computer world”. T. O'Reilly, 'News from the future', Make:magazine, vol. 1, January 2005, p. 13.

[30] T. O'Reilly, 'The Legacy of the Whole Earth Catalog', *O'Reilly Radar Blog*, 2006, viewed 12 October 2011, <http://radar.oreilly.com/2006/10/the-legacy-of-the-whole-earth.html>

‘Make: Magazine - Technology on your time, is a new magazine dedicated to showing how to Make technology work for you. More than mere consumers of technology, we are Makers, adapting technology to our needs and integrating it into our lives’.

The figure of the ‘maker’ Dale Dougherty infused the magazine with, dip into the mythical imagery of a American society united in, what becomes the almost spiritual act of, manufacturing. In January 2011 at TED@MotorCity in Detroit[31] he shared a fragment of his inspiration, a collage film entitled ‘American Maker’ and produced in 1960 by Jam Handy Organization as a commercial visual communication for the Chevrolet division of General Motors. While a large view over a desert beach focus on two male children constructing a fortified sand castle, a typical 50s-60s male narrator’s voice explains ‘of all things Americans are, we are makers. With our strengths and our minds and spirit, we gather, we form, and we fashion -- Makers and shapers and put-it-togetherers’[32]. As the image fades, Dale Dougherty attempts to actualize these images with his contemporary America: ‘it was a sense of pride that we made things that the world around us was made by us, it was fairly commonplace to think of yourself as a Maker’ and as a closing remark ‘what will America Make? It is more Makers’ [33]. As the verb ‘to make’ it is crafted into an embodied noun, the rather mythological figure of the ‘American Maker’ is brought up-to-date by making it operates the contemporary tools and technologies featured in the magazine. The American middle class D.I.Y culture is revitalized into the contemporary culture of 'grassroots American innovation’[34].

---

[31] D Dougherty, 'We are Makers', in TED, January 2011, viewed 7 August 2011, <http://www.ted.com/talks/dale_dougherty_we_are_Makers.html>

[32] Dougherty, 2011.

[33] Dougherty, 2011.

[34] N. Gerschenfeld, *Fab:The Coming Revolution on Your Desktop--from Personal Computers to Personal Fabrication*, Basic Books, 2007, p. 14.

Although a detailed content analysis of Make:magazine would be a requirement to establish more in depth conclusions. By biographically situating three of the Make's editorial board leading figures, it is nonetheless possible to link Make:magazine editorial culture to the information technology tradition of the Whole Earth Catalog and its successor magazine Wired. Sociologist Ronald Burt term of 'network entrepreneur' [35] well expresses how Mark Frauenfelder, Tim O'Reilly and Dale Dougherty crafted the magazine so to bring together 'an holistic media environment'[36]. While through the mythical figure of 'the maker', a new generation of leading institutional scientists, 'world tinkers', IT professionals, hackers, 'drop out from specialization', artists, crafter and their families, can continue to read themselves as part of a leading 'community of consciousness' organized around a contemporary set of personal technologies[37] . The next two sections explores how in Make:magazine biology, as a technology, was first inscribed as a tool of the 'maker' and subsequently experienced as part of the Maker Faires community culture.

3. Second Snapshot: Crafting backyard biology as a personal technology for the techno-libertarian home

In this section we propose a brief content analysis of Make:magazine Backyard Biology issue, published the 24th August 2006, two years before the first DIYbio meeting was held in Cambridge, Boston[38]. By describing how language and visual elements are presented in the cover and the concerned articles, our aim is to address what is meant by 'backyard biology'. How does an activity become 'backyard biology' and how does this category perform as a connector federating the experience of

[35] R. S. Burt, 'The Network Entrepreneur' In *Entrepreneurship: The Social Science View*, edited by Richard Swedbers, Oxford: Oxford University Press, 2000, pp.281-307.

[36] F. Turner, *From Cyberculture to Counterculture, Steward Brand, The Whole Earth Catalogue and the Rise of Digital Utopianism*, The University of Chicago Press, Chicago and London, 2006, p 72.

[37] Turner, p. 75, 2006.

[38] J. Bobe 'Don't phage me! Bro' Posted on May 24th 2008. Viewed October 2011, http://diybio.org/2008/05/24/dont-phage-me-bro/

biology as a personal technology, to the actualized figure of ‘the maker’.

