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Transnationality, Morality, and Politics of Computing Expertise

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Doctor of Philosophy in Anthropology

by

Luis Felipe Rosado Murillo

2015

ABSTRACT OF THE DISSERTATION

Transnationality, Morality, and Politics of Computing Expertise

by

Luis Felipe Rosado Murillo

Doctor of Philosophy in Anthropology

University of California, Los Angeles, 2015

Professor Christopher M. Kelty, Chair

In this dissertation I examine the alterglobalization of computer expertise with a focus on the creation of political, economic, moral, and technical ties among computer technologists who are identified by peers and self-identify as "computer hackers." The goal is to investigate how forms of collaborative work are created on a local level alongside global practices and discourses on computer hacking, linking local sites with an emergent transnational domain of technical exchange and political action. In order to advance an understanding of the experience and practice of hacking beyond its main axes of activity in Western Europe and the United States, I describe and analyze projects and career trajectories of programmers, engineers, and hacker activists who are members of an international network of community spaces called “hackerspaces” in the Pacific region. Based on ethnographic research at community spaces, professional meetings, and informal gatherings I pursue the question of the conditions for cultivation of skills, moral sensibilities, and political orientations which allow for active participation in computer expert collectives. Drawing from ethnographic work, I suggest that “hacking” has become a global rubric for disparate cultural practices due to the confluence of Free and Open Source technologies and elite technologists with local community centers to support pedagogical practices for technical experimentation and political formation. In describing global and local level applications of computing expertise, I demonstrate how hackerspaces and computer technologists are, respectively, formed at cross-cultural contact points with the project of rearranging, challenging, and transforming established technical practices, infrastructures, and political imaginaries.

The dissertation of Luis Felipe Rosado Murillo is approved.

Mariko Tamanoi

Yunxiang Yan

Sharon Traweek

Christopher M. Kelty, Committee Chair

University of California, Los Angeles

2015

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VITA

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Curie, Morgan; Murillo, Luis Felipe R.; Kelty, Christopher. 2013. "Free Software Trajectories: from organized publics to formal social enterprises?" In: *Journal of Peer Production*, n. 3. ISSN: 2213-5316 (*authors in alphabetical order*).

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Murillo, Luis Felipe R. 2015. "Distributed Expertise and Responsibility in Open Source Radiation Monitoring" In: Fortun, Kim and Scott Knowles (org.). *Disaster STS Handbook.* Philadelphia: University of Pennsylvania Press (*forthcoming*).

Murillo, Luis Felipe R. 2013. "Free and Open Source Software". In: *The Johns Hopkins Encyclopedia of Digital Textuality.* Lori Emerson, Benjamin Robertson and Marie-Laure Ryan (ed.). Baltimore: The Johns Hopkins University Press.

Murillo, Luis Felipe R. 2010. "Política, Cultura e Tecnologia na Comunidade Brasileira de Software Livre e de Código Aberto" In: Leal, Ondina Fachel and Souza, Rebeca V. (org.). *Do Regime de Propriedade Intelectual: Estudos Antropológicos*. Porto Alegre: Tomo Editora.

LIST OF ACRONYMS

ASIC	Application-Specific Integrated Circuit
BBS	Bulletin Board System
CC	Creative Commons
CNC	Computerized Numerical Control
DSL	Dim Sum Labs
FISL	Forum International Software Livre
FLOSS	Free/Libre and Open Source Software
FOSS	Free and Open Source Software
FSIJ	Free Software Initiative Japan
FTDI	Future Technology Devices International Ltd.
FTP	File Transfer Protocol
GCC	GNU C Compiler (GNU Compiler Collection)
GPL	General Public License
GNU	Gnu's Not Unix project
JUNET	Japanese University/Unix Network
IDE	Integrated Development Environment
IT	Information Technology
IPA	Information-technology Promotion Agency, Japan
IPR	Intellectual Property Regime
IP	Intellectual Property
MCU	Micro-Controller Unit
METI	Ministry of Economy, Trade and Industry, Japan
MRI	Mitsubishi Research Institute
NB	Noisebridge
NGO	Non-Governmental Organization
NPE	Non-Practicing Entity
OSHW	Open Source Hardware
OSS	Open Source Software
PCB	Printed Circuit Board
STEM	Science, Technology, Engineering, and Mathematics
THS	Tokyo Hacker Space
UNICAMP	Universidade Estadual de Campinas
UUCP	Unix-to-Unix Copy

Au fond, ce sont des mélanges. On mêle les âmes dans les choses; on mêle les choses dans les âmes. On mêle les vies et voilà comment les personnes et les choses mêlées sortent chacune de sa sphère et se mêlent: ce qui est précisément le contrat et l'échange.

Marcel Mauss, Essai sur le don

INTRODUCTION

One of the key questions of our technological present and future concerns the digital mediation of social, economic, political, and intimate relations. Conditioning and yet potentializing collective lives in the contemporary, emergent sociotechnical projects delineate and substantiate the moral and the political, complicating established interpretative frameworks in anthropology. Due to increased acceleration of social life with multi-scalar interconnection between events and processes, canonical conventions of ethnographic fieldwork have been challenged, inciting new research problems, demanding new modes of engagement.

One of the main questions in this historical problem space is related to the contemporary production, circulation, and deployment of digital technologies with particular forms of expertise. Lévi-Strauss identified an elementary form of this questioning in Saint-Simon who, "in announcing the passage from the government of men to the administration of things [...], anticipated [...] the conversion which advances in information theory and electronics allows us to see at least as a possibility, the conversion of a type of civilization which once inaugurated historical development, but at the price of transforming men into machines to an ideal society which would succeed in turning machines into men" (Lévi-Strauss 1983:30). Having the backdrop this modernist utopian projection, digital technology has been broadly conceived as one of the building blocks of new sociocultural formations. Connecting remote locations, providing platforms for political mobilization, and integrating local economies and global capital, information technologies (IT) can be better understood anthropologically, I suggest, as embedded in particular historical and cultural relations of production and circulation of gifts, commodities, and technoscientific agents.

Concomitant with the expansion of information and communication infrastructures, computer expertise has become a politicized skill-set, encompassing under a common rubric distinct institutions, instruments, practices, and moral orientations. This common rubric is that of "hacking" whose agent has been depicted in various narrative positions as trickster, rebel, government ally, occultist magician, or virtuous technologist and architect of new sociotechnical formations. What counts as hacking today? Why is this question worth asking from an anthropological perspective? Computer experts have not only come to exercise an ever-increasing degree of technical power in contemporary Euro-American societies, but also to help challenge established institutional practices. In the past three decades, political events involving the dispute over access to information and communication infrastructures brought invisible computer collectives to the attention of mainstream media, creating a spectacularized version of the cultural practice of hacking. The term itself has served as an identifier for a fairly heterogeneous set of practices with either positive or negative overall valence: in the 1960's it was loosely identified with direct action for access to information on telephone networks; in the 1970's it was associated with a particular set of skills of expert computer engineers working for well-funded research centers; in the

1980's the term shifted from a positive to a negative connotation and started to circulate among underground groups of adolescent computer enthusiasts; from the 1990's to the present, it has been used increasingly to identify cosmopolitan practices of software development as well as emergent forms of political action. These collective historical experiences took root primarily in North America and Western Europe only to become a transnational identifier for specific computing, engineering, and political practices worldwide with the popularization of commercial Internet access in the mid-1990's. Competing definitions of hackers as computer criminals or virtuous technologists who guide themselves by the high value of self-wrought, unmediated technical education and the fierce defense of autonomy from institutional constrains to explore technical systems have become objects of public discourse. As a practical symbol, hacking has constituted a form of cosmopolitanism which has been sustained through the circulation of computer professionals and hacker activists, developers and engineers, information security professionals and enthusiasts alongside the products of their digital labor.

There has been a flurry of publications on hacking "everything" in the past decade from cooking to household appliances, agriculture, industrial production, human bodies, health, finance, biology, journalism, education, disaster response, financial systems, civic engagement, autonomous and institutional politics. Governments are no longer passive victims of cyber-attacks but have become main perpetrators and financiers of a virtual instance of heated geopolitical dispute. They have also come to be identified as partners (or potential partners) of "civic hackers" and companies in the role of information providers through Open data initiatives. Hacking has also been confused with the practice of organized electronic crime. It has become a market-place for selling information on unpublicized security flaws by information security consultants. For Internet companies, the term has been used to index both ordinary software development and extraordinary technical skill. Public relations campaigns around the company Facebook, for instance, have branded it as the "hacker company." The street that leads to its corporate buildings in the working-class neighborhood of East Palo Alto carries the name of "hacker way." In a generous characterization offered by its CEO "hacking just means building something quickly or testing the boundaries of what can be done." In the longest *dureé* and according to this definition, "hackers" are, put simply, "doers[1]" which syllogistically entails that they have been around since the creation of our mode-1 stone tools some 1.3 million years ago (Clark 1969).

Beneath the tame surface of IT companies' public relations, there have been charged disputes over the legitimacy to define and translate the hacker identity and stigma across several domains of practice. Consider a contemporary instance from the antagonistic side of the IT industry, the so-called "hacker underground." In a recent interview to one of most influential underground publication venues, the Phrack zine, a controversial hacker declared the death of the underground. Using an overt racist and misogynistic tone, he sentenced that "nowadays it is claimed that the Chinese and even WOMEN are hacking things." According to his definition, "hacking" is exclusionary and exclusive since hackers "are people who gain unauthorized access to computer

1 Source: http://notes.fundersandfounders.com/post/50417296471/who-are-hackers-hackers-are-doers (accessed on 10/03/2014).

systems[2].” Symbolically violent in its own terms, this observation indexes not only the ethnocentric and gendered lifeworld of many hacker collectives, but also interestingly the fact that hacking is no longer limited to the virtual play-fight among Anglo-American suburban boys. It has been expanded considerably on a planetary scale, different actors have come into the scene.

In contrast to this perspective, the Internet Engineering Task Force (IETF) community describes in its Internet Users' Glossary the hacker as a person “who delights in having an intimate understanding of a system,” whereas his or her opposite, a “cracker,” is an individual “who attempts to access computer systems without authorization[3].” What is important to emphasize in these examples is not the adoption of one definition or another, but the evidence of a series of disparate, conflicting, and generative differences in the contextualization of hacking as a cultural practice.

Past academic studies and public discourses on computing have defined “hackers” as skilled and nonconformist technologists, undistinguished by gender, nationality, ethnicity or religion, and united by a common ethic, grounded on information sharing, personal freedom, and the value of self-education (Castells 1998; Himanen 2001). Recent literature on this topic in cultural anthropology has reacted to this depiction by describing and analyzing moral economies of hacking which draw upon and criticize the liberal tradition from within (Coleman and Golub 2008; Kelty 2008; Leach 2008; Coleman 2012). Yet no systematic studies have explored the linkages between moral personhood, local socioeconomic realities, and technopolitical histories

2 Source: http://phrack.org/issues/65/2.html (accessed on 03/03/2014). Emphasis on “women” in all-caps is in the original.

3 Source: https://tools.ietf.org/html/rfc1392 (accessed on 04/12/2014).

within and beyond the globalization of Euro-American technopolitical projects. Ethnographic approaches to the formation of expertise and circulation of technical experts are needed to respond to the question of how emergent forms of technopolitical practice are created, sustained, and circulated in the contemporary, finding fertile grounds within and beyond North America and Western Europe.

What follows is a monograph on computing expertise with a focus on the creation of political, economic, moral, and technical ties among technologists who are identified by peers and self-identify as hackers. The primary goal is to investigate how current forms of collaborative work are made possible on local level alongside global practices and discourses of hacking, therefore linking local sites with an emergent transnational domain of technical and political practice. In order to advance an understanding of the experience of hacking in the contemporary, I describe and analyze career trajectories of programmers, engineers, and activists who are active participants of an international network of community spaces called "hackerspaces." Based on ethnographic research at hackerspaces, professional meetings, online spaces, and informal gatherings I pursue the question of the conditions for cultivation of technical skills, moral dispositions, and political orientations which create subjective and objective conditions for participation in transnational projects.

The following chapters were organized within three interpretative frames that are meant to convey fundamental processes at play for the formation of technical expertise: *the personification, the spatialization, and the politicization of computing expertise.* The first chapter is dedicated to the presentation of the research design with a discussion of the theory and practice of multi-sited ethnography. One of the key questions I tackle in this chapter concerns the possibilities and impossibilities of fieldwork when the very definition of the field demands reformulation, that is, when the criteria for personal immersion is predicated upon a particular set of assumptions which are not informed by the naturalistic ideal of the solitary ethnographer as the explorer in a geographically-bounded field site.

For the second chapter, I describe key metaphors and infrastructural transformations of digital computing from the Second World War to the present. I revisit first the literature on the history of computing to discuss a series of events of particular interest for the contextualization of hacker narratives in the subsequent chapters. I explore the passage of human to electromechanical and, then, digital computing which culminates in the transformation of computer machines from instruments of bureaucratic control to personal and business tools. I also dedicate a section of this chapter to the anthropological topic of magic in order to address the creation of social boundaries dividing computer experts and laypersons across public and communitarian spaces. Further, I present the contentious issue in the literature on hacking as to whether it is a culture guided by a cohesive set of ethical norms and constraints or diverse cultural practices which encompass distinct moral commitments. For this debate, I frame my description and argument in a dialog with Marcel Mauss' draft of a theory of magic and, more specifically, with his discussion of the socially imputed attributes and roles of magicians and their magic. As an exercise of comparison, I draw a parallel between the sociological attributes of the magician with boundary-making practices to define hackers and their *ethos* from the outset, that is, not by hackers to hackers, but by laypersons for whom hacking generally represents a sort of occultist magic, a fearful crime or, in the language of computing programming, a "black art", that is, the art of casting technical spells and finding solutions to complex problems (Ensmenger 2010). For this purpose, I compare the Maussean magician in sociological terms with the present-day hacker in order to explore political and cultural aspects of boundary-making surrounding technical collectives. For the final section of this chapter, I discuss the event of political mobilization of computer technologists after the tragic death of the hacker and activist, Aaron Swartz. Based on participant observation at his memorial service at the Internet Archive and a "hackathon" at Noisebridge hackerspace in San Francisco, I discuss how the recent history of dispute over intellectual enclosures is foregrounded in current narratives to frame a history of collective action around the electronic liberation of intellectual works. Not by accident but in virtue of an accident charged with accusations of abuse and legal overreach by State authorities, Aaron's life, construed under the light of contemporary technopolitical struggles, has become the inductor of a narrative on information freedom and openness. As an event with historical weight, the loss of Aaron's life magnified ongoing disputes in the domain of academic publishing, copyright reform, and, more broadly, an ongoing struggle against the enclosure of public goods and intellectual work.