3.1 The in use definition of backyard biology

Although the compound noun *backyard biology* has not yet been inscribed in dictionaries, a search for the term shows that it is used by actors in the field of education and environmental awareness. In this context it refers to a subset of outdoor activities for children and young adults concerned with the scientific observation of living organisms and natural phenomenon in areas of proximity, where urban and natural elements coexist. As stated on a website entitled backyard biology, ‘it is not necessary to travel to exotic places to enjoy nature. Every backyard woodlot or neighborhood stream abounds with living creatures with interesting stories to tell’[39]. Finally in some rare cases the term is used as a synonymous of particular citizen scientist's activities as part of wild life research projects[40] or to refer to conservation biology research projects studying the impact of gardens as repositories of biological diversity[41] or the causes of ecosystem invasion by non-native plants[42].

As the in use meaning of *backyard biology* has been briefly exposed; the following paragraphs address what is specifically meant by *backyard biology* in the context of Make:magazine.

3.2 The representation and celebration of the backyard in Make:magazine

The ‘backyard’ as a place and a theme was part of Make since its first issue. As an example the column

---

39 Viewed 1 October 2011, <http://www.backyardbiology.net/aboutBYB.shtml>

40 M Reece, 'A Breakthrough in Backyard Biology Essex man gets $260,000 grant for wildlife transmitter technology, growing interest in birdhouse mon', May 2011, *Flathead Bacon*, viewed 1 October 2011, <http://www.flatheadbeacon.com/articles/article/a_breakthrough_in_backyard_biology/23145/>.

41 G. Galluzzi; V. Negri, 'Contribution of backyard gardens to conservation of biological and cultural diversity and to human well-being', *Acta Horticulturae*,No. 881, 2010 pp. 179-183.

42 A. Marco; S. Lavergne; T Dutoit,V Bertaudiere-Montes, 'From the backyard to the backcountry: how ecological and biological traits explain the escape of garden plants into Mediterranean old fields', *Biological Invasions*, Vol. 12, No. 4 2010, pp. 761-779.

Made on Earth: Report from the world of backyard technology', published since the 1st edition of Make:magazine and it is entirely dedicated to the presentation of 'the maker' culture as it extends to the domesticated exterior of the 'backyard'[43]. In the backyard too, the appropriative act of making marks the threshold where the different value between impersonal incoming objects and personal home-made objects is negotiated[44]. After the basements, the workshops, the garages and the kitchens, the backyards are also celebrated as place of homemade personal production[45]. Given these preamble how the category of backyard biology is used in Make?

3.2 Biology as a backyard biology personal technology

The composition of the Backyar Biology issue cover marks a first and important distinction. A zoomed image portrays two impersonal hands: one holding a lily while the other is holding a pair of tweezers near the lily's stamens, where the pollen is stored. The picture figures the act of removing the stamens – 'emasculation (ouch)' as described by the editors, a sometime required step before hand pollination[46]. If the choice of the impersonal hand is a classical way to represent the possibility to participate[47], in this context the image is also a visual celebration of a new diversification of the act of 'making'. This is a first for Make:magazine, the media upon which the act is performed is not an electro-mechanic device,

---

43 Made on Earth, viewed 24 October 2011, <http://Makezine.com/made/>

44 The Oxford Dictionary definition of backyard includes a note on the informal usage of the term as "the area close to where one lives, regarded with proprietorial concern: children must be made aware of environmental issues in their own backyard". Viewed 15 October 2011, <http://oxforddictionaries.com/definition/backyard>

45 Make Issue 18th "Re-Make America" is where this ideal is the most explicitly expressed. The text presenting the issue states: "ReMake America! These challenging times have presented us with a rare chance to try out new ways of doing things. The opportunities for Makers are terrific — we can start at home to reMake manufacturing, education, food production, transportation, and recreation. In Make Volume 18 you'll learn how to Make an automatic garden, heat your water with the sun, monitor and share your home energy usage, and more". Viewed 13 October 2011, <http://Makezine.com/18/>

46 Cover, Make:Magazine, Issue 7 Backyard Biology, 2006, O'Reilly Media Inc.

47 F .Panese, 'Doctrine des signatures et technologies graphiques au seuil de la modernité'. *Gesnerus*, 60(1-2), 2003, pp. 6-24.

but a colorful and imposing flower. For a magazine focused since its launch on electro-mechanical and digital technologies ‘the maker’ and the lily form a new and peculiar figurative pair whose relation needs to be explained. The image is therefore combined with the exhortation ‘hack *your* plants’ followed by the proposal of ‘nine backyard biology projects’.

Hand pollination, a classical technique used in horticulture since the 19th Century[48], becomes a ‘hack’ and ‘hacking’ plants becomes a ‘backyard biology' activity. The category of living as a media upon which a ‘hack’ can be performed is further expanded from plants to bugs, ‘living stuffs’ and biology at large[49]. At page forty-two, in a section entitled Proto ‘Profiles of corporate Makers who have managed to parlay their hacker sensibility into a career’, Drew Endy a leading figure of the emerging field of synthetic biology is portrayed[505152]. The piece entitled ‘Garage Biotech’ describes a Drew Endy irritated by bugs: ‘this object should be editable’, shortly after ‘Why can’t I just hack this stuff?’ and ‘[..] if engineers can only see that biology is simply another substrate to hack’. Reused by the journalist, the term comes up later ‘degree in hand, Endy left school to hack more living stuffs’[53].

Furthermore in the article Drew Endy explains ‘Biology just isn't that hard. You just have to poke and

---

48 J. Arditi, N. Adisheshappa and H. Nair, 'History-Pollination Hand-Pollination of Vanilla : How Many Discoverers?' *Orchid Biology: Reviews and Perspectives*, 2009, pp. 233-249.

49 Other than in reference to biological entities, Make is an important channel promoting the semantic displacement of the term “hack” to describe other activities that do not always involves electronics or informatics. A short but illustrative list of examples is given here: Curtain rings used to hang bananas becomes *banana hook hack* (P. Torrone, 'Banana Hook Hack', Make:magazine blog, 2006, viewed 18 October <http://blog.Makezine.com/archive/2006/11/banana-hook-hack.html>), taking macro pictures by mating lenses together is referred as *a macro lens hack* (C. Culling, 'How to – Macro lenses hack', Make:magazine blog, 2008, viewed 18 October <http://blog.Makezine.com/archive/2008/09/how-to-macro-lens-hack.html>) hack can be performed on knitting machines (J. Baichtal, 'Gears of War Lego Hack', Make:magazine blog, 2011, viewed 18 October, <http://blog.Makezine.com/archive/2011/10/gears-of-war-lego-hack.html>), and Legos can be used to hack (J. Baichtal, 'Gears of War Lego Hack', Make:magazine blog, 2011, viewed 18 October <http://blog.Makezine.com/archive/2011/10/gears-of-war-lego-hack.html>).

50 E. Drew, 'Foundations for engineering biology', *Nature* 438, 2005, pp. 449-453.

51 E. Drew, 'Synthetic biology: Can we Make biology easy to engineer?' *Industrial Biotechnology'* , 2008, 4(4), pp. 340-351.

52 H. Bügl, J. P Danner, R. J. Molinari, J. T. Mulligan, H. Park, B. Reichert, D. A. Roth, R. Wagner, B. Budowle R. M. Scripp, J. A. L Smith, S. J. Steele, G. Church & D. Endy 'DNA synthesis and biological security', *Nature Biotechnology,* 25, 2007, pp. *627 – 629.*

53 *R. Parks, 'Garage Biotech – For a safer world, Drew Endy wants everyone to engineer life from the ground up', Make:Magazine,* April 2006, *pp. 42-45.*

prod and see what happens'. The exhortation, highlighted in red in the article, declassifies biology as a science but also suggest that 'hack' when used in the context of biology becomes a 'poke and prod' heuristic[54]. The informational and digital epistemology of biology has again mutated to be thought thought the term 'hack'[5556]. This representation could be understood as yet another move toward what Haraway expressed as the "translation of the world into a problem of coding, a search for a common language in which all resistance to instrumental control disappears"[57].

Nonetheless as the content analysis of the Backyard Biology section will further highlight, Make:magazine editorial culture is tool oriented and focus on small scale technologies as mediators. The expression 'back-to-the-tool' seems again a more inclusive attempt to reconsider the emerging role of 'instrumental control'. Also through the words of Drew Endy, engineering biology as a 'hack' comes to sustain another ramification of making 'There's a visceral satisfaction to making a physical object. But the first time I cut and spliced a piece of DNA, I felt the same joy of making something. I was like, ''Holy crap! It works!'"[58].

As the eleven pages that separate Drew Endy's portrait and the Special Section: Backyard Biology, are filled with the journal usual content, 'backyard biology' becomes simply part of it.

The nine 'backyard biology' projects are spread among the five articles of the Special Section. Together the articles brings up-to-date a specific representation of science by promoting the figure of the 'solitary' and anti-institutional scientist as a Maker[59] [60], in opposition to the

[54] E. Fox Keller, 'The Biological Gaze', in *Future Natural.* Ed. Sally Stafford. Routledge, 1995.