In the third chapter I examine a set of life-histories with prestigious Free and Open Source hardware engineers and software developers from Japan, China, United States, and Brazil to address distinctive manifestations of moral personhood in technical practices *vis-à-vis* global instances of interaction for technological development. Under the rubric of *personification of technology*, I address what matters the most for those who engage in practices of technical self-cultivation and collaborative technical development. I advance the argument that the hacker embodiment has been neglected in the literature, whereas it represents one of main interpretative keys to access moral idioms and forms of ethical problematization in a shared, transnational landscape of technopolitical projects. I also advance the proposition that the *spatialization of technology* (with the extension of computing infrastructures, access to computer technologies, and creation of community spaces for socialization around Free and Open source technologies) cannot be described and understood if personal trajectories are not accounted for in processes of local and transnational exchange. Attending to personal trajectories of technologists and the trajectory of their technical projects at once allows for placing ourselves at a vantage from which to describe how moral dispositions and forms of technical expertise are articulated on a local and personal level through global practices and discourses on openness, autonomy, and collaboration as "practical ideas" and embodied knowledge after Marcel Mauss (1950). Drawing from narratives of personal trajectory, I invite the reader to redirect his or her attention to the embodied dimension of hacking: the incorporation and actualization of bodily dispositions in moral, technical, economic, and political dimensions of lived (and digitally mediated) experiences. The life-histories I present bring to light the experiential grounding of the symbols of openness and autonomy *vis-à-vis* the transnational experience with collaborative digital work. Identifying oneself as a hacker implicates the cultivation of a personhood as a form of communion that is marked by a particular set of practices, skills and sensibilities as much as by the intimacy with specific prosthetic extensions, such as computer machines, information networks, protocols and alternative legal devices rendered in Free and Open Source licenses. After James Clifford's interpretation of Leenhardt's Do kamo[4] (1947), personhood is understood as a form of "communion in the time of the other" (Clifford 1993:186). Examining how sociotechnical ties constitute a hacker *personae* has the benefit of creating an interpretative register from which to analyze the conditions of possibility of global networks and advance an understanding of the formative ties and contemporary politics of computing expertise.

In the fourth chapter I turn to the ethnographic description of the *spatialization of technology* to account for the creation of spaces and places of technical exchange and technopolitical experience. I explore the role of socioeconomic, political, and geographic distance and proximity in forging ties between community spaces, commercial enterprises and Free and Open Source projects among computer technologists. For each community space, I describe a particular set of projects: at Tokyo Hacker Space in Tokyo, I follow the development of an Open Source radiation monitoring device after the Fukushima disaster and elaborate on questions of responsibility and distributed expertise among technical volunteers; at DimSumLabs in Hong Kong, I investigate the shared grounds for creating start-up companies with the deployment of technologies and techniques borrowed from rapid prototyping Free and Open Source-based hardware and software projects; at Noisebridge hackerspace in San Francisco, I examine the pedagogical tools and forms of mobilization around political

4 In Leenhardt's terms, "[the] person manifests relations between [these] two elements, between these two poles, that of individuation and that of human reality" (Leenhardt 1947:270, my translation). In his treatment of personhood, biographies are understood as "plenitudes" not wholes, which is to say: "the person, in opposition to the individual, is capable of enriching itself through a more or less infinite assimilation of exterior elements. It takes its life from elements it absorbs, in a wealth of communion. The person is capable of super abundance" (Leenhardt 1947:271, translation by James Clifford).

issues, such as surveillance, privacy, and military funding for community-driven projects; finally, at Chaihuo in Shenzhen, I investigate the collaboration between young Chinese industrialists and local engineers for the advancement of Open Source hardware products in transnational partnerships with Euro-American designers and engineers. Drawing from the ways in which Ivan Illich's notion of "convivial tools" (1973) is mobilized to frame pedagogical encounters, I describe the conceptualization and actual construction of hackerspaces with a focus on three interrelated dimensions: 1) the production of new places of sociability (*hackerspaces as convivial places*); 2) their emergent socioeconomic and technical arrangements (*projects as convivial technologies*); and 3) the circulation, interaction, and cultivation of technologists who animate the imagined spaces and convivial places (*technologists as hackers and/or makers*).

For the conclusion, I return to the question of the constitutive ties of computing expertise to address the consequences of the global dispersion of hacking and its pragmatic and moral articulation through pedagogical modes of interaction. Based on the ethnographic work, I argue that hacking has become a global technopolitical practice due to the confluence of digital technologies and elite technologists of local community spaces with key resources to support collaborative and pedagogical instances for technical experimentation. In describing global and local level applications of computing expertise, I demonstrate how hacker spaces and technologists who self-identify as hackers are, respectively, formed at cross-cultural contact points to rearrange, challenge, and transform established technical practices, infrastructures, and political imaginaries in the contemporary. As a concluding argument, I suggest that the anthropological and societal relevance of hacking as embodied and practiced by transnational communities resides in its opening of new political imaginations, institutional arrangements, and reorganization of productive activities through technical practices and narrative practices of technological autonomy beyond (and yet in connection with) established educational institutions and IT businesses.

This monograph is not an attempt to describe the whole range of practices under the rubric of hacking. Rather, one of the main goals is to demonstrate the impossibility of speaking of "hacking" without specification of personal and technical trajectories in the processes of spatialization of hacker collectives worldwide. To describe the spatialization, personification, and politicization when analyzing contemporary forms of technopolitics serves primarily to delineate a domain of research in anthropology of technology in urgent need of attention. The interpretative framework I devise is meant to account for the sociotechnical production, circulation, reproduction of computing expertise. Questioning a commonly held interpretation of global and local level politics as processes of homogenization or outright resistance, I demonstrate how community spaces, technopolitical subjectivities, and political collectives are co-produced to accommodate, challenge, and transform technical practices, meanings, and infrastructures in the contemporary.

CHAPTER 1

Multi-sited Research Design: Theoretical and Methodological Contributions

An anthropological project with computer technology collectives and digital technologies implicates a whole complex of moralities, materialities, temporalities, and spatialities with a highly compressed historical and accelerated machinic time which paces and punctuates the ethnographic experience, subjecting computer technologists and non-technologists alike. Any project on the topic demands attention to emergent spaces of exchange, their historical and sociocultural conditions of possibility with utopias of technological liberation which come into play through the everyday work upon machines and upon ourselves. Given the proliferation of sociological and societal problems in the study of localized and partially globalized computer collectives, further ethnographic work is needed to specify the processes in which "multiple sites are interlocked constituting new political locations" (Gupta and Ferguson 1992).

In this chapter I construct the object of inquiry and the research design I devised for the study collaborative spaces for training and socialization of computer technologists. As I describe in the following chapter, diverse historical narrative threads provided the conditions for the cultural reappropriation of hacking beyond and yet centered around the Euro-American axis. I examine sociotechnical processes of local/global connection and disconnection, production and circulation, and attend to the objective conditions and subjective dispositions for moral cultivation and technical formation. Through the description of transnational spaces, technical expert and volunteer networks, Free and Open Source projects and personal trajectories, I reconstructed the sociotechnical ties binding technologists and establishing pathways for contact and exchange among unequal partners. Focusing on moral and technical responses to heavily debated public issues, such as personal privacy, access to knowledge, government transparency, post-industrial production, intellectual property protection and circumvention serves the purpose of studying alternative forms of computing expertise.

In what follows I will present the conditions under which the project was conducted as well as the contemporary debate regarding space, place, exchange, and globalization to introduce the relevance and challenges of multi-sited research. First, I discuss my experience of entering the field and creating the conditions for participant observation. Then, I provide contextual information about research sites and co-participants. After describing contexts and constrains of fieldwork, I will move on to the evaluation of theoretical contributions and methodological implications of a multi-sited approach with a focus on three interrelated processes: spatialization, personification, and politicization of computing expertise. Before moving into the debate of these processes, I will offer a brief revision of the literature on exchange and gift economy to specify the problem-space of "social ties" for this monograph.

1.1. “Anthropology: Isn't it some sort of Social Science?”

Fieldwork among computer technologists involved being identified and recognized based on my self-presentation, description and practical display of interests. Classification and assessment of a person's ability to contribute are generally informed by long-lasting prejudices and divides between humanities and sciences. Based on my institutional affiliation, an initial puzzlement would make people balk at the description of my work, “but… isn't anthropology some sort of social science?” The implicit suggestion would quite often be, “how come you are talking to us about this or that particular type of technology?” As far as the experience of fieldwork dictates and goes, I have learned socially and technically as much and as hard as I tried to explain the project in way that would make sense for those who eventually would find it to be worth pursuing—that is, beyond the divide setting technologists and their non-technical others apart.

My own trajectory illuminates partially the conditions of possibility for participant observation. As my research co-participants, I grew up in connection with a world of fast design, development, commercialization and selective distribution of digital technologies. The captivating magical aura of computers embraced us all, but what was experienced in practice had specific sociotechnical configurations in different countries. Unequal and wide distribution of computer technologies created a collective condition in which we could speak of common technical experiences and yet find numerous cases in which no translation was possible whatsoever. For this reason, the interplay between recognition and misrecognition, locality and globality, commonality and specificity in respect to technical, political, and cultural differences rightly imposes itself as a key issue for contemporary studies of computing in the anthropology of science and technology.

It is a matter of privilege to be able to learn about computers as a child, since it involves an array of supportive sociotechnical infrastructures, including but not limited to trade agreements allowing for logistic interconnection, communication networks, educational institutions, commercial and state-owned computing facilities, etc. As an elementary school student, I had some but not all of the supportive infrastructures in place. Most of the co-participants of the project had the privilege of growing up with infrastructural preconditions well in place and learned about computing and electronics at a very young age. It became as naturalized as the technology of reading and writing the capacity to interact with computer machines through the medium of formalized, artificial languages and tinkering through trial and error. I remember learning with a personal computer, an MSX Z80-based machine, in the context of market reserve and import control of electronics in Brazil of the 1980's. When in high school a decade later, computing became an obsession as the local market was flooded with Intel-based machines equipped with parts and peripherals of East Asian provenance under the dominance of Euro-American, Japanese, and Taiwanese transnational companies. This period was marked by a violent shift in economic policy in Brazil with the end of the national policy for computing (*política nacional de informática*) and introduction of an orthodox neoliberal market reform on a national level (Tigre 1993). In this period, I volunteered for a local IT company in order to learn how to assemble and fix personal computers. The company agreed to pay for my time with bus tokens so I could return everyday after school. There I learned about the everyday sociotechnical inner workings of a commercial computer lab. We were surrounded by computer machines and peripherals to fix and to experiment with, and we received regular visits from more senior computer experts, engineers, and desperate customers. This was the very first time I experienced how asymmetric the relationship between technologists and users could be. Even in the condition of apprentice, it promptly came to my realization how strong a dependency tie was created with wider distribution of personal computers and operating systems as off-the-shelf commodities. Customers were quite often desperate to fix malfunctioning machines. They had to stop working more often than not because of hardware and software issues. As experts on the other side of the counter, we could avoid addressing the problem directly, therefore avoiding the need to lecture them on certain aspects of the system at fault; we could instruct them to interact with the machine in certain ways. They were not careful enough about what was stored in their machines and how easy it was to access it all. It was too much power for technicians to have. And we could have done it all, but a moral stance from which we undertook repair tasks led us to perform blind backups and avoid taking the route of inquisitive, unethical curiosity. Stories of unethical practice, however, abound all around us. It was a familiar terrain in which we did not want to stake our technical present and future. In quite specific ways, the co-participants of the research held similar positions in respect to the usage of their technical powers, which we will examine in detail in the following chapters. The shift in perspective, I learned, takes place when the nexus between knowledge, power, and responsibility is problematized, therefore becoming an unavoidable object for ethical reasoning when dealing with cultural practices of computing.

In my early technical experiences, I soon found myself fixing computers for family members and neighbors. There was just a handful of us with deep, bordering an obsessive interest for computers in the whole neighborhood before computing colonized many lifeworlds. We would exchange ideas, workarounds, solutions, software, and even swap parts, given the scarcity of equipment at hand. Except for certain components, we used mostly clones of famous manufacturers from Japan, United States, and the UK. Early technical experiences also landed my first job as a computer technician for a mid-sized printing and advertisement company right before college. At one exceptional occasion, the company was brought to a complete halt with the impromptu visit of the federal police accompanied by a university professor who was serving as an expert auditor. The police raid was led on behalf of the Brazilian Software Association (under the auspices of the Business Software Alliance) to audit computer machines and identify pirated copies of software. Under the injunction of a search warrant, I accompanied the auditor machine after machine to annotate serial numbers for every piece of proprietary software installed. When we approached the computer lab, I expressed how eager I was to let the auditor inspect my own machine. It was running only Free Software, so I told him half-jokingly, "I guess you will enjoy inspecting this one!" To my surprise, he decided not to inspect it at all as he did not also bothered to audit the servers, which were also running only Free Software. This memorable event made vividly present to me yet another important lesson regarding power, not the one I experienced as a "computer person" but that of transnational computing businesses in regulating and shaping practices and possibilities with digital technologies around the globe.

My job as a computer technician did not last as I gave it up in order to dedicate myself to a research assistantship in discourse analysis at the Linguistics and Literature department. This period was characterized by a critical split between my deep interest for computers and my training in human sciences. I felt that I could not reconcile the fast-paced work of the industry with the slow temporality of academic research. Now I realize that I was rather naive and short-sighted since academic work has become tremendously accelerated with series of transformations in educational policy with auditing and assessment of academic productivity.

By the time I abandoned the IT industry, computing morphed into an object of academic interest. It was no longer a job, but it kept being more or less a hobby and, for the purposes of my research on alternative computing, it become constitutive of my intellectual work. Early on, I was drawn into political history and human geography by junior high school teachers, whose tears I remember witnessing fifteen years later for telling them we would never forget their classes. I was given lessons on the basic mechanisms of plus-value extraction in 8th grade. Copies of “What is Socialism?” by Castoriadis (published in Portuguese during the dictatorship by a “ghost” printing press) circulated in the hands of the students who did not behaved nor performed as expected in class. I started to learn English by translating computer manuals, bits and pieces of the political Chomsky and, later, had my introduction to anarchism with a Spanish translation of Daniel Guérin. Ironically, I was given as a Christmas gift a used copy of the foundational classic “Las Veñas Abiertas de América Latina” by Eduardo Galeano. Henceforth I started to appreciate those who breathed progressive and radical politics with conscious efforts inside and outside academia.

The late 1990's and early 2000's were marked by a critical juncture with renewed political effervescence in Brazil. The opposition to successive neoliberal-oriented mandates on the federal level with market liberalization and privatization of public companies, institutions, and services reached its peak. Right after taking university entrance exams, most public universities went on strike, and I was pulled into the oppositional front to hegemonic world political economy, the World Social Forum (WSL, *Fórum Social Mundial*) in my home town. I do not remember making a conscious decision whether to get involved. Computing was one of my few skills, so I felt inclined to help a São Paulo-based technical collective to setup connection for an Internet radio at the Youth camp. For the second year of the WSL, I kept volunteering and helped organize the "global space" for the Independent Media Center (IMC) network with machines for public use. The experience made clear one of the possible articulation points between computing and collective action as I found myself absorbing everything that I could not learn as an IT worker. In this unique anti-structural moment, I also learned about the ethics of Free Software, which, at first, was nothing more than an interesting technical possibility. It was only after the experience with the IMC at the WSL that the ethical and political dimensions of Free Software structured a lasting and intricate dilemma in dealing with digital technologies.

At the last stage of my undergraduate studies, I returned to the topic of Free Software and dedicated a thesis to the examination of the Brazilian community. I continued on to transform Free Software into a problem space for my Master's thesis in social anthropology. For a total of three years, I conducted research in Brazil among

Free and Open Source activists and developers and worked as a volunteer for the non-governmental organization ASL.org (Free Software Association) helping to organize an important meeting, the International Free Software Forum (FISL, *Fórum International Software Livre*). For this previous research, I analyzed online mobilization campaigns, forms of discursive dispute, and collected interviews with developers and activists, asking questions about personal and technical trajectories trajectories, formal work, and volunteer experiences with local and international projects. During field research, I also mapped the social network of the Brazilian community, collecting data on social ties among developers, activists, artists, public and private organizations. This project resulted in the reconstruction of the cultural history of Free Software in Brazil with the recapitulation of the question of technological sovereignty and autonomy with national IT development policies and politics. My work on Free Software paved the way for key design decisions I implemented in my field research[5] for the project I report in this monograph. It is with the problematic of the interplay between local and transnational political, economic and sociocultural processes that I advanced to the preparation of the doctoral project I describe next.