[55] J. D. Harraway 'Gene: Maps and Portraits of Life Itself', in Haraway J. D. *Modest_Witness@Second_Millenium.FemaleMan©_Meets_Oncomouse™*, Routledge, 1997, pp. 131-173.

[56] E. Fox Keller, 'Making Sense of life: Explaining Biological Development, Models, Metaphors and Machines", Harvard Press, 2002, pp. 123-173.

[57] J. D. Harraway 'A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century", in Haraway J. D. *Simians Cyborgs and Women the reinvention of nature.* New York; Routledge, 1991, pp. 149-181.

[58] Parks, 2006.

[59] C. Platt, 'Life and Death at Low Temperatures: How to freeze and revive garden snails', *Make: Magazine*, April 2006, pp. 54 – 56.

[60] M. Kuniavski, 'A sublime machine: Mike Wilder Makes Lego robots for time-lapse 3D videos of carnivorous plants', *Make:Magazine*, April 2006, pp 56 -58.

institutionalized elitist experts not to be listen to[61]. Cryobiology is also portrayed as a transgressive activity ‘challenging conventional concepts’ such as death[62]. Molecular biology unveils the ‘extraordinary and miraculous blueprint of life itself’[63]. The agency of horticulture is exhorted as ‘hack your plants!’ and ‘play God in your garden’[64] and finally the use of mycology techniques to cultivate mushrooms is portrayed as a ‘cultural revolution’[65].

By crafting terms such as ‘backyard cryobiologist’ and’ backyard biologist’ the authors also reclaim the possibility for the *everybody* in the journal’s readership to become actors in the techno-scientific community. If reading and appreciating techno-scientific progress, in this case related to biology and reproducing outdated but foundational experiments are classical pedagogical tool in the area of science vulgarization[66], the authors propose a figure of experimental self-sufficiency relaying on gathering and assembling tools.

By focusing on the fabrication of research tools, while giving little information about how these tools are used and on what knowledge they relay, the ‘backyard biology’ become a linguistic laboratory of self-sufficiency. As all the proposed activities are presented from the perspective of ‘the maker’ agency, none of these projects would have previously been presented as a backyard biology activity. The imagery of the backyard is no more the one of a place where the backyard biologist can meet ‘living creatures with interesting stories to tell’[67] but become a place of experimentation and production. There, life and death can be given or taken, wondrous plant growth is matched by being experienced through

---

61 Kuniavski, 2006.

62 Platt, 2006.

63 C. Shawn, 'Kitchen Counter DNA Lab, Extract, purify, and experiment with the blue print of life', *Make:Magazine*, April 2006, pp 59 – 64.

64 R. Luhn, *'Hack Your Plants! Play God in your garder - create custom fruits, flowrs, veggies, and more', Make: Magazine*, April 2006, pp 70 – 76.

65 P. Ross, 'Home Mycology Lab', *Make:Magazine*, April 2006, pp 100 – 110.

66 B. Schiele, D. Jacobi, 'La vulgarisation scientifique. Thèmes de recherche ", dans Daniel Jacobi et Bernard Schiele (dir.), *Vulgariser la science. Le procès de l'ignorance*, Seyssel, Champ Vallon, coll. " Milieux ", 1988, p. 12-46.

67 Viewed October 2011, <http://www.backyardbiology.net/aboutBYB.shtml>

robotic 3D imagery, the blueprint of life itself can be, not only extracted and quantified with widely available household products but also duplicated and analyzed with homemade gel boxes and PCR machines[68]. Finally when the act of making is technologically weak, meaning it requires few tools as in the case of grafting and hand pollination, it is reinforced by being called a 'hack'.

As such the meaning of 'backyard biology' is specifically extended, if outside Make, 'backyard biology' activities are characterized by the act of observation, they now become through the use of the term 'hack' a synonymous for intervention and experimentation.

This is not a moral argument trying to qualitatively position the differential value that the category of 'backyard biology' is given to perform in Make. But a first attempt to describe how by inscribing pre-existing subjects such as cryobiology, molecular biology, horticulture and mycology as 'backyard biology', Make:magazine editors extend the claim for the right of 'adapting technology to our needs and integrating it into our lives' to biology at large[69]. As 'biology' is crafted into a subject of interests for Make:magazine readership, its experience needs to be mediated by technological manipulations. It is from the 'backyard' that biology enters the home and becomes a media for personal experimentation. As such, the yet not clearly localized device of the home laboratory becomes part, with the basement, the home workshop and the garage, of the American myth of homemade innovation. Additionally as the Backyard Biology issue was published two years before the first official meeting of the DIYbio network, its content can be understood as a discursive precursor to both the expansion of the term 'hack' to living media and DIYbio network constitutive claim of 'making biology an accessible pursuit for citizen scientists, amateur biologists and biological engineers who value openness and safety'[70].

---

68 J. Nakane, B. Keddie, P. Danielson, J. Fox, Y. Shirazu, D. Lee, E. Abd-Elmessih and D. Ng (UBC Advanced Molecular Biology Lab) 'Home Molecular Genetics: Extract, fingerprint, and replicate your DNA', *Make: Magazine, April 2006, , pp 65 – 71*.

69 D. Dougherty, 'The Making of Make', *Make:Magazine*, January 2005, p.7.

70 From DIYbio website main page, viewed 4 October 2011, <http://diybio.org/>

4. Snapshot three: Maker Faires, DIYbio and the gathering of a public

This last section will briefly describes the role of Make Faires's community culture, in particular the importance of gathering to experience the act of making. Thereafter by presenting the progressive and enthusiastic participation of the DIYbio network's members to Make Faires, this section explores how they came to belong to 'the maker' culture, and experience themselves as 'makers' while 'makers' become one of their public. These descriptions are informed by preliminary interviews with members of the DIYBio network and participants observations of Newcastle and Bay Area's Maker Faires held in 2011.

4.1 Maker Faires as family friendly 'forum of production'

A prototype of the Maker Faire[71] model was first tested in 2005 at the O'Reilly Emerging Technology Conference. As Arwen O'Reilly Griffith, daughter of CEO Tim O'Reilly and staff editor at Make:magazine reported: 'Geeks gather together for an evening of DIY fun in our first-ever mini MAKE Fest'[72]. As the event was considered as a success, in April 2006 on the San Mateo Fairgrounds, at the hearth of the San Francisco Bay Area, the first Maker Faire took place.

Only five years later more than twenty Maker Faires and Mini Maker Faires have been organized among the USA, Canada, UK and Egypt. While according to the organizers this year original Bay Area Maker Faire was visited by more than 70'000 attenders.

On the event website, Maker Faire is presented as 'the premier event for grassroots American

[71] As another example of Make use of language as a craft, is the choice of the term "faire" that in French can mean both to do and to Make. Viewed 3 August 2011, < http://ebMakerfaire.wordpress.com/tag/Maker/>

[72] A. O'Reilly Griffith, 'Maker Fair: Maker Fair: Geeks gather together for an evening of DIY fun in our first-ever mini MAKE Fest at the O'Reilly Emerging Technology conference in 2005. Make;magazine Vol.2, pp 38'

innovation. As the World's Largest DIY Festival, this two-day family friendly Faire has something for everyone - a showcase of invention, creativity and resourcefulness and a celebration of the Maker mindset". Richard Metzger, a long lasting writer for Wired and Boing Boing, defined the Maker Faire as the 'Woodstock of DIY'[73].

After its first edition, in a short and personal report entitled 'Genuine Ingenuity' and published in the Make issue Backyard Biology, Make Faire founder Dale Dougherty, recalls the value of gathering:

'The new interest in DIY is more than just fun; it is part of a deeper search for authentic experiences, something our contemporary culture just doesn't offer enough of. Maker Faire was highly engaging. Unlike so many tech events, there was no one sitting in a corner with a computer checking email or Iming someone. Everyone was fully present, in body and spirit, kids and adults alike'.[74]

As isolated instant messaging (Iming) becomes an anecdotal fragment of what Dale Dougherty's critically experiences as a form of digital disembodiment, Maker Faires community culture becomes its antidote. The fair organized around the communal core of the family, is where to embrace the bonding experience of 'grassroots American innovation'[75].

4.1 DIYbio network members becomes makers and makers becomes a public for DIYbio

It is at the 2009 Bay Area edition, entitled 'Re-Make America', that Tito Jankowski a major actor of the then emerging Bay Area DIYbio network, had his first sign up for a booth accepted. Over two days Tito ended up supervising almost one thousands DNA extractions from visitors' saliva[76].

[73] Metzger, 2010.
[74] D. Dougherty, 'Genuine Ingenuity', Make:Magazine, January 2006, p. 48.
[75] Dougherty, 2006.
[76] Personal conversation, 15 October 2011.