1.2. Research Methods, Sites, and Co-Participants

The research design I devised is composed of two main research techniques: multi-sited ethnography (Marcus 1995; Falzon 2009) and trajectory interviewing (Bourdieu 1986; Lahire 2002). The primary research site was the network of community

5 My work with the Brazilian Free Software community was not discussed at length in this monograph since it was the object of my previous studies (Murillo 2007; 2010).

spaces for computing and electronics called "hackerspaces[6]." For research purposes, I conducted participant observation[7] at technical community centers, following projects online and offline, traveling with technologists to professional conferences (as a participant and, at times, organizer) for the period of two years, starting with preliminary fieldwork in June, 2011 and ending in September, 2013[8]. The following

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6 The website "hackerspaces.org" lists 1,342 spaces around the world at the date of preparation of this monograph, but several other places are being planned. The biggest concentration of active spaces can be found in United States and Germany. In Latin America, Brazil, Mexico, and Argentina have the most active spaces. In Asia, India has the biggest number of spaces followed by China. Places identify either as "makerspace" or "hackerspace" (and sometimes as "co-working" for-profit spaces which are criticized in the community as illegitimate hacker or makerspaces). Community spaces such as maker and hackerspaces offer workshops and classes on computer technology, electronics, arts, and crafts. All courses and workshops are open to the public for free or for a fee. Most spaces are equipped with computers for public use, Internet connection, machine shop, and various tools for electronics, 3D printing, and, if space and budget allows, wood and metal working. Most spaces are also maintained with membership fees as well as with donations from companies, government agencies, and volunteers. The spelling "hackerspace" is attributed to the German hackerspace community early influence in the renaissance of hacker and maker clubs around the globe. In Chapter 3 I describe some of the key nodes in the hackerspace network in the Pacific region: Noisebridge in San Francisco, Dim Sum Labs in Hong Kong, Chaihuo in Shenzhen, and Tokyo Hackerspace in Tokyo, as well as their members and founders' trajectories and projects (which is also the concentrated topic of Chapter 2).

7 In Malinowski's (1950) definition, ethnographic projects should be grounded in isolation and immersion in the life of a group whose cultural background is distinct, distant, and strange for the fieldworker. It is important to free oneself from preconceived ideas in an effort to avoid imposing them onto the observed societal life. In his work among the Trobriand of the Eastern coast of New Guinea, Malinowski observed and described the cultural institution of Kula, a ritual involving exchange of ornamental objects, which was aimed for communication among islands as well as for circulation of goods and strengthening of ties among kinsmen. The Kula circuit was "a big, inter tribal relationship, uniting with definite social bonds a vast area and great number of people, binding them with definite ties of reciprocal obligations, making them follow minute rules and observations in a concerted manner" (Malinowski 1950:510). His description was an attempt to reach a more comprehensive depiction of cultural institutions in the form of a critique of primitive economics as described by formal economics, as well as the persistent fictional character of the *homo oeconomicus* taken as a universal abstraction of humanity in its supposedly natural state.

8 I helped organize the International Free Software Forum in Brazil for consecutive years since 2008 (skipping the year of 2013 because of fieldwork) as well as many informal gatherings and workshops at hackerspaces. At each site, I attended several conferences, professional meetings, and informal gatherings of computer technologists. In Japan, I participated in the Python JP (2011), Ruby Kaigi (2011), and the Open Source conference (2012) and as well as the informal Debian JP gatherings, the Free Software Initiative Japan meetings and the "Document Translation Fest" at the Red Hat company headquarters in Tokyo. In the Bay Area, I attended the Designcon (2013) in San Jose; Open Source Business Conference (2013) in San Francisco; Maker Faire (2012 and 2013) in San Mateo and several informal and regular gatherings of information security professionals and activist groups at Noisebridge hackerspace in San Francisco and Sudo Room in Oakland. In Southern China, I attended the Open Source Conference in Hong Kong (2013), the first hardware hackathon (2013) in Shenzhen

spaces were studied during 16 months of field research: "Noisebridge Hackerspace" in San Francisco, United States; "Chaihuo Makerspace" in Shenzhen, China; "DimSumLabs" in Hong Kong and "Tokyo HackerSpace" in Tokyo, Japan.

Hackerspaces represent spaces of socialization for technologists equipped with tools for technical self-training and advancement of collaborative projects. They stand for translocal places of experience for human connection rooted in a specific locales with access to particular infrastructures, shaping possibilities and impossibilities for technical and political formation. They are very distinct in their internal dynamics and organization to the point that even the label "hackerspace" is quite often an object of dispute and questioning. Hackerspace members constitute and partake the imaginary of a collective in contrastive ways from hobbyist clubs, such as chess, personal computers, arts and crafts, even though these membership-based club activities are also hosted at hackerspaces. It stands in contrast even in relation to closer experimental technoscientific laboratories, such as "skunk works" in the US defense industry. Within the distributed network of community spaces, hackerspaces draw from different genealogies in the history of computing and, in particular, computer hacking. Its variants can be as culturally and technically distant as a politicized, autonomist convivial zone or a co-working space for flexible and precarious IT work; a space to attract computer programmers and investors to ignite start-up companies or merely an ordinary place to meet, functioning as a community center for expatriate computer

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organized by Haxlr8r and Seeed Studio and several informal and regular gatherings of the local community of software and hardware engineers and developers, representing groups such as Shenzhen Do It Yourself (SDIY) and Shenzhen Linux Users' Group (SZLUG). In Los Angeles, I joined the Southern California Linux Expo for three years (2010, 2012 and 2014) and became a member of Crashspace hackerspace for a brief period in 2014 while working on this monograph.

aficionados in global cities. Hackerspaces assume various forms in distinctive contexts, thus accommodating a wide array of perspectives and practical experiences in computing. It is fundamentally a function of its place in the experience of members, its imagined space as a part of a network, and its ongoing projects for the circulation of technologists and technologies.

Identifying pathways for circulation of technologists, technologies, and symbols—which are key for the formation and sustenance of hackerspaces and projects around software and hardware technologies—was one of the outcomes of fieldwork. As a fundamental aspect of network building, circulation imposes practical issues since the flux of socioeconomic and technoscientific elites does meet the same restrictions researchers (and, most importantly, researchers from the Global South) encounter. The strategy I devised to follow and describe patterns of circulation and collaboration was to seek visa sponsorship and funding from various research centers with different regional foci in order to guarantee entry and re-entry in various countries for research[9]. This strategy was particularly important in the context of sociocultural anthropology given the preponderance of the naturalistic and empiricist understandings of the "field" which amounts for the difficulty of securing funding for multi-sited projects.

9 Given their regional and national foci, I proposed the Terasaki Center for Japanese Studies at UCLA the study of Free Software and Open hardware hacking in Tokyo; for the UCLA Latin American Studies center, I request summer funding in order to return to the country, conduct a series of life-history interviews, participate in a hackerspace tour and help organize an international event for Free Software developers; and, finally, for the University of California Pacific Rim research program, I requested funding for conducting research in the Pacific region (southern China and California) and for preparing publications on my work in Japan. I am deeply grateful for the support of all aforementioned research centers. I was also supported by the Fulbright commission and CAPES (*Comissão of Aperfeiçoamento de Pessoal de Ensino Superior*) from Brazil for four academic years in order to prepare for fieldwork. For many years of support from Fulbright and CAPES, I am profoundly grateful.

The rationale for defining a subsection of the hackerspace network for field research resides in the identification of its position in the extended network, that is, the patterns of interconnection with projects of transnational scope and technologists with prestige and international ties. This is not an easy matter in project design as most pathways are the end result of the research and cannot be anticipated. The strategy was to transform it into a research question instead of a point of departure.

In spite of historical conflict, economic interdependence and competition involving both powerful and peripheral countries, the Pacific region was connected through various pathways linking technoscientific elites from United States, Japan, and Taiwan with poor countries for outsourcing labor in various industries, including but not limited to the microelectronics and computing industries of Southern China. For the purposes of the project, the Pacific Rim was of particular interest for providing a center of closed circuits of migration of IT professionals, informal exchange among hacker collectives and other professional IT networks, including Free and Open Source software and hardware projects.

Hackerspaces tend to concentrate and operate in global cities (Sassen 1991), which facilitate exchange among itinerant experts and "technical tourism" in places with huge electronics markets, such as Huaqiangbei in Shenzhen and the Golden Shopping Arcade in Hong Kong, and technological sacred sites, such as Akihabara in Tokyo. In the United States, the San Francisco Bay Area has risen in prominence historically as a central hub for highly specialized research and development on computer engineering and software development given the growth of its native computer industry with strong information sharing, early hacker groups, research institutions, and countries sending skilled immigrants[10] (Levy 1984; Turner 2006; Saxenian 1996), backed by Cold War funding for basic research in science and engineering (Edwards 1996). Both regions display patterns of connection and disconnection which merited empirical research. Global flows are nothing new (Wolf 1981; Petras 1995) but the scale of articulation of transnational capital and solidarity among social movements fundamentally is (Sassen 1991; Evans 2008). Series of transformations since the 1980's with deregulation of national economies, migration control, intellectual property enclosure and enforcement, and retraction of state control in certain areas of economic activity created the conditions for the emergence of new forms of interconnection and translocality, setting the stage for emergent forms of resistance and collaborative technological development. This political context is aptly summarized by Jean and John Comaroff (2014) in their reflection upon the “cultural and material corollaries of neoliberalism” as marked by “1. movement of people across the planet in search of work and opportunities to trade; 2. transnational mediation of signs, styles, and information; 3. rise of the electronic commons; 4. growing hegemony of the market; 5. distillation of culture into intellectual property” (op. cit. p. 76).

During preliminary fieldwork, I identified influential computer experts who traveled regularly around the Pacific to visit hackerspaces, and East Asian technologists who identified hackerspaces, companies, projects, and hackers from Euro-American countries as models for creating local community spaces. I have also identified computer engineers and software programmers from China, Japan, Brazil and United

10 Saxenian (1996) tells a popular anecdote that Silicon Valley “runs on ICs” (Indian and Chinese immigrants, not integrated circuits).

States who collaborated regularly over the Internet and face-to-face using Free and Open Source technologies, sharing technical platforms for software and hardware development, having English as their main language for international communication and technical exchange.

Co-participants of this research included computer experts who identify themselves or are identified by peers as "computer hackers." Their age ranges from early 20's to early 50's, they are mostly single with either flexible well-paid or precarious jobs, and identify themselves as men (with very few co-participants identifying themselves women and queer). All of the participants were selected based on their participation—as volunteers, self-employed, or paid workers— in transnational collectives and community organizing for software and hardware development.

Based on trajectory interviews, I described moral elaborations on hacking and its practice as an important form of self-cultivation. Its articulation was discussed not only through life-history interviews, but everyday experiences at hackerspaces. Co-participants were invited to contribute to the project if they met the following criteria: 1) active and sustained participation in community-based technical collectives; 2) experience with international collaborations around Free and Open Source technologies; and 3) competence to read, dialog, and write English to an equivalent level of non-native linguistic ability of the principal investigator.

Learning about narrative compositions of personal trajectory was paramount for understanding the conditions of participation in technical, political, and moral worlds experienced at community spaces. Narrated trajectories are not meant to represent a factual reconstruction of a person's life-history but to access intimate understandings of life events, meaningful experiences, and ethical problematizations. Combined with observational data, trajectory interviews provided an analytic window into non-documented or publicly disclosed practices of self-training and cultivation of skills in addition to ethnographic observation. The interpretation of trajectory interviews was done with two passes of coding: one preliminary pass for the identification of major topics in the whole body of interview data, seeking for elaborations on the following themes: family life, school experiences, hobbies, mentors, volunteering experiences, topics of technical and scientific study and interest, technical work, major technical and scientific accomplishments, perceptions of cultural difference in transnational IT projects, experiences at professional meetings, collaboration with local and foreign hackers, positions on Intellectual Property and Internet privacy issues, and personal reasons and justifications for participation in technical collectives. Posterior to the identification of major and recurrent topics, a second pass was done to extract excerpts from interviews and interpret convergent and divergent approaches to the cultivation of technical expertise.

For reconstructing accounts of personal trajectory, I collected several hours of formal and informal interviews[11], socializing with co-participants in many instances of exchange. In some cases, I visited their homes and spent time with their families. We participated in conferences together at various occasions and I attended their talks and workshops at different hackerspaces and other community events. I traveled with most

11 I collected extended trajectory interviews with four prestigious computer hackers in Brazil, China, Japan, and the United States. These interviews were recorded throughout the period of two years. They amount for 32 hours of recorded audio plus several registered conversations face-to-face and on the Internet. I also collected 36 trajectory interviews with hackerspace participants. The total number of collected interviews, including those from the preliminary phase of fieldwork, amounts to 67 audio interviews of two hours of duration on average.

of them to conferences and helped spread information and write documentation about their projects as I mastered the details. We dedicated time for discussion of our interviews and my final text face-to-face, but also over email and over Internet Relay Chat (IRC). I gave them a copy of my interview transcripts, as well as drafts for discussion of their perspectives on my perspective and their estrangement of their own opinions as I quoted verbatim from interviews. The co-participants were not only concerned with the questions I posed regarding trajectories, technologies, moralities, and politics, but also deeply engaged with issues they considered to be part of their formation as hackers. For my part, I made an effort to situate myself as an apprentice, vigilantly struggling against the tendency to assume that I already knew the meaning of certain expressions. Before starting the research, I had many assumptions in respect to what I thought I knew about hacking. I was required to educate my attention over time and over innumerable encounters in order to observe differences differences shatter the calm surface of linguistic regularities and pre-constructed discursive forms around notions of openness, autonomy, freedom and computer-mediated political action. Hacking became something else over time—which attests to its ongoing historical and political transformation as it spreads around the globe.

Against the traditional objectifying relationship with research subjects, I approached field relationships on the register of friendship and collaboration. Genuine interest in political and technical aspects of Free and Open Source technologies served as a means for establishing and sustaining contacts within a fairly international community of computer technologists within and beyond hackerspaces. This was not planned as an instrumental move, but rather one that was mobilized to allow for coevalness of the ethnographer and the co-participants in and out of fieldwork settings, which is to say, without creating a disjuncture between co-presence in field experience and co-presence in narrating events for the purposes of ethnographic description and theorizing. Language, in its dialogic and intersubjective foundations, is not assumed as a "tool for extraction of information from 'natives'" as Fabian (1983) aptly puts it, not meant for manipulative usages pre-, during, and post-field work, but for establishing *rapport*. For the purposes of research, I mastered English in its technical form and jargon spoken among computer technologists. To rely only on English proficiency would have not been sufficient. It was necessary to experiment with software and hardware technologies as well as to read online publications of all sorts, participating in polemic debates to be able to speak and reason with technological materials and symbols of collective interest. Reflecting upon the informal minimum of ¾ of language ability proposed by Malinowski[12] under the demand for political reinvention of ethnographic research and writing advanced in the past four decades (Fabian 1983; Clifford and Marcus 1986; Marcus and Fischer 1986; Strathern 2004), one could argue that meaningful anthropological research rests on the ethnographer's capacity to establish communication beyond formal language exchange, that is, having the effective capacity to engage in what Fabian termed "communicative praxis" which extends, in the context of computing collectives, well beyond spoken standard languages and

12 Malinowski was known to have said to his students that "three quarters of the success of fieldwork depends on the right equipment and attitude to language" (Lopaciński 1971 *apud* Young 2004). Reinforcing the importance of language ability was important part of Malinowski's discourse on method, as well as an important object of inquiry in itself for his studies of pragmatics (cf. Malinowski, Bronislaw. "The problem of meaning in primitive languages." In The Meaning of Meaning. A Study of the Influence of Language upon Thought and of the Science of Symbolism, edited by Charles Ogden and Ivor Richards, 296-336. London: Kegan Paul, 1949).

involves extra-linguistic practices, grounded in embodied knowledge of digital equipment, programming languages, and computing cultures.