As Maker Faire spread, local members of the DIYbio network became regular participants. Ten month later the second European Maker Faire was held at Life - Science's Centre, during the Newcastle Science Fest. This was the first occasion for two Europe based members DIYBio network, Brian Degger and Cathal Garvey to physically meet. They co-hosted a booth and proposed a DNA extraction from kiwi with household's reagents. Brian 'a scientist, part time cryptozoologist, interdisciplinary researcher and artist'[77] constructed a DIY magnetic spinner at the table. As Cathal, a recently graduated student in genetics, was prevent by air company policies to bring his bioluminescent bacteria over, he could only showcase the rotor of its first invention, the Dremelfuge[78] and his printed protocols explaining how to isolate luminescent bacteria from squids. Their proposition captured the attention of a journalist from the British Broadcasting Corporation (BBC), who diffused the video of the DNA extraction on their website[79]. In December of the same year, Cathal's Dremelfuge was also featured in a Make Blog in a post form Becky Stern, the Associate Editor and video producer of Make blog.

Two month later Bay Area DIYbio member held again a booth at the San Mateo Maker Faire. This time Tito Jankowski was in company of OpenPCR co-founder Josh Perfetto, a software engineer and autodidact biotechnologist. As part of a workshop entitled 'Hate Brussels Sprouts? Blame your genes!' and based on a Singular Nucleotide Polymorphism (SNP) genotyping experiment, they showcased the Open Gel Box 2.0[80] and the OpenPCR, the 'Open Source, hackable PCR machine'[81]. Although they presented the first prototype, more than ten visitors signed up pre-orders for the OpenPCR, their

---

77 From Brian Degger personal web page, viewed 18 October 2011, <http://transitlab.org/about>

78 Upgrading Dremel renowned versatility, Cathal designed rotor with open source software CAD, 3D printed it with his Makebot, screwed it to the spinning head of his Dremelfuge and used is as centrifuge.

79 M. Ward, 'Tech Know: Life hacking with 3D printing and DIY DNA kits', *Live BBC New Channel*, March 2010 , viewed 17 October 2011, <http://news.bbc.co.uk/1/hi/technology/8595734.stm>

80 The Open Gel Box is an open source hardware used to "run"agar gels. Viewed October 2011, <http://www.pearlbiotech.com>

81 The OpenPCR is an open source hardware used to produce the poly chain reaction (PCR), a chemical reaction used to dublicate sample of DNA. Viewed 12 October 2011, <http://openpcr.org/>

motivation was boosted[82]. At the booth nearby, Ery Gentry and Joseph Jackson co-founder of Biocurious –'the Bay Area biology collaborative lab space' distributed leaflets presenting the project at its early stage and advertising membership deals.

In the autumn of the same year, three members of the DIYbio NYC network were invited by Ben Dubin-Thaler funder of the Biobus[83] to participate to the World Maker Faire, held at the New York Hall of Science. Dan, Russ and Ellen proposed to the visitor of their booth to join the 'DNA extraction Party' where they could extract DNA from strawberries. An account of the activity was published on Make:magazine Blog[84] by Ery Gentry[85]. As Genspace member recall their participation to the event, Dan mentions, 'I remember how amazing it felt to join this group of Makers. A home coming of sorts'.[86]

This year members of the DIYbio network participated at least to five different Maker Faires, respectively in Newcastle, San Mateo - Bay Area, New York, Brighton and Cairo.

As Cathal left 2010 Newcastle's Maker Faire with the impression he didn't showed much, 'next Maker Faire I said no, let's do this properly I have more time to prepare – and the next year we had a load of stuff on the table'[87]. The organizers sign presenting the booth entitled 'DIYbio/IndieBiotech'. The short text mentioned 'you can learn to grow some awesome microbes using only equipment and ingredients from your department store. Perhaps the next RadioShack will be "BioShack"?'[88] Wearing a thick pair

---

82 Personal conversation, June 2011.

83 Biobus is "a high-tech laboratory on wheels" aimed to bring "hands-on science education to communities that rarely have such opportunities", viewed 2 October 2011, <http://biobus.org/about-us/>

84 Since September 2010, Ery and Tito were invited to regularly post on Make Blog as Citizen Science Guest Authors. Ery and Tito blog post on Make Blog has since also included announcement for events taking place at Biocurious, viewed 11 October 2011, <http://blog.Makezine.com/archive/author/tito_jankowski>