In respect to the amassed research data, one of the key issues with multi-sited ethnography is generally the sheer amount of one's collection. This is nothing new as Evans-Pritchard (1976) warned in the appendix of *Witchcraft, Oracles, and Magic among the Azande*: the bigger the number of sites, the bigger the time spent at home analyzing data and writing the ethnographic monograph. This is a risk to bear in mind when designing and conducting an ethnographic study. The orientation I have found in the literature on multi-sited research requires sites to be redefined in reference to their importance to a particular multi-sited phenomenon. Bearing this basic methodological (and theoretical) orientation in mind, I mobilized a particular strategy to deal with the issue of proliferation of data online, often termed "data deluge." In order to build a *corpus* of multimedia, which happens to be constantly flowing (and overflowing) through several social networking services and protocols over the Internet, I archived documents of concentrated collective attention for posterior analysis. I did not follow nor logged all the online activities at all times, even though the technical capacity to do so was available. First and foremost, it would have been unethical. Certain places, such as the Noisebridge chat channel at Freenode IRC network, does not allow logging conversations. Other places, which are erroneously assumed to be public, such as popular commercial social networking platforms, are often spaces for conversations that some co-participants later realize they would not like to see in print. As a matter of respect and ethical conduct, I observed local norms and restrictions when collecting documents and registering conversations. I also made the effort to reach out for the co-participants I quoted and requested for their authorization to use linguistic and semiotic manifestations they inscribed online. Some of the co-participants manifested their preference for having their actual handle or name to be used. I coined fictitious names and Internet handles for situations in which the identification of co-participants could bring legal, political, or moral consequential damage.

In the remaining sections of this chapter, I will introduce theoretical debates in anthropology to substantiate my methodological decisions and frame my interpretations throughout this monograph. First, I will present early and contemporary contributions to the study of social ties in order to situate my relational approach to sociotechnical phenomena. Second, I will discuss the process of spatialization of hacking with the presentation multi-sited ethnography and a brief incursion into the literature on space, place, and globalization. Finally, I will recast the debate on personhood and morality to elaborate on the question of personification for interpretation of personal trajectories. The goal is to examine the question of the constitutive social ties of hacking to better position ourselves to tackle the problematic of computing expertise.

1.3. Holism, Individualism, and Exchange: the Question of Social Ties

Tensions between collectivism with the expressed value of information sharing *versus* individualism with the quest for self-expression through virtuous technological creation[13] is constitutive of alternative computer expert collectives. To surpass this

13 The separation between individual and society according to the processual sociology of Norbert Elias (1991) is a false problem. His category of "social habitus" or "social composition" allows us to avoid

opposition, scholarly work on holism and individualism can provide interpretative keys to situate ethnographic studies of expert communities in relation to broader social and historical transformations (Dumont 1985; Lukes 1973; Giddens 1990; Beck and Beck-Gernsheim 2002; Yan 2009).

The constitution of the person in the context of computer expert communities can be examined within the problem space of cultural production, circulation, and exchange. The value of the self-taught computer hacker and his/her right to privacy and freedom to explore technologies can be partially illuminated as cultural elaborations on historical values constituted by the liberal tradition (Macpherson 1962; Taylor 1992) however limited this might be to the Euro-American experience. In this respect, there is indisputably the need to account for differences and parallels within subaltern Eastern and Western contexts as well. In addition to the explanatory power of conceptual and moral genealogies, we must advance ethnographic studies of concrete manifestations of expert values and sensibilities in order to foreground emergent forms of political action and moral reasoning within and beyond the Euro-American axis. For this task, I contend that it is fruitful to recuperate the theoretical discussion about the nature of social ties so as to place ourselves from a vantage to study the relational constitution of expertise under unequal conditions.

The inquiry into the nature of social ties was a modernist intellectual occupation, extending from the history of early 18th century political philosophy

the trap of the dichotomy. His categories are conceived as the very basic structure of personality, language, time, and personal style, a "common ground from which individual characteristics flourish, based on which the individuals differ from other members of society" (op. cit. my translation). Language is one of the key components of the *habitus*, whereas the continuity of memory is another. It is important to observe that the historical tendency to individualization does not imply atomization as it is ordinarily suggested but greater variability in social relations.

centered around the question of the social contract to the development of social theory in the wake of the 20th century with a renewed focus on what makes societies possible. In the domain of classical French sociology and ethnology, Marcel Mauss was one of the key references in the study of exchange putting into circulation people and things, marking forms of belonging and proximity, distance and adversity. In Mauss' conception, it is not only a matter of what binds persons and things, but their very entanglement, as people are reflected in objects, having their relationship represented as cultural values and their values are produced in circulation as social forces to bind or sever ties[14]. Mauss' sociology is of particular interest for our study in providing a framework for tracing and describing patterns of association and dissociation, possibility or negation of relationships. This is useful in describing a framework from which to examine relationship within technoscientific communities and beyond their perceived and institutionally enforced limits. It should be clear that is not meant as a form of generalized relationality which assumes anything to be related to everything else, but as a framework for an empirically-driven effort to specify the contingent and motivated ways in which technologies and technologists come together to exchange in particular ways through specific sociotechnical formations.

For the study of sociotechnical phenomena, it is of interest to trace back the foundations of relationality in social theory. For Marx, it is a relational economic

14 Camile Tarot (2003) offered a renewed interpretation of Mauss' *oeuvre*. Unlike the definition of gift as a manifestation of pure disinterest or reciprocity, according to the author Mauss' contribution itself as a "radical reflection of the emergence and nature of social ties, caught between violence, rivalry, reason and obligation" (Tarot 2003:73, *my translation*). In the genealogy which starts with Durkheim and can be traced to Bourdieu's analysis of the gift, Mauss' analysis would be "the amplification of the critique of individualist ideology of the *homo oeconomicus*" (op. cit.). Far from being the contract the origin of society, consciously agreed upon between free and autonomous individuals, Tarot argues that it is society that gives origin to contractual forms.

philosophy that is conceived for studying the relationship between the species-being and its historical context, and, from this elementary relationship, the guarantee of subsistence and the creation of particular socioeconomic arrangements humans entertain among themselves and their technological conditions. As pointed out by Axelos (1961), Westing (2009), and Ingold (2001), Marx was a thinker of capital's relational machinery with its extractive relations of production, reproduction, and its mobilization of productive forces. Relationality is used here in a similar sense discussed by Franz Releaux (1963) [1876]—being technological artifacts relational devices in themselves for implicating human kinectic force to varying degrees as part of the functioning of a machine. Relationality is also foundational in Weberian sociology with respect to the concept of social action as product of intersubjective engagement and recognition with and of the other and his or her behavior assumed or observed. For the Durkheimian sociological tradition, relationality is explored as the question of the nature of social ties which is taken as a major orientation in the creation of British social anthropology and advanced by Marcel Mauss in the studies of the gift economy. In the history of sociocultural anthropology, Radcliffe-Brown's definition of social structure as a network of observable relations (Radcliffe-Brown 1952) is a stepping stone for the seminal work in social network analysis carried out by the Manchester School. Relationality, in diverse theoretical elaborations, is undoubtedly foundational to social theory and, for this reason, indispensable for ethnographic theory.

Marcel Mauss' *Essai sur le Don* (1923) [1950] launched an enterprise of ethnological theorizing with his elaboration on the nature of ties among persons, and persons with objects. This ethnological piece in provided a definitive contribution for contemporary studies on the nature of social ties. Under the rubric of the "system of total prestations," Mauss described an economy oriented toward delayed reciprocity with the circulation of goods, indexing symbolically several aspects of social life, not strictly economic, but equally religious, domestic, political, juridic, and aesthetic. In his description, the gift resembles an early form of social contract anchored in three obligations (*give, receive, and reciprocate*) binding persons, and persons and objects in specific ways. The Maussean concept of "total or general social fact" was used to analyze the practice of gift-giving as an interconnection and interplay of complex dimensions of social life. The investigation of "general prestations" of the so-called primitive societies suggested that they extrapolate the economic dimension of exchange, having to do with symbolic and practical dimensions of social intercourse, religious motives, and moral obligations as necessary conditions of sociality and political antagonism in gift-giving—which is, conversely, made to be impossible to be paid back, maintaining asymmetric power relations. The gift has placed in the anthropological imagination the theme of the intertwining of persons and objects and the relation between persons in cultural institutions. Gifts operate as symbols, instantiate forms of relations, carry with them the *spirit* of the donor, binding groups, families, individuals, individuals and gods in relations of obligation, debt, friendship, marriage, and war, creating various connections, and keeping a channel of communication and exchange of other valuables. According to Mauss' interpretation of Maori cosmology, *hau* is the spirit that follows the given things, acting as an imposition of symbolic nature and having as its primary function to animate the economy, creating, maintaining, or severing social ties. In other words, *hau* is a "complex concept which underlies all economic acts [...] and is not neither the purely free and purely costless provision, nor the production and a purely interested in the usefulness share. [This is] a kind of hybrid that flourishes in these societies" (Mauss 1950: my translation).

The notion of hybridity involving persons and objects opens up an important venue for engagement and understanding of pedagogical forms of technical cultivation and collective organization of technopolitical collectives. The language of the mixture between subjects and objects is productive because of the intimate connection between subjects of computing as *hackers* and digital devices and network infrastructures as foundational for self-wrought technical subjectivities (Turkle 1984). Mobilizing Mauss' theoretical contributions, we would say that the order of alternative computing could be defined as a "general social fact" for implicating aesthetic, technical, economic, political, and, as we will see in the next chapter, religious and ethical dimensions.

In another relational approach to social ties that are cultivated through institutional forms of exchange, Lévi-Strauss (1969) offered a structuralist interpretation of Mauss in order to advance his own program of research, methodologically inspired by formal Saussurean linguistics reworked by Roman Jakobson. Lévi-Strauss emphasized the importance of the concept of total social fact and the way in which objects and subjects were implicated in a relation of complementarity, or to use the Durkhemian original terms in this debate, *things* and their *representations* in the human spirit. This issue in Mauss' theorizing was explored by Lévi-Strauss through a reduction of gift economies as communication systems. For the author, the total social fact is not a mere sociological integration of several dimensions of social life, but the articulation of multiple social dimensions as they are experienced by subjects. Thus, the identified need to reflect upon the real (social) as integrated in a system (total), given that methodologically the order of real would guide ethnologists to understand the order of thought. Lévi-Strauss' argument also pointed to the fact that Mauss was mystified by the native explanation for exchange practices[15].

On the topics of personhood and relationality, Louis Dumont's work is of importance for this monograph for following the Maussian project of a history of the development of the notion of person, investigating comparatively the constitution of Western and Eastern value systems regarding the relationships between personhood, individual, and society. One of his main contributions was to foreground the importance of socioeconomic principles and global ideologies in the binary opposition between hierarchy/holism and equality/individualism. In this work, ideologies are defined as configurations of values, coherent sets of ideas. Starting from the awareness of our inevitable collective condition, Dumont established a comparative sociology on the basis of a common substrate, the "homme sociale[16]." It is the very gesture of

15 A key contribution to the contemporary sociological debate on the gift was offered by Bruno Karsenti in his discussion of a relational logic that can be abstracted in establishing analogies between Marx and Mauss: "it is less important to refer *hau* to a positive spiritual reality, than to shed light onto the imbrication of the spirit and the matter and their relationship in the economic, juridic level in which they are actualized" (Karsenti 1997:385, my translation). This imbrication was discussed also by Lévi-Strauss and it can be found in several passages of the *Essai*, such as this one: "there is in all of this a sort of rights and duties of consumption and retribution, corresponding to rights and duties of giving and receiving. But this intimate mixture of symmetric rights and duties and contraries is not contradictory if we think that there is, above all, mixture of spiritual ties among things, that are souls, and the individuals and groups that treat themselves as things" (Mauss 2003: 202, my translation).

16 In respect to the persistent figure and fiction of "real people, doing real things" which surreptitiously introduces and masks the literary devices we mobilize in ethnographic writing, Dumont responds to the criticism ethnographers have with the fact that he occupied himself mostly with texts as an armchair anthropologist: "in social sciences in general", he argues, "it is a fallacy to claim, as it is often done, that traits, elements, or individuals are more tangible than sets or wholes" (Dumont 1992:11).

perceiving oneself as part of a collective that marks the first fissure in the Western distinction between individual and society. The point being that the historical figure of the individual is not present in all societies and, therefore, does not serve for comparative analysis. The individual, Dumont contends, as a modern value is distinctively Western: it is part of a configuration of values *sui generis*. His materials are not ethnographic, but historical, sociological, and comparative. His reconstruction operates with the Hegelian notion of totality to develop a "history of ideas." Ideology, used as an analytical tool, has two functions in this regard: to divert from the Marxian definition of ideology as an inverted and false representation of reality but also to provide grounds for a comparison of fundamental values, such *individualism*, in which other values and institutions are grounded, such as *hierarchy* for holistic societies. One example that Dumont provides is that of totalitarian regimes having a fundamental contradiction based on the imposition a holistic, hierarchical principle over individualist societies. Totalitarianism expresses a fundamental tension between the founding value of modernity (*individualism*) and its contrary (*holism*). Dumont also criticizes the form in which liberalism is defined by Polanyi and the substantivists as the disembeddedness of the political and the economic. From his totalizing perspective, Dumont does not accept the compartmentalization as a historical argument. For the author, liberalism was a product of a global ideology. Polanyi uses ethnographic cases to argue that in non-modernist societies economic relations where embedded in social institutions. For Dumont, the ethnographic cases do not provide sufficient evidence, given that one of the role of anthropology and its method *par excellence* is to re-connect, re-unite instead of compartmentalize sociocultural realities as they are experienced in everyday life. His methodology consists in searching for “configurations as sets of relations” found in texts, which leads him to uncover common threads by asking how they were historically formed. Dumont's history of ideas is not the same as the Maussean empirically-informed history of causal linkages, but a history of formations of ideological networks as processes of differentiation of ideas leading to, for instance, individualism as a set of values, a specialized category. In his discussion of the major division of social sciences between methodological individualism *versus* methodological holism, Dumont partakes the French sociological school postulate of the primacy of the social—from Durkheim to Mauss, Dumont, and Bourdieu. In his distinction *homo hierarchicus versus homo aequalis* (Dumont 1966) one can read “society” as encompassing individuals, ordering persons under the principle of hierarchy, set against “individuals as the ultimate value in society” and operating under the principle of equality. In spite of this crude dichotomy, holism is, according to Dumont, an elementary condition of every social group: “it is nevertheless true that the ideological affirmation of the individual is accompanied empirically by an unprecedented degree of interdependence. We may suppose that such a chiasmus between levels always accompanies an ideological differentiation” (Dumont 1966:61, my translation).

This discussion is of particular interest for the study of computer expert groups. The historical trajectory of the notion of the individual in the Euro-American context serves us in the task of contrasting the global *spatialization* of hacking with the *personification* of hackers, that is, the (partial) Euro-American, global extension of symbols and practices and their grounding in diverse political histories and moral landscapes in Eastern and subaltern Western contexts.

Another important contribution for the debate on personhood and individualism was offered by Stephen Lukes' (1990). His project resembles Dumont's historiographical approach, but differs in supporting his argument in political and moral philosophy to describe the foundational axes of the modern notion of the individual for which "dignity" is the "general justifying principle in moral argument" (Lukes 1990:51). For the author, the question to be asked regarding Durkheimian holism is: "what extent are the holistic tones of Durkheimian project projections of his religiosity"? The question of autonomy—individual self-determination, freedom to decide, to think, to choose for him/herself which are key themes in Euro-American hacker politics—is definitive and defining of modern individualism. It is "central to the morality of modern Western civilization" (op. cit. p.58) alongside the notion of privacy in its close connection with the idea of a private domain, detached from the public and the collective, the group, which also expresses "a negative relation of the individual with the wider public, including the State" (op. cit, p. 66). Privacy is closely linked to the idea of property as extension of the domain of the individual to things of his possession and right to exclusive fruition. If the notion of privacy has deep liberal roots, the notion of self-development has romantic roots in the Euro-American tradition. Self-development "specifies an ideal for the lives of the individuals" (op. cit, p. 71), expressing another fundamental aspect of hacker narratives of self-training. The notion of "abstract individual" has to do with the development or the cultivation of oneself. In this regard, Lukes poses a comprehensive question, "what is the connecting thread of all the basic ideas of individualism?" Question for which the answer is the modernist notion of the “abstract individual.” Lukes further suggests that the study of personhood is key to the investigation of equality and liberty for taking “individuals in their concrete specificity [...] and taking fully into account their own definitions of their social situations” (Lukes 1990:148). This is an important departure from Dumont's position on the study of personhood for offering an alternative to an intellectualist treatment of the subject.

Less discussed and yet fundamental reference in this debate was George's Bataille's *La Part Maudite* of 1967. In his introduction to the book, Jean Piel pointed to Bataille's pioneer work on the notion of gift and the “generalized economy” starting with his critique of the notion of the utility in classical political economy. His main argument is that human activity cannot be reduced to the processes of production, conservation/reproduction, and consumption, but should be divided in processes which are fundamental for the productive activity and processes which are related to “dispense” in unproductive activities: such as luxury, wars, religious cults, construction of sumptuous monuments, games, arts, and sexual behavior that is not limited by genital activity (Bataille 1967:28). Bataille's principles of loss [*perte*] refers to the way in which neoclassical economy *imagined* primitive economy as a manifestation of the need to satisfy necessities, whereas certain forms of exchange were otherwise clearly dedicated to destruction. The relevance of the notion of *perte* in the context of hacking resides in possibility of illuminating the internal politics and disputes of technical collectives whereas larger gifts as Free Software or reverse engineered hardware with the liberation of popular electronic devices becomes a means for demonstration and assessment of a technologist's worth. The question of competition among expert peers in the context of collaborative software sharing communities has been emphasized and well described in the literature (Coleman 2005; Kelty 2008), but little attention has been given to the symbolic dimension of agonistic forms of exchange (O'Neill 2008). This is precisely the point in which Bataille and the current studies of gift economies in contemporary societies becomes relevant (Caillé 2002; Godbout 2003).

Except for French and English language publications, most contributions to the anthropology of the gift in other languages are mostly unknown to professional audiences in anthropology. An exemplary case of neglect is that of Bóldog Somló and the publication of his piece *Der Guterverkehr in der Urgesellschaft* (1909) [The circulation of goods in primitive societies] which predates Mauss' ethnological systematization of gift economy (Berthoud 1999). In his work, the German ethnologist explored various forms of circulation without limiting his analysis to the register of production. He posed the inverted question of "what happens to the objects in production and consumption?", thus subverting the neoclassical postulate in which the division of labor is the primordial condition for the circulation of goods. For the author, the circulation itself creates forms of division of labor. Somló further argues, in parallel to Mauss, that every economic phenomena is situated in an amalgam of moral, religious, and juridical prescriptions. Interestingly, he denies two of the most common themes in the study of primitive economics: primitive communism and egoism (or primitive individualism). The complexity of the archetypical form of gift is described instead. Based on the examination of personal status, Somló unveiled social forms of wealth circulation defined by prestation of gift and tributary obligations. Exchange-gift is, in this sense, a juridical act that is situated between practices of exchange, marking symbolically "us" and "them". This type of exchange is a hybrid, to use Mauss' expression, it does not fit the hypothetical "pure gift" nor the controversial self-interested gift, nor does it fit "equivalence" in market exchange. Rather, it is a hybrid of spontaneity (unidirectional giving) and obligation (mandatory return).

Somló's work predates some of the contemporary developments in the context of anthropology of gift, such as those provided by Alain Caillé and the M.A.U.S.S. collective, by criticizing both the romantic vision of the primitive communism, the holistic sociologism, and the neoclassical formalist perspective on the circulation of goods. In chapter 3, we will return to this discussion in specific for the analysis of the imbrication between gift and commodities in Open Hardware enterprises.

In a concise overview of the literature on the gift, Yan (2005) highlighted recurrent themes in ethnographic and ethnological studies: inequality and hierarchy in gift-giving; horizontality among people of the same group/strata; gender and the distribution of women's wealth among groups. The "spirit of the gift" controversy returned to the forefront in the 1980's with the discussion of exchange in the caste system—the Indian notion of giving without expectation of return. Mauss' explanation of *hau* as the force behind exchange was substituted by the notion of inalienability further developed by Arnette Weiner[17]. Specifically in respect to the nature of the gift,

17 One of the most influential contributions to the debate on gift-giving in the Anglo-Saxon tradition came from Arnette Weiner's work on "Inalienable Possessions" (1992) based on her ethnography among the Trobriand. The author re-posited the problem of exchange in the literature on the gift by displacing the relationship between persons-persons, persons-objects to movable-immovable, property-possession in the Melanesian context. Weiner took as her starting point Mauss' observation that the gift is inalienable (it circulates, but carries something of the original owner, *this something* has been the object of a history of disputes in anthropology of the gift). For the author, exchange works for domination or to maintain hierarchy. She foregrounds the importance of gender and the role of women in producing sacred/valuable objects. The principle of keeping-while-giving is at the core of the gift and the enigma of *hau* (not the norm of reciprocity as in Malinowski's treatment and economicist interpretations). Reciprocity has a political history, the concept of "keeping-while-giving" highlights what is kept in the exchange of gifts and its effects on distinctions, such as me/producer – you/consumer or me/owner – you/beneficiary. The discussion is grounded on the

anthropological studies described a form of thematic circularity: the debate started with Mauss and Somló on the nature of the gift; it was criticized under the rubric of the reciprocity (with Malinowski and, later, Sahlins[18]); it was later challenged with the discussion on the "Indian gift" (which attacked the conflation of gift with reciprocity) and reached a well developed critique with Weiner's work in the 1990's and the assertion that Mauss was right about the spirit of the gift as a form of inalienable possession. Strathern contributed an analysis of the difference between gift and commodity as, respectively, qualitative and quantitative (one is about personalities, the other is about abstract value). The reflection on the notion of person in its connections with gift economies was tackled by Parry (1986) with the argument that the operation of separation between persons and things is a christian cosmological invention with the idea that man was created after god, as his image, also created the myth of the pure gift —disinterested gift-giving. Personhood is key to the understanding of gift-giving, as

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division of "things to keep/things to circulate." Weiner further argues that this division is disguised at the very core of the reciprocal exchange (as a manifestation of inequality). Her main argument resides in the assertion that keeping possessions operates as a marker of difference: "What motivates reciprocity is its reverse – desire to keep something back from the pressures of the give and take" [...] "The motivation for reciprocity is not centered in the gift *per se*, but in the authority vested in keeping alienable possessions" (Weiner 1992:40). Authentication has an important role: it functions as "an external authority, outside the presence, gives possessions fame and power." Ownership of valuable possessions "makes authentication of difference rather than the balance of equivalence the fundamental feature of exchange." Control over alienable possessions reside at the source of authority, promoting centralization, rank/hierarchy. In his critique of Weiner's work, Graeber (2001) suggests that "Weiner points in all sorts of interesting directions, but she often seems trapped between creating a mere mirror-image of economism or alternately (as in her notion of "reproduction": Weiner 1978, 1980, 1982) swinging towards something much more like Dumont's position. Between formalism and substantivism, then, there still does not seem to be much middle ground" (Graeber 2001:35).

18 As a case in point, Sahlins (1972) criticized Mauss' interpretation of *hau* for not being aware of its economic relevance, therefore introducing important distinctions that were taken up in the debate, such as generalized, balanced equivalent return, and negative reciprocity (with the asymmetrical gift which cannot be paid or returned). Sahlins suggested the linkage between mode of production and mode of exchange: "the real distinction between gifts and commodities lies in different orders of social relations that are constructed and mediated through the exchange of objects" (Yan 2005:254).

gifts carry something of the giver. Based on his ethnographic work in rural China, Yan (1996) elaborated on the importance of the emotional dimension of gift-giving as one of the gaps in the literature. His argument is that the study of the gift operates as an analytic window into the "core of Chinese culture" with a focus on cultural meanings and operative logics of gift-giving in the village of Xiajia (North of China). Among emic categories, *lǐwù* (gift) is a central one, the ritualized thing, represented by two characters in Chinese [礼物], expresses the normative, cultural aspect of exchange practices. Gift lists are central as a cultural practice in village life as "they record the activity of exchange and display a network of personal connections" (Yan 1996:51). Ceremonial gift-giving is also a "special arena for the display of status and connection, visible proof of the relational capital one is able to mobilize" (Yan 1996:52). According to Yan, Chinese scholars developed a framework to study gift exchange in China based on native categories such as "*guanxi* (personal networks), *renqing* (moral norms and human feelings), *mianzi* (face), and *bao* (reciprocity)" (op. cit., p.15). *Guanxi* is the key notion that "involves not only instrumentality and rational calculation, but also sociability, morality, intentionality, and personal affection" (op. cit. p. 88). It stands for a "power-game" and also a life-style. It has an economic function and a social support function. *Renqing* operates as an ethical system in the village life. Reciprocity assumes different cultural forms. *Renqing* is the force behind the gift, social force for solidarity, sharing, and cultivation of personal connections. This notion points to the moral obligation that is part of everyday gift-giving. In Yan's words, "gift-giving is, perhaps, the most common channel for expressing one's emotional responses" (op.cit., p.141). It has been defined in the literature in terms of a fundamental asymmetry between givers (to attaining prestige) and receivers having important bearings on questions of power. The Chinese case provides evidence of the contrary: prestige is attained by the receiving part; because of the prestige of receiving, villagers feel compelled to give.

If relationality has been foundational in social and anthropological theory, it has only recently assumed centrality as a topic of reflection. As one of the key contemporary theorists of the question of relationality, Marilyn Strathern worked out the problem of difference in anthropology by comparing and contrasting Western and Melanesian notions of "society/sociality" (and Melanesian and Western social theories, the Melanesian 'partible person'/'dividual' *vis-à-vis* Western feminist theories). In "Gender of the Gift" (1988), the author discusses the constitution of the Melanesian person as a product of relations in which both men and women are subjected. The ways in which Strathern builds her argument reveals great influence of Roy Wagner's theory of symbolization. She proposes to elucidate processes of objectification that occur both on the anthropological side and the other, that is, both on the anthropological Western feminist side she occupies as well as on the Melanesian one. The anthropologist takes up the place/role of liaison as the object of inquiry itself, being the experience of contact approached from the place in-between the anthropological and native domains of experience and practice. This in-betweenness is precisely the point where anthropologists and their informants work out the invention of culture for Wagner (1976). The importance of gift exchange and value is that "value is constructed in the identity of a thing or person with various sets of social relations in which it is embedded, and its simultaneous detachability from them. Here lies much of the significance of gift exchange." Gift exchange implies an extractive relation: the object is possessed by its owner, but it is extracted from this relationship when it is exchanged in the register of the gift, creating a new social relationship. In New Guinea, "neither agency nor intentionality is a simple expression of individuality, inasmuch the being of other is an internal condition of one's own activity" (Strathern 1988). This observation resonates with Sahlins rendition that "unlike the classic bourgeois individualism, the body is not the private possession of the individual, a body is the responsible of the micro-community that feeds and cares for it" (Sahlins 2008:50).

We have briefly surveyed the theoretical landscape of the gift, personhood, individualism, and holism. We have also accessed the debate on the postmodern condition of self which leads us to our final topic: the sociology of individualization[19]. In contemporary Western European sociology, Beck and Beck-Gernsheim (2002) advanced the program of study of individualization in contemporary capitalist societies. According to the authors, the process refers to transformations in the labor market, family structure, and educational system, as well as intimately in the notion of self. As theorized by Giddens, Beck, and Lash's (1994) "reflexive modernization" is characterized

19 Beck and Beck-Gersthein (2002) distinguish between the entrepreneurial individual of neoliberal economics in their definition of "institutionalized individualism" [Individualisierung]. According to the authors, the question is not of increased atomization but of imposition of individualization with societal demand for living a "life of one's own" (a "self-culture") with disregard for actual ties of interdependence. Uncertainty in social relations and institutions leads to the imposition of a never-ending constellation of choices, what the authors call a "do-it-yourself biography," which comes with a generalized sentiment that one is responsible for his or her life in its entirety: "The human being becomes (in a radicalization of Sartre's subject) a choice among possibilities, "homo optionis." Life, death, gender, corporeality, identity, religion, marriage, and parenthood are becoming decidable down to the smallest print; once fragmented into options, everything must be decided." (Beck and Beck-Gersthein 2002:5). The so-called "self-culture" is organized around three basic social processes according to Beck and Beck-Gersthein (2003:43): "staging the self" in creating a life-style of one's own, "an internalized, practising consciousness of freedom," and "self-organization" beyond the channels of participation in institutionalized forms of political action. All of these processes are important for our reflection in the next chapter on hacker personhood for casting light onto the processes of fashioning one's life around IT development, engaging in debates regarding software freedom and technological autonomy, and self-organization as a cardinal aspect of collective organizing among hacker groups.

by re-enforced individualization, societal risk with the crisis of technoscientific authority, and multi-dimensional globalization with selective cosmopolitanism. As Beck and Beck-Gernsheim put it, on the epistemological level, "unequivocal, newtonian social and political theory of first modernity is being substituted by the Heisenbergian uncertainty principle of social and political reality" (Beck and Beck-Gersthein 2010:XVI). In this context, individualization promotes the "[d]isembedding and removal from historically prescribed social forms and commitments in the sense of traditional contexts of dominance and support, the 'liberating dimension'; the loss of traditional security with respect to practical knowledge, faith and guiding norms, the 'disenchantment dimension'; and – here the meaning of the word is virtually turned into its opposite – re-embedding, a new type of social commitment, the 'control' or 'reintegration dimension'" (Beck 1992:128). The historical project of modernity is, according to the author, radicalizing itself: "it is precisely the victory march of modernity that is shaking its principles to the core" (op. cit.). Giddens contributed to this discussion by elaborating on micro-interactional aspects via Goffman and Garfinkel, the mode of "civil disattention" as a "basic type of facework commitment in encounters with strangers in circumstances of modernity" (Giddens 1990:82). Trust in abstract systems is another key feature: "the nature of modern institutions is deeply bound up with the mechanisms of trust in abstract systems", such as trust in expert systems as a form of "faceless commitment" (Giddens 1990:83). In this conception, there is very little room to opt-out of those abstract systems as their construction implies the separation between back and front stage in order to separate the space of experts and that of lay persons, disguising the fact that experts fail and fail often in their own domains of knowledge practice. Post-modernity creates the opportunity for distancing in space/time that are coeval with relations of trust. Facework is considered important for the maintenance of trust (at computer conferences, hackerspaces, examples of "re-embedding of social relations," the reliance on social relations of trust not only impersonal systems). The nexus between *personification* (with the ongoing process of individualization) and *spatialization* (with the translocality of computing expertise) leads us to the anthropological debate on globalization in the next section.