85 G. Ery, "DIYbio NYC on the Biobus", Make:magazine Blog, 2010, viewed 3 September 2011, <http://blog.Makezine.com/archive/2010/10/diybio-nyc-on-the-biobus-1.html>

86 Personal conversation, 12 October 2011

87 Interview, 29.11.2011

88 Radioshack is an American franchise of retail electronic with branches in Europe, South America and Africa. Viewed in October 2011.

of red rubber glows and casual cloths, Cathal displayed the essential elements of his own home made laboratory. Under his sterile homemade hood[89], participants were invited to inoculate a potato starch media petri dish with a culture of *bacillus subtilis.* While Cathal recalls his last Maker Faire's favorite moments, he explains:

'Where the message of DIYbio which is probably the wrong message to say "you can do science too!", I think a better message is what make scene is doing as a start, to no even mentioning the word science, let's do DNA extraction, let's sequence your DNA, let's hack that bacteria, let's program that petunia, it is not science it's hacking, it's making, it's playing, it's fun'[90].

From his participation to what he calls the *make scene*, Cathal realizes that by removing the word science or stereotypical representations such as the lab coat, he could allow visitors to experience science, in his case microbiology and genetics as common, normal and belonging to the familiar and innovative space of the house.

This year Bay Area Mateo Maker Faire was entitled 'Take the world in your hand'. DIYbio presence and proposition was larger and more sophisticated. Under the new phrase 'explore the world of biotech on your desktop!' Tito and co-founder Josh presented their progress on the almost ready to ship OpenPCR. They didn't proposed any experiments, instead they advertised their first social outreach project. The '7 Days 7 Schools' initiative, aimed to raise money to deliver seven OpenPCR machines in schools around the world. In respect to his participation to Maker Faires Tito felt that although other attenders interest were different, they all shared the same level of passion, while he couldn't felt the

<http://www.radioshack.com/home/index.jsp

89 Cathal produced the home made hood by following the instruction in "Home Mycobiology Lab" project by Phillip Ross, in Make:magazine Backyard Biology Issue, Vol 7. Personal conversation, 19 October 2011.

90 Interview, 29 November 2011

same at any other events focused on biology that he attended in the past[91].

At the adjacent booth five funding members of BioCurious, rebranded ‘a hacker space for biotechnology’, proposed to observe slides of mouse brain tissue, worms and onion skin under the microscope, to test the production of electricity from Winogradsky columns and to win free classes at BioCurious by taking a picture in an empty hole of BioCurious ‘Mad Scientist Hall of Fame’. At the end of the day Biocurious was given the Maker Faire Education Award [92] and a couple of month later a video-interview of Ery Gentry presenting Biocurious at the Maker Faire was posted in Make:magazine Blog[93]. Ery’s motivations were taint with pragmatism: ‘I was told Maker Faire was a good way to expose many people to Biocurious. Since it was important to get support, I went’. She also thought that their proposition was ‘atypical but fits in, as it is diy and the audience seems to embrace science and hackerspaces’[94].

Finally last month GenSpace was invited to Maker Faire Cairo, the third event of the Maker Faire Africa series. There Ellen, Oliver and Sung (two other co-founder of Genspace) proposed two, three our long, workshops and a talk. The workshops proposed to practice personal genotype using SNP sequences and build ‘hacked biotech equipment’. While the talk presented preliminary work on software aimed to facilitate the downloading and use of sequences from the BioBrick registry[95]. Sung, an undergraduate student in physics recalls ‘well preparing for that event was actually the trial by fire of belonging to DIYbio’ but also that ‘Genspace participation in Maker Faire was a great idea. I felt

---

91 Personal conversation, October 2011.

92 Personal conversation, May 2011.

93 M Brokelynn, 'Biocurious: Eri Gentry', 2011, On Maker blog, 6 October 2011, viewed 7 October 2011 <http://blog.Makezine.com/archive/2011/10/biocurious-eri-gentry.html>

94 Personal conversation, October 2011.

95 ‘The BioBricks Foundation (BBF) is a not-for-profit organization founded by engineers and scientists from MIT, Harvard, and UCSF with significant experience in both non-profit and commercial biotechnology research. BBF encourages the development and responsible use of technologies based on BioBrick™ standard DNA parts that encode basic biological functions.’ Definition from ‘*Going Synthetic: how scientists and engineers imagine and build a new biology*
Caitlin Cockerton, PhD Thesis, London School of Economics, 2011

like we really belong there'[96].