1.4. Space, Place, and Globalization: the Question of Spatialization

Studies in anthropology of globalization promoted a shift from sociological descriptions of major economic and societal transformations to the empirical investigation of articulations and tensions between local processes, histories, and global imaginaries that are mutually but partially constituted by the transnationalization of markets, media, and digital technologies (Lins Ribeiro 1994; Marcus 1995; Appadurai 1996; Hannerz 1996; Gupta and Ferguson 1997; Escobar 2008). This body of literature has shown how transnationality entails not only an imposition of neoliberal economic policies, but the mutual constitution between local and transnational processes for wider circulation of discourses, commodities, managerial and technoscientific elites (Inda and Rosaldo 2002; Tsing 2005; Ong and Collier 2005; Lins Ribeiro 2006). This research area is relevant for the study of emergent forms of collaborative work among unequal partners in computing, especially in respect to the circulation and exchange of computer technologies and technologists in late industrial and recently industrialized countries. It provides relevant pointers for designing a multi-sited research in areas of economic integration, such as the Pacific Rim, helping to illuminate cultural and economic dynamics beyond the phenomenon of migration to information technology hubs (Saxenian 1999; Pellow and Park 2002; Zlolniski 2006). When treating the question of "spatialization" as a process in which hacking becomes a translocal phenomena, I am drawing from this literature and speaking of the production of space alongside the production of subjectivities with digital technologies.

Transnational social phenomena beyond logistics and trade—such as the global expansion and enforcement of the Intellectual Property regime (Vaidhyanathan 2001; Drahos and Mayne 2002; Boyle 2008; Leal and Souza 2010)—have been disputed through new forms of expert knowledge in different areas of computing and political activism regarding issues of access to knowledge and education, freedom of speech, and respect to privacy. The analysis of the emergent phenomena of digitally-mediated collective action is to be found in the literature on Internet-based and volunteer-based collaborative production (Weber 2004; Benkler 2006; Reagle 2010). Little attention has been paid, however, to cross-cultural forms of exchange, as well as the question of engagement in collaborative Internet-based cultural production.

The project of "multi-sited" or "multi-locale" ethnography was elaborated at the moment of paradigmatic crisis of social sciences (Marcus and Fischer 1986; Ianni 1990; Santos 2000) as a reaction to the deep rooted naturalist orientation of fieldwork[20]. It was

20 The anthropological tradition of ethnographic research has its origins in the context of natural history and its fieldwork practice of the 19th century (Kuclick 1997:50; Barth et. al. 2005). In *Les Mots and Les Choses* Michel Foucault (1966)[1987] described, among other key transitions in the order of modernist knowledge of proto-sciences with the so-called crisis of the classical notion of representation. In an interview with Paul Rabinow, Foucault elaborated on the process of spatialization which follows the emergence of a new orientation for research in biological sciences:

intended as an experiment to address the issue of the crisis of representation in the canonical form of ethnographic writing, recasting the critical reflection developed in the late sixties around ethical and political relationships of researchers and their subjects, as well as the forms of description of fieldwork experience, of mediation, and interpretation (and *institution*) of cultural differences. The design for multi-sited ethnography research, however, has more to do with a renewed conceptual framework to situate contemporary anthropological inquiries than a set of practical strategies for going about fieldwork. The practice of multi-sited fieldwork implies re-conceiving the field as a "complex web of interactions in which anthropologists in collaboration with others, conventionally conceived as informants and located in a variety of often contrasting settings, trace connections and networks, mutations, influences and cultural forces and changing social pressures" (Marcus and Fischer 1986: XVIII-XIX). It is not about comprehensive data gathering through participant observation guided by an external, academic agenda, but the description of what it means to be entangled in the very web of relationships the ethnographer finds herself.

In "The Emergence of Multisited Ethnography" George Marcus (1995) offered an important intervention in the debate of the contemporary transformations of ethnographic practice. According to the author, the objective of the multi-sited

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"what calls attention in respect to the mutations and transformations of the 17th century is to see how the *spatialization* of knowledge was one of the factors in the constitution of these forms of knowledge as science. If natural history and the Linean classification were possible, it is due to a certain number of reasons: on the one hand, there was literally a *spatialization* of the object of their analysis, they imposed themselves the rule of studying and classifying a plant based only on what was visible" (Foucault 1984: 254, my emphasis). This naturalist orientation had a great impact in anthropology, having a legacy of long lasting effects until the present in spite of several waves of criticism with the prominence of historical approaches (see: Sahlins 1981; Wolf 1982; Rosaldo 1989) and the critique of the relationships between the discipline and its close ties to colonial enterprises (Asad et al. 1973).

approach is “to start with some prior view of a system and to provide an ethnographic account of it, by sharing the forms of local life that the system encompasses, and then, leading to novel and revised views of the nature of the system itself, translating its abstract qualities into more fully human terms” (Marcus 1986:171). In spite of the methodological orientation of “following” the flux of life-histories, objects, conflicts, metaphors and associations, the proposition of multi-sited ethnography consists in displacing the canonical understanding of the field as well as the practice of fieldwork in order to describe the circulation of “meanings, objects, identities” (Marcus 1996: 96). One of the key tasks of multi-sited ethnography consists, therefore, in translating between cultural idioms, since the field is not organized using the master trope of the familiar/unfamiliar which demands more attention to the nuances, denegations, effacements, detours, and slippages in language practices. It is the practice of translation in itself that bridges “various localities which the research explores along unexpected and dissonant fractures of social location” (Marcus 1995:100).

Along similar lines, Ulf Hannerz (2009) evoked his British training in sociocultural anthropology to suggest a different position in respect to the practice of fieldwork: “social anthropology, conceptually, is primarily about social relationships and only derivatively and not necessarily about places” (op. cit., p. 29). By reflecting upon his own trajectory as an anthropologist, he characterizes his work as “studying down, up, and sideways” which constitutes an imposition of globalization as social distances in the field are, at the same time, cultural, geographic, economic, legal and political. Suggestively, he argues that an important issue was overlooked in face of the saturation of the debate on the status of the field and the practice of fieldwork: the moral aspect, which leaves the researchers with a model of and a model for an anthropology by immersion (with personal engagement) and an anthropology by appointment (characterized by the lack of engagement) in accelerated social tempos. The reflection upon the missing dimension of morality should help us aim to "cultivate an understanding of the connections between the kinds of relationships we study and the relationships we ourselves have in the field" (Hannerz 2004:35). This observation is of particular interest for this monograph, since the description of technologies and personal trajectories I offer are meant to be read along the multi-dimensionality of the digital, the moral, and the political, which is to say in other terms, along technical infrastructures, moral practices of self-cultivation, and political disputes over the present and the future of our technical collectives.

The field as a network of hackerspaces evokes yet another set of important contributions from contemporary anthropology. In his essay "Spatial Practices," James Clifford (1992) focused on the concept and usage of the notion of the field and the imagery it evokes, for example, with Malinowski's tent in the Trobriand islands or Mead's pictures in Samoa. Clifford's point of anchorage is the notion of the "spatial practice" borrowed from De Certeau's for whom space is conceptualized as dependent on the corporeal and the discursive, as well as heavily dependent on the experience of the actor in movement in space, working against the modernist notion of the (empty) Cartesian space. The question of "what counts as fieldwork" currently is worth questioning as the discipline faces new challenges that are drastically transforming our analytical tools and perspectives on (long established) notions and concepts such as culture, place, field, and technology. These transformations are accompanied by a sense that cultural differences are felt just as strongly at home. Despite the existence of numerous heterodoxic examples of contemporary ethnographic practices, by and large the dominant sensibility still construes "real ethnography" in the canonical sense[21]. In this context, Clifford argues that "fieldwork has played—and continues to play—a central disciplining function" (op. cit., p.192). This disciplinary function has led historically to the creation of a "habitus rather than a place" (op. cit., p.199), meaning the establishment of "an ungendered, unraced, sexually inactive subject interacting intensely (on hermeneutic / scientific levels at the very least) with interlocutors" (op. cit., p.202). Of crucial importance for the study of personal trajectories for this monograph is the legitimacy of co-participants to theorize, describe, and criticize social realities. Thinking alongside—and *not critically aside*—the co-participants of this project served the purpose of getting at the unspoken and unattended dimensions of moral cultivation and ethical problematization.

Drawing from a distinct anthropological tradition across the Atlantic, Marc Augé (1995) contributed to this debate with the evaluation of our contemporary global condition with his discussion of "supermodernity" and the "anthropology of near" with

21 It is fortuitous for us here to recapitulate the naturalist foundations of the anthropological canon. From the pioneer expedition to Torres strait led by the naturalist A. C. Haddon in 1898, Malinowski (1950) found the institutional support for elaborating on three foundational principles of fieldwork: 1) isolation of the researchers from the company of those who share the same culture, aiming to become closer to the natives and the tribal life; 2) find inspiration in theory, but liberate oneself from preconceived notions whenever the field brings forth new evidence; 3) offer a clear, objective, and detailed representation of the constitution of the tribal life. In his orientation for fieldwork based on participant observation, Malinowski followed the methodological orientation of Haddon and his adviser and participant of the expedition C. G. Seligman to study the Trobriand island. This project took part in the evolutionist argument of the time in defense of the comparative method: by conducting a wide range of case studies, the anthropologist as the biologist would have the possibility to compare between groups and reconstruct the scale of human evolution (Kuklick 1997:55). This tradition laid the groundwork for the notion of field as discrete and delimited geographical site with long lasting consequences for our understanding of the practice of fieldwork today.

exercises of ethnography "at home" in Euro-American societies. The author questions our current interpretative power by asking, "are the facts, institutions, mode of assembly (work, leisure, residential), modes of circulation, specific to the contemporary world, amendable to anthropological scrutiny?" (Augé 1995:11). In dialog with the French sociological school, he criticizes the persistence of a notion of place as culturally and contextually circumscribed using rather the notion of place in French ethnology with the "idea of culture localized in time and space" (op. cit., p. 34). Recuperating Mauss he further discusses the concept of "total social fact"—the synthesis of economic, aesthetic, technical, familial, etc. plus the subjective experience of this totality. As Augé puts it, "experience of the total social fact is doubly concrete (and doubly complete): experience of society precisely located in space and time, but also experience of the individual belonging to that society." The condition of supermodernity is characterized by excess in several arenas of life in accelerated transformation: 1) perception of time and the usage of it; 2) excess of space with integration via fast transportation between several locations; 3) changing of scales, proliferation of the imagined and the imaginary references; and 4) advancement of forms of "individuation." As a consequence, supermodernity produces "non-places which are not themselves anthropological places." An anthropology of place would, therefore, account for "concrete and symbolic construction of space, which could not of itself allow for the vicissitudes and contradictions of social life [...] because all anthropology is anthropology of other people's anthropology, that place—anthropological place—is a principle of meaning for the people who live in it and also a principle of intelligibility for a person who observes it" (op. cit., p.51-52). As a concluding argument, Augé contends proliferating non-spaces are contrary to anthropological places, pointing to a productive distinction introduced by Merleau-Ponty between geometric space and anthropological space, the existential space *par excellence*, “experience of the relations with the world on the part of a being essentially situated 'in relation to its milieu'”, (op. cit., p. 80). Differently from the Anglo-Saxon debate in the anthropology of space and place, Augé emphasizes the process of increased “individuation” that is being championed by globalist discourses and economic practices, which consists in the enforcement of individual property rights and the emphasis on individualism in the form of consumerism and unbounded economic competition.

Anthropologists could readily question the empirical grounding and generalizing power of Augé's notion of “non-place” despite his important contributions for the debate on time, space, and place. Of particular interest for us is the distinction between space and place which serves to frame the presentation of spaces of global articulation around imagined communities of computer experts and places of experience of situated computer technologists manipulating concrete tools and abstract data structures to advance a collective ideal of transnational, nonrestrictive, and morally-sound collaboration. This distinction is used throughout this monograph to make sense of the difference between the way hackerspaces are experienced and the ways in which they are imagined and constructed with circulating narratives of global range. Practices of imaginative projection and presentation of hackerspaces as networked spaces are central in helping to create a sense of (transnational) scale and belonging.

Another important conceptual distinction for our study was proposed by Tsing

(2005) between the discourse and practice of globalism and the politics of global scale-making[22]. For Tsing, "globalism" reflects the multi-referential discourse of globalization: "part corporate hype and capitalist regulatory agenda, part cultural excitement, part social commentary and protest" (Tsing 2005:332). In order to analyze and reflect critically about globalization, the author proposes the study of politics and cultures of scale-making which render possible planetary interconnection and disconnection. Political and economic events of the late 1960's created the conditions for the circulation and interpretation of globalist discourses, such as the advent of developmentist projects post-World War II, the emergence of the environmental discourse—creating a sense of holistic co-existence between nations in the globe—and the new left discourses on the successive crises of capitalism, as well as the transnational mobilization practices against the tendencies of corporate multinational expansion and market (de)regulation. Tsing cautions anthropologists to avoid jumping too quickly into the wagon of futurists who are eager to declare the rise of a new era

22 In her book "Friction" (2005), Tsing further elaborates on a comprehensive framework for the anthropological study of scale-making which benefits our study of alternative computing. By questioning the deforestation and the dramatic change in the landscape of Indonesia, Tsing (2005) argues that it is not possible to account for a supposedly local environmental crisis without approaching the interconnection of local and global agents. It is only by elaborating on a method to study culture as a product of cross-cultural encounters (Wagner 1976)—or what Tsing calls "an awkward, unequal, unstable, and creative qualities of interconnection across difference" (Tsing 2005:4)—one is capable of examining the constitution of global capitalism. The place where Tsing conducted her ethnography is the south Kalimantan in the island of Borneo, Indonesia. The author explores transnational and transactional ties with mining companies and corporations of various sorts, the development agenda of the government (and how it was linked to the practice of neoliberalization in 1990's) and environmentalist initiatives. Beyond the discourse on Nature (capital N nature, the universal recipient of truth), Tsing also explores the implication of nature/culture with the aim of problematizing this modernist long-lasting divide. This divide has been constitutive of sciences and historically reinforced, only to be criticized recently (Ingold 2000; Descola and Palsson 1996) in the context of ethnology and science and technology studies (Latour 1993; Pfaffenberger 1999). If an ethnographer focuses on the forms of interaction between human and non-human agents, she can follow "how the forest becomes readable as a social space" (Tsing 2005: 175) and how claims of universality mediate (with gaps, partialities, ambiguities) our relationship with nature.

brought forth by globalization, defined by a new economy, culture, and society. This form of awareness is important for anthropologists of computing since most discourses on digital technologies are organized as globalist and universalist magic incantations to disguise unequal conditions of production and circulation. The task is, rather, the investigation of how technical alliances are made, how are they carried out and what gets in and out of global circulation; what correlation of political forces and cultural institutions? It is advisable for any study of transnationality to avoid framing questions in terms of "global forces" versus "local places" which can be traced back to conventional wisdom in anthropology in basically two distinct ways: the "old" days of the discipline, criticized in the 1960's and 1970's as institutionally committed to imperial powers, operating with the notion of space-bounded cultures; and, conversely, the advocacy for the new interconnection between regions, nations, groups and cultures which depicted a world of intense circulation and flow with little regard for the processes of local appropriation. Local, regional, and planetary organization of space-time, in sum, is to be understood under the light of practices of scale-making with a refusal to embrace the language that has been offered by globalist discourses.