While Oliver who could only participate to Maker Faire Africa, in Cairo mentioned 'Maker Faire is more like a science festival – flee market'. Later while speaking about his relation to 'the maker' movement he expressed:

'I wish I was a maker, I wish I had my workshop outside Genspace, I wish I was tinkering out more, building my own car, it is ingrained in American culture, and I appreciate the movement. That whole core principle of self-sufficiency it is a very protestant American core principle and in that sense I think it is immensely positive'[97].

As Dale Dougherty has expressed in his talk at Ted@MotorCity, 'we have been organizing makers at our Maker Faires'[98]. Similarly to how Fred Turner describes the Burning Man (which statues and installations are also showcased at Maker Faire) with the expression 'the festival becomes the factory', Maker Faire is a science and technology festival, a family market, and a 'forum of production' where social networks are formed and performs once attenders goes back to their daily life[99].

Although DIYbio members have participated to numerous other events; Maker Faires have become a referential event. From their participation members of DIYbio receive immediate benefits such as: the possibility to physically meet other member, receive important media coverage, attract new members, to showcase their products in development to get financial support but also to sell them.

More importantly, in the course of their participation, members of the DIYbio network comes to share,

---

96 Personal conversation, October 2011.

97 Personal conversation, October 2011.

98 D Dougherty, 'We are Makers', in TED, January 2011, viewed 7 August 2011, <http://www.ted.com/talks/dale_dougherty_we_are_Makers.html>

99 F. Turner, 'Burning Man at Google: a cultural infrastructure for new media production' in New Media Society , 11, 73, 2009, p. 89, SAGE.

with their peers, the artefacts they have manufactured and they learn how to narrate what is DIYbio so to engage *makers*. As pointed out by Jennifer Reardon in the case of the politics of personal genomics (Reardon, 2011), DIYbio network members are similarly struggling to define who is the 'persons' and the 'biologies' in 'personal biology'[100]. In this moment of uncertainty, *makers* become a referential public through which DIYbio members can exercise their vision of a personal biology open to everyone and experience their belonging to a much larger and organized movement.

5. Conclusions

Rather than recapitulating evidences and arguments presented in the paper, the conclusive section will propose to contextualize this work as part of the special issue theme: 'expanding the frontiers of hacking'.

As the content analysis of Make's the Backyard Biology issue illustrates, the magazine, as an information technology is at least one precursor in constituting and diffusing a representation of biology as 'hackable'. Biology as a technology is framed, perpetuating and actualizing the Whole Earth Catalog and lately digital generation's techno-libertarian tradition, as personal technology for 'individual consciousness'[101]. But more importantly as this new representation emerges it is immediately reabsorbed as part of the figure of 'the maker'. This figure becomes a federative imagery in which the techno-libertarian vision of personal technologies as tools for social change and the American middle class romantic vision of DIY as homemade innovation and self-sufficiency come once more to coexist.

While the 'expansion of the frontiers of hacking', as described in Otto von Bush and Karl Palmas work,

[100] J. Reardon, "The 'persons' and the 'genomics' of personal genomics", *Personalized Medicine* 8(1), 2011, pp. 95-107.
[101] Turner, 2006, pp 73-78.

is understood as a contemporary critique of the ‘dominant technologies’. The critique is not only characterized by the necessity to acquire an active ownership of the technology but it requires the understanding of the technology’s politics of production and its influence over the organization of the social[102]. In this respect the actualization of the techno-libertarian ideal as it infuses the figure of ‘the maker’ and the *modern DIY* activities it gathers, is still embedded in the Californian grassroots innovation culture[103]. As the DIYbio network members recognize themselves as *makers*, they bound to the vision of biology as a personal technology, by becoming an important vehicle of the expanding representation of biology as ‘hackable’.

Crafting the expression 'the making of an hackable biology' is an introductive and conclusive attempt to linguistically enclose the recursive politics of a social group where subjects are valued in relation to the specific objects they manufacture, and where biology also become a tool for the manufacturing of subjectivities.

Acknowledgments

This article was inspired by early comments from Alain Kaufmann, Marc Audetat and Severine Trouillou. While Sarah Franklin and Sara Aguiton provided patient and engaged reading. Sally Haywill and Ricardo da Silva helped me to improve my writing.

[102] O. Von Bush, K. Palmas, 'Abstract haktivism, the making of a hacker culture', 2008 <http://www.isk-gbg.org/abstracthacktivism/?page_id=2>

[103] J. Heath, A. Potter, 'The rebel Sell: how counter culture became consumer culture': Capstone, Leicester, 2005