In parallel with previous studies of globalization and transnationalism, Arturo Escobar in *Territories of Difference* (2008) responds to the call for a multi-scalar study of the production of global spaces, taking local processes of developmentist intervention and radical politics fully into account. The objective of his study was to examine "place-making and region-making from multi-level economic, ecological, and cultural perspectives." Escobar provides interpretative keys to the understanding of the geopolitics of knowledge in the context of what he calls the "contemporary enactments of globality." Through extended fieldwork in the region of the Colombian Pacific, Escobar engages with the mobilization practices of the local black and indigenous movements in their struggle against government and multi-national development projects which include their ancestral territories in modernizing plans for Colombia. According to the author the emphasis on place-making and coloniality serves as an antidote to the effacing effect of globalist discourses which renders places meaningless (Escobar 2008:35). Instead of assuming territory in the canonical sense, that is, the space produced by a sovereign State power, he defines territory an articulatory discursive practice: "the concept of territory produced by a number of movements in the 1990's articulated a place-based framework linking history, culture, environment and social life" (Escobar 2008:62). This indigenous articulation created the conditions for a new politics of place in Colombia, a "novel political imaginary in that it asserts a logic of difference and possibility" (op. cit. p. 67) beyond and despite the hegemonic globalizing and colonizing forces. The Colombian Pacific is constructed, thus, as a place for livelihood in the dispute for categories of perception of the social world, diverging from the hegemonic development and globalist projects.

Refusing to frame the problem of the transformation of local cultures in the context of transnational, global flows with traditional anthropological approaches to culture and locality, Arjun Appadurai defines as his central question "what locality might mean in face of nation-state contemporary destabilization" (Appadurai 1996:178). The author approached locality as "primarily relational and contextual, rather than scalar or spatial" (op. cit., p. 178). He also calls attention to the distinction of "local in itself" / "local for itself" which recasts the classic marxist distinction advanced by

Luckács in his discussion of class consciousness. Appadurai argues that “much of what was considered local knowledge is actually knowledge of how to produce and reproduce locality” (op. cit., p. 181). He goes on to suggest that we must approach the ethnographic record as a history of the “techniques to produce locality” (op. cit. p. 182). Locality, therefore, is defined as a “phenomenological property of social life, a structure of feeling that is produced by particular forms of intentional activity and that yields particular sorts of material effects” (op. cit., p. 182). Following the discussion about contemporary transformations in capitalism, he proposes a framework comprised by five dimensions which account for “disjunctures in global economy of culture, politics and economy”: ethnoscape (Rouse 1991; Kearney 2002), technoscape (Arturo 1994; Fischer 2003), ideoscape, financialscape (Maurer 2005; Ho 2009) and mediascape (Ortner 1998, Larkin 2008).

Similarly, Inda and Rosaldo (2002) argued for a view of our global condition that is not limited by our critical discourses on homogeneization, westernization, and americanization of the world. The idea of dislocation, borrowed from the political scientist Ernesto Laclau, suggests that our cultural condition is not viewed adequately “in terms of the monolithic core-periphery model, but as an interconnected cultural place, one full of crisscrossing flows and intersecting systems of meaning” (Inda and Rosaldo 2002:26). Globalization reflects an intensification of cultural, economic, migratory flows with interconnection and re-created interdependence between different locales of the planet. Surpassing the tendency for the imposition of sameness, global interconnections are marked by unevenness: certain hackerspaces are more situated and connected than others, certain groups of hackers are allowed to circulate, whereas others are forbidden; mobile capital, software, and hardware have particular circuits that are not evenly distributed across regions and national borders. It is widely accepted that this condition of unevenness and increased complexity in social life led to a reorganization of time and space. There are several concomitant processes which promoted this transformation, such as space-time compression, as discussed by Harvey (1976) with increased advancement in transportation and information technologies; acceleration of time via transformation of productive forces, imposing a new rhythm to labor and fast turn-over of capital in the context of a post-fordist flexible accumulation and supply-chain network formations; and the "interlocking" of the local and global, the connection of locales for the needs of capital. David Held (1999) summarized these points in his description of the main characteristics of globalization: 1) speed up of flows; 2) intensification of links between remote locations; and 3) stretching of social, cultural, economic and political practices across national borders. Against the common critical assessment against globalization *qua* cultural imperialism, Inda and Rosaldo (2002) suggested that "there is no dislodging of everyday meanings without some form of territorialization", in other words, for every process of de-territorialization—"how politics, identities, communities, consumption becomes detached from local places" (Kerney 1995:554)—there is a counter movement of territorialization, which recreates the symbols and commodities in circulation in the context of the historical experience of particular groups.

The multi-sited ethnographic approach is not immune to various risks which are related to the acceleration of time and compression of space which amounts to the difficulty of guaranteeing access to the field, leading to "drive-by" ethnographies and “ethnographies by appointment” (Hannerz 2004). This issue speak to the conditions of possibility for any ethnographic project. Reflecting upon his own ethnographic work among international correspondents in Tokyo, Jerusalem and Johansburg, Hannerz (2003) suggests that the notion of multi-locality is rather confusing, given that what is at stake is translocal work, that is, the transit of the object of inquiry, of social actors, and of the researcher herself across various localities in which certain processes and cultural practices are elaborated, ressignified, reproduced, and transformed. In respect to the question of intensity, time compression, and cultivation of relationships in the field, the canonical format of, at least 12 months at a particular site, were considered the minimal sufficient time for observation of a whole cycle of political, legal, religious, and economic activities throughout the seasons. This orientation carried with itself the imperative of the description and explanation of social life in its totality with special emphasis on observable social relations. The objective was that of reconstruction of observable social relations and the explanation of its functions for maintenance of a determined social group. The question of relationships in the field, observes Hannerz, in the context of multi-localized ethnography is related to the introduction of anthropological questions in the context of transnational social networks. What fundamentally distinguishes the nature of contemporary ethnography in relation to the established canonical orientation? Anthropology, in the context of transnational computing collectives, constitutes itself amongst practical difficulties and a renewed set of conceptual tools in the “art of possible” (Hannerz 2003: 213). What Marcus has called the “Malinowskian complex” with its “peoples and places cultural expertise” is being currently challenged by multi-sited projects.

The previous discussion about the findings of the anthropology of space, place, and globalization is of particular importance for this project. I was trained in a traditional program of Social Anthropology in Brazil where I learned through formal and informal ways about the canonical orientation for fieldwork: spending at least a year in a particular site, having a clear notion of its boundaries, building rapport with the group as a *sine qua non* condition of fieldwork, and describing social realities as close as possible to the "group's point of view" after learning through immersion. It is not an elementary matter to follow all the channels of simultaneous communication and action connecting the various areas of non-institutionalized, translocal computing activity. Reflexive multi-sited practices must involve the questioning of "intensity, boundedness, and defamiliarization" in field experiences (Marcus 2011). I did fieldwork from 5 to 6 months in each location, and traveled for the remaining time of fieldwork to various IT conferences and gatherings. As the fieldwork experience unfolded—and in virtue of connections between the sites—I realized that the fieldwork did not stop but continued in another hackerspace; it continued through similar infrastructural means and objects, discourses, and practices. Everyday activities and routines people executed were similar (workshops, talks, discussions, sources of news in topical everyday conversation) as well as the utopias of technical liberation and technological advancement were shared at the surface level. What I found to be radically different was the condition under which activities were carried out (access to tools, resources, legal constrains, perceived cultural interdictions) and the ways in which discussions were contextually informed and interpreted based on personal and technical trajectories. Despite strong concentration around sources of information and debate around similar types of technical objects, interpretations were widely different as they were experientially grounded. I came to experience events in which projects, people, and practices became global, whereas others would be only deemed local. While technical elites circulated across all the sites I conducted fieldwork (as much for me, a non-elite anthropologist who circulated with the support of an elite institution) others were marginalized for not having the experience of participating actively in the global networks. Over time, one of my guiding questions became, "what does account for this *difference* which produces differences?" The answer turned out not to be trivial since the course of the project depended upon it, and since one of the key discourses on hacking with strong binding force is the one about the imagined hacker community being indifferent to differences of color, religious belief, socioeconomic background, and nationality (Mentor 1981; Levy 1984; Himanen 2001). The emphasis on technical virtuosity was identified as paramount.

The question of online and offline collaboration—not only as an object of discourse, but as a practice to build ties—became central for this study. I gradually learned about the importance of work for the hackerspace community, collaborative work that I involved myself in the course of fieldwork. I witnessed events in which members and non-members would become undesirable presences for not conducting or helping to conduct projects. They were not perceived as hackers nor as contributors of worth. As for me, it was not hard to find projects to work on and tasks to help around hackerspaces which I took up with much energy and minute doses of occasional pride for small technical accomplishments, despite their insignificance in the bigger order of technical projects. The general orientation for the ethnography of sociotechnical collectivities would include, first and foremost, a rehashed version of a common mantra among researchers trained as anthropologists: in order to study networks one has to actively get emmeshed in them. Tasks I performed at hackerspaces included: helping and being helped with technical projects; clean and organize the space; help with infrastructural issues; collaborate to produce documentation, testing, and debugging of projects; discuss and incite participation around open hardware and free software projects; work and figure out solutions for particular technical issues as I was encouraged to learn by myself. All in all, this is not to say that I was not denied several times to join particular discussion groups at particular events, so I could understand where the boundaries lie and under what circumstances and conditions one is to be invited to join exclusive groups within larger groups. I would list as the most important insight-inducing challenges I faced during fieldwork the following: 1) the promise of a multi-sited ethnography and its practical limits (the difficulty to secure visas and being able to stay in one location for more than 2-3 months and having to leave and re-enter countries such as United States, Japan, and China to renew visas several times); 2) the accelerated world of IT, the hectic pace of computer professionals and the difficulties of finding time to have more engaging conversations and interactions such as the interviews around the clock and, as Hannerz (2004) points out well according to his own field experiences in global cities, the "ethnography by appointment"; 3) power dynamics, puzzlement, and asymmetrical relationships involving the researcher and co-participants, plus the perception of the fieldworker from a "third world country" identified with a prestigious research university; and, finally, 4) collaboration and co-participation: my previous experiences in computing allowed for building stronger ties as I engaged with genuine interest in the technical aspects of the practice with the same avid investigative focus I would dedicate to questions of cultural practices and historical formation of computer collectives.

Building and sharing a world of experience through moral, technical, economic and political ties have helped hackers to reconfigure the domain of computing through the circulation of the fruits of their labor and their own circulation as technologists. The unequally inhabited "technoscape" (the mutually constitutive realms of *experience* and computing *infrastructure)* shapes new conditions for the practice of ethnography. As an example of experimental ethnography which have deeply inspired the design of this project, Kelty (2009) suggested the notion of "composition" for new collaborative engagements with the goal of encompassing different types of media and inscriptions as forms of ethnographic register (such as blog posts, wiki entries, commentaries on web pages, collaborative interviewing, databases, etc.), reflecting upon the challenges and opportunities for the transformation of ethnographic offered by the Internet. What does change with the advent of the Internet is not only the relationships that we have with our informants and their practices, but the electronic mediation we now have with them and with other (virtual or actual) objects in our fields—with no guarantee whatsoever of a more insightful and encompassing ethnographic registry despite the wide availability of powerful information technologies at our disposal. The expansion and application of new media into different realms of social life impose challenges and bring forth potentialities that were under-explored by anthropologists. My involvement in this respect has been multiple and spanned across different registers of practice in the context of the hackerspace community. I helped to organize different workshops on cryptographic technology, soldering, and debates regarding the politics of information in Open Access, Free Software, Open hardware and Open Data. I also helped collect data, document, and test Free Software technologies with collaborators from Japan, China, United States and Brazil. At hackerspaces, I conducted my own projects which consisted in an electronic (wearable) drum kit, a pedal for controlling a media player for my own interview transcriptions, and an arcade game box based on a small single-board GNU/Linux computer. I conducted these activities with the indispensable help of other hackerspace members. And I converted these endeavors into Free Software and Open hardware projects by distributing the source code and design files online under flexible copyright licenses and in public domain. Practical lessons I could not have had access to if it was not for the physical co-presence and sharing of common tools at hackerspaces.

We will now proceed to the theoretical discussion on personhood, selfhood and morality to address the constitutive ties binding technologists and technologies around Free and Open source technologies and hacker collectives.

1.5. Personhood, Morality, and Exchange: the Question of Personification

Contemporary studies of personhood, morality, and ethics in anthropology provide an important contribution to the investigation of computer expert training for helping us bridge the investigation of the globalization of hacking with the study of actual practices of self-cultivation and expert training. Viewed as embodied skill and trained perception, expertise can be productively studied in anthropology using a relational approach to the cultivation of self (Csordas 1990; Hollan 1992; Morris 1994) and the moral person (Zigon 2008; Kleinman 2011). The anthropological import of moral frameworks resides in their intimate connections with notions of self and assessments of worth of human persons. When one of the co-participants of this project describes science and technology as his *first, not second nature*, we must situate his observation in perspective by attending to the ways in which his trajectory is reconstituted within the narrative threads of his lived experiences (Ricouer 1984; Taylor 1989).

The work of Marcel Mauss on the notion of person is seminal for the anthropological debate across national disciplinary traditions. In his lecture entitled *La Notion de Personne* given to the British Royal Anthropological Institute in 1938, Mauss described the project of tracing the social history of the notion of person from the relations between clans and individual persons to the development of the notion of the "autonomous individual" in Western societies. In his presentation, Mauss elaborated on a uni-lineal path of development of the social category of person from Australian aborigines to American Northwest Indians, Romans, Indians and modern Western societies. Universality of the notion of self as self-awareness, borrowed in the context of French sociology from Kant, is taken as the basis for inscribed social representations. The sociological task would be to find specific elaborations on character, personal attributes, and values associated with the role and the status of an individual person. This proposition has been central in the historical development of the discipline as different schools such as the North American "Culture and Personality" and the Brazilian ethnological school (Seeger, da Matta and Viveiros de Castro 1979) both elaborated on this work in different ways, addressing different collectives. Mauss' heuristic distinction between *self* (psychological being) and *person* (social being) rests, however, on a rather problematic definition of the *homo duplex* elaborated for the Durkheimian sociological program. Until recently with the work of Bernard Lahire, revitalizing the "dispositional sociology" of Pierre Bourdieu through the study of personal trajectories, social facts as objects of inquiry had, as a rule of method, to be clearly distinguished from what pertains to psychology in relation to what is of competence of sociology (Lahire 2002). Mauss anchored his work on the person in the Durkheimian project by separating psychology (*soi*) and socially informed notions of personhood (*moi*), but his contribution did not stop there as we discussed in the previous section with the developments of the notion of "general or total social fact" whereas the symbolism he identified as a distinguishing general principle of gift relations reconnected the spiritual, the economic, the political, and the social in ways that were not previously accounted in a more fully relational fashion.

In the context of moral philosophy, Charles Taylor's (1989) discussion of the Western notion of person was offered to provide grounds for comparison with non-Western groups in his historical reconstruction of the moral frameworks of modernity. Taylor provides an alternative to what he calls the "representationist" view of person, which we could attribute to Mauss given his emphasis on the symbolic dimension of personhood as a social mask instead of a set of practices for the cultivation of self. For Taylor, a person is any self-aware agent capable of experiencing shame, guilt, emotions, and a sense of dignity, that is, "holding values"/significance as he/she represents the world and the self for his/herself (Taylor *apud* Carrithers et al. 1985:265). Taylor argues that language is the major force shaping personhood, given that the notion of self is, according to him, constituted in dialog with a particular culture as one becomes “a person and remains one only as an interlocutor” (*Ibid.*, p. 276). Against a representationalist treatment of personhood, Taylor argues that the dichotomy between *moi* and *personne* (the sense of *self* and the notion of *person* respectively) is not adequate as it is not only in the mind as a representation of the world for the self that the person arises, but also by through the linkage of the self to an external, public space of (moral) language dialogically constituted.

In the Euro-American context, Bellah et al. “Habits of the Heart” (1996) offered a major contribution to the study of personhood and individualism. Focusing on the culture of individualism and its manifestations in the United States, Bellah et al. discussed the decline of associative practices and the contemporary development of a new phase of capitalism with free market orthodoxy and stronger individualistic values. Their concept of "representative character" is mobilized to discuss organizing symbols which help individuals to shape their actions collectively, defining a shared moral vision of life. With the transformation of United States into an industrial power in the late 19th century, the representative character changed to the figure of the *entrepreneur* which has since become a hegemonic force for the cultivation of capitalistic selves. The authors' main contribution is the distinction between “expressive” and “utilitarian individualism” as a dynamic tension in the foundation of North-American individualism[23]. The figure of Benjamin Franklin stands for the “self-made man,” serving

23 Reservations we could have in respect to Bellah et al. refer to understudied forms of associativism among economic, intellectual, managerial, and technical elites, which include computer hackers but also entrepreneurs in influential regions such as Silicon Valley (Saxenian 1996; Lee et al. 2000). The

as an instance of classic utilitarian individualism, while Walt Whitman exemplifies the standpoint of expressive individualists with the figure of the self-centered, romantic individual in search for self-development, celebrating himself through poetry and devotion to the arts and the enjoyment of life.

Another key contribution for the discussion on subjectivity and ethics is the late work of Michel Foucault. In the course of his studies on the history of sexuality, he shifted his focus to a more general project of a genealogy of the practices of "care of self" from Antiquity to the present, practices in which one cultivates oneself into a virtuous being in the context of a particular philosophical tradition. Whereas in the Maussean treatment of the category of person one is able to find a historical reconstruction of the different contexts which established what it means to be a person, in Foucault's work there is a similar effort of historical reconstruction remounting to the Greeks and the Christian tradition to describe, differently from Mauss, the actual practices of self-cultivation (Foucault 2005). If for Mauss the focus was the representations and their history, the question and focus of historical reconstitution for the late Foucault are the actual practices of cultivation and their genealogies (to the extent in which they can be reconstructed from the historical record).

critique of individualism overlooks the mechanisms in which individualistic values are embodied and expressed, finding different elaborations on what it means to be a person. Given the forces for fragmentation in public discourse with moral relativity, precarity of labor conditions in the global North and South, and the concomitant rise of individualization in various national and regional contexts, another misleading question in Bellah et al. is framed in terms of the need for fostering communitarian values. If the conditions under which social life is currently organized, conducted, reproduced, and signified are shaped mainly by individualistic orientations, what are the means to achieve a higher form of consciousness that stem from a sense of shared existence, solidarity, community in the context of ethical hacker collectives? I contend this questioning is misleading for assuming too readily a distinction between holism and individualism, as well as for diverting our attention from the circularity of the original argument as it seems to suggest that economic equality will solve the problem of the internal divisions (racial, economic, gender, etc.), bringing us back together again in communion of higher moral values (Bellah et al. 1996:87).

Drawing from Foucault's historical line of inquiry, Nikolas Rose (1996) offered a contemporary study of subjectification and the intertwining between expert knowledge and disciplinary control. The author sets off to conduct a "genealogy of subjectification" not a "history of ideas[24]" of the person, focusing instead on practices of historical constitution of subjects and aiming to investigate the "historical *a priori* of our existence." The inquiry is directed toward the study of the self as a construct of a particular regime of power which presupposes a relation to the self as historical not ontological, that is, the study of the techniques one employs to act upon oneself.

For the purposes of this project, a parallel could be made between Foucault's discussion of the Christian principle of "Know Thyself" and its importance for the formation of the Christian subject and the contemporary hacker equivalent I would call the imperative to *self-train oneself* (Turkle 1984; Levy 1984; Raymond 1999). Rose is concerned with the historical techniques creating the nexus to articulate personhood with a sense of identity and interiority, autonomy and individuality. Focusing on the techniques of subjectification of the body becomes not only the point of departure for the analysis but a support, assumed to be too varied since psychology cannot account for its processes because its origins lie in the same regime of the self: "subjectification is

24 It is worth noting how Rose's project echoes a famous pronouncement of Michel Foucault in 1971 as he took the chair of the "History of the System of Ideas" at College de France from Jean Hypolite's Hegelian project of a "history of ideas". This is a key moment in the development of Foucault's *démarche*, as he moves from his archaeological project (with the study of the historical practices of articulation between discourse practices and institutional domains of regulation) to a genealogical project, exploring the nexus between power and body, without ever abandoning the focus on the nexus power/discourse. For our discussion here the most important contribution is actually to be found in the late Foucault, when he returns to the open question of the subject he suspended in his archeological work until the 1970's (for which the subject is defined as an "empty position" in the order of the discourse (Foucault 1969)[2004] and his genealogical research of the disciplinary forms of power where the body is the negative surface of inscription of power. The subject is only seriously taken up as a problematic for the late Foucault in the early 1980's a few years before his tragic death which left his project of an archeology of the subject unfinished (Foucault 2005).

not to be understood by locating it in a universe of meaning or in the interactional context of narratives, but in a complex of apparatuses, practices, machinations, and assemblages within which human beings have been fabricated" (*ibid.*, p. 10). By reconstituting the history of the psychological and psychiatric disciplines in the nineteenth century, Rose uncovers the discursive technologies which created the relationship between Western subjects and themselves, inaugurating the modern selfhood. What modernity invented was a particular set of techniques for "conducting conduct." Rose's thesis, in sum, is that the development of psychology in Western Europe and North America in the 19th century is connected to the exercise of political power in liberal democracies. It came into being at the point of intersection between the development of techniques to govern the life of others (*biopower*) and to govern oneself (*care of self* as a research theme of the late Foucault). Freedom in Rose's project is assumed to be "articulated into norms and principles for organizing our experience of our world and of ourselves; freedom as it is realized in ways of exercising power over others, freedom as it has been articulated into certain rationales for practicing in relation to ourselves" (*ibid.* p. 16). The subject is not considered an "entity with history" but rather a point of intersection of various vectors of social forces: "the interiority which so many feel compelled to diagnose is not that of a psychological system, but of a discontinuous surface, a kind of unfolding of exteriority" (*ibid.* p. 37). There is no space in Rose's analysis for an interpretation of embodiment and cultivation of dispositions as any active political subject is meant to be solely "understood in terms of the consonance with the rise of regulatory technologies that enable the subject at home and at work, in acts of consumption and pleasure, to be governed at a distance" (*ibid.*, p.

165). Discursive matrices in articulation with non-discursive regimes operate as subjectification apparatuses, that is, “the name one can give to the effects of the composition and recomposition of forces, practices, and relations that strive or operate to render human beings into diverse subject forms, capable of taking themselves as subjects of their own and others practices upon them” (*ibid.*, p.171). Subjects, for this reason, might be “better seen as assemblages that metamorphose or change their properties as they expand their connections, that are nothing more, nothing less than the changing connections in which they are associated” (*ibid.* p. 172). The author criticizes the interactional symbolists' view of language as talk, which informs the work of Taylor and various anthropologies of moralities with phenomenological and ethnomethodological orientation, and mobilizes instead Deleuze's notion of “folds,” drawing from four ethical technologies described by Foucault in his hermeneutics of the subject. The self constituted by ethical technologies is cultivated through *mimesis* and alterity, defined through what the self is not, made subject in discursive positions in relation to sexuality, life-styles, aspirations, etc.

If a historical reconstitution of processes in which oneself comes to be defined as a person, scrutinized, and self-constituted by ethical technologies is crucial, it is not to be validated without empirical work in and beyond Western contexts. In the domain of psychological anthropology, more nuanced and empirically-informed perspectives of the historical processes of cultivation of personhood and its experiential dimensions have been developed. In his review article, Hollan (1992) criticizes the data collection method of the body of research on cross-cultural comparisons of the notions of self, pointing to the equivocal operationalization of the binary “sociocentric, holistic, traditional society" *versus* "individualistic society" with egocentric divisions. As I discussed in respect to the work of Marcel Mauss, the comparative approach to the notion of self (*egocentric*) in anthropology with the other notions (*sociocentric*) has been the normative guise of ethnographic studies of personhood. Geertz expresses a widely accepted position in this regard:

> "The Western conception of the person as a bounded, unique, more or less integrated motivational and cognitive universe, a dynamic center of awareness, emotion, judgment, and action organized into a distinctive whole and set constrastively both against other such wholes and against its social and natural background, is, however, incorrigible it may seem to us, a rather peculiar idea within the context of the world's cultures" (Geertz 1974: 59; see Spiro 1993 for a response).

A common position in psychological anthropology is the one which assumes experiential selves to be necessarily embedded in cultural models. Hollan goes on to make a critical remark of Geertz and Dumont in their treatment of the notion of person which "may too readily assume a close correspondence, or even identity, between cultural models or theories and subjective experiences" (Hollan 1992:285). The ways in which a person lives by a particular cultural model is, therefore, an empirical, open question.

This debate points to a key aspect of my argument for the importance of focusing on socioeconomic, political, and moral ties as foundations for reconstructing the experiential domains of computer hacking. This is the point in particular for which Hollan's contribution becomes more readily evident. Relationality, according to him, is also part of the Western/egocentric self: given that the self is always partially constituted by the other (as long as we assume intersubjectivity to be foundational of human experience). Equally, autonomy can be found in more holistic contexts. Hollan suggests, in sum, we focus on degrees of openness, relatedness, egocentrism, sociocentrism, and individuation within specific cultural contexts, revealing a position on the nexus between personhood and selfhood that is fruitful for our study of the cultivation of hacker selves within local, national, and transnational contexts.

Along similar lines of inquiry, Thomas Csordas' (1990) theoretical work on embodiment revisited the problem of personhood and the body (techniques) in Mauss uniting them via Merleau Ponty's notion of the phenomenal body and Bourdieu's concept of *habitus*[25]. In his working definition, the self is "neither substance nor entity, but an interdeterminate capacity to engage or become orientated in the world, characterized by effort and reflexivity" [...] henceforth, the "Self occurs as a conjunction of prereflexive bodily experience, culturally constituted world or *milieu*, and situational specificity or *habitus*" [...] "Self processes are orientational processes in which aspects of the world are thematized with the result that the Self is objectified, most often as a

25 Aiming to rework Bourdieu's concept of *habitus* to avoid its strong schematism, Bernard Lahire (2008) maintained the thread of (currently nuanced) anti-humanist critique of the uniqueness of the self as a well-grounded illusion, the so-called illusion of unicity of the individual self as grounded in "unifiers of personal, social, and legal identity." One of Lahire's main questions is "what are the sociohistorical conditions under which a plural actor or an actor defined by a profound unicity is cultivated?" The author advances a sociology of dispositions by criticizing its context of elaboration: Bourdieu's notion of *habitus* was created in the context of his study of Kabile society (weakly differentiated and with weak division of labor in a pre-industrial, pre-capitalist context). Reworking the notion of *habitus* in order to dissipate the determinism suggested by Bourdieu's praxiology, Lahire focused on the internalization of dispositions instead of on the "system of dispositions" and its coherence with structures of "fields" of socialization. As the author puts it, "to focus on the system of dispositions implies that the same body goes through different stages and is fatally carrying schemes of action or heterogeneous habits and even contradictory" (Lahire 2008:22, my translation). Lahire's social actor, therefore, is conceived as a plural actor, a "teratologic being" since he or she is a products of experiences of socialization in multiple contexts. The plurality of the actor cannot be studied from the standpoint of the problematic "division of self"—because this implies in giving too much weight to the conscious subjectivity of the actor and the socially maintained illusion of the coherence and unity of the self. The dispositional sociology is more adequate to the task: "the coherence of habits and schemas of action (senso-motor schemes, perspection schemes, evaluation and judgement) which each actor may have had internalized, depends, however, on the coherence of the principles of socialization in which he/she was subjected" (Lahire 2008, p. 36, my translation). As I will elaborate on Chapter 3, Lahire's work is key for conducting trajectory interviews and trajectory analysis.

“person” with a cultural identity or a set of identities” (Csordas 1994). Additionally, Csordas observes that Mauss elaborated on his notion of person independently from the techniques of the body suggesting a division sustained by Spinoza and Descartes between the body and the mind (Csordas 1994:277). Csordas' suggests that the response is to be found in “embodiment,” ground of perception and reflexivity, the preobjective ground of the self combined with the objectified notion of the person: “we must not start with self-awareness, but with the problem of how self-awareness is produced” (Csordas 1994: 278). Self-processes constitute a duality we experience in terms of pre-objective/objective, self/person, being in the world/representation, mind/body relations.

Similarly attentive to the question of the relational foundations of personhood, contemporary studies of morality in anthropology further the connection between philosophy, anthropology of ethics, and the study of cultivation of a moral personhood within ethnographic contexts (Throop and Zigon 2014; Parish 2014). Zigon's (2011) analysis of the ethical practices and “moral assemblage” of heroin addicts in a drug rehabilitation program run by the Russian Orthodox Church is one of the examples of recent studies in this area. His work focused on the rehabilitation program as “a process to ethically remaking one's moral way of being in the world” (*op. cit.* p.4). Morality, in this sense, is defined as an assemblage of “institutional, public discourse, and non-conscious bodily dispositions”, and ethics, as an “intentional, reflexive tactics and practices utilized in moments of ethical demand when a person has to work on herself in order to be with others morally” (Zigon 2011:5). This approach follows the development of phenomenological anthropology with its close attention to the (phenomenal) body as the existential ground for moral personhood and struggle, where ethical and moral discourses and techniques “set the range of possibilities within which persons are produced” (Zigon 2011:63). The study of “ordinary ethics” represent another position in this contemporary debate with an exploration of the intersections between philosophy and anthropology. In his work, Lambek's (2010) work has the merit of bringing the discipline in dialog with the long tradition of inquiry in the topic of ethics, as well as to bridge the internal divide between linguistic and sociocultural anthropology through the study of the ethics in everyday life through language practices. The unit of analysis is the language practice as a situated practice that is a primordial form of ethical action and evaluation. In respect to the ethics/morality distinction, Lambek uses the terms interchangeably but prefers the usage of ethics because it usually refers to action rather than to notions of good or bad as morality often implies. Ethics as an object of anthropological inquiry covers complexity and inconsistency in human action, which has been systematically neglected in social theory until recently (Strathern 1991; Escobar 1994; Lahire 2001). Ethics is not to be assumed as a specialized domain of action, it is present in several spheres of social life. As the author puts it: “there is no great methodological danger in dissolving the ethical into the social once the social is conceived as an (Aristotelian) activity, practice, and judgment rather than (Kantian/Durkheimian) rule or obligation” (Lambek 2010:14). The Boasian and Durkheimian traditions represent in his view a problematic legacy in respect to the study of “ordinary ethics”: the obstacle is particularly represented by the Durkheimian emphasis on norms and obligations and the Boasian focus on cultural norms. The inquiry on ordinary ethics attempts to avoid the common opposition between universal and particular, since both are instantiated in ethical everyday practices. Much of the anthropological theory on morality draws from Kant (since Boas, Durkheim, and Lévi-Strauss are canonical examples). For Lambek, a better point of departure would be Aristotle to whom ethics was connected to action. Examples of practical and everyday instantiations of the ethical can be found in the theme of care, since it transcends the distinction between the rational and the sensory. As Lambek further suggests "a focus on self-fashioning can open up questions concerning how much each of us is part of others and how much my Self is determined by the self-making projects or the acts of others, as well as the acts I carry out for, in respect to, or inextricably interconnected with others" (Lambek 2010:16). The ethical as intrinsic to action has two dimensions, specific acts (performance) and ongoing judgment (practice): "ethics is an intrinsic dimension of human activity and interpretation irrespective of whether people are acting in ways that they or we consider specifically "ethical" or ethically positive at any given moment. One can neither reduce human motivation to the ethical nor reduce the ethical to human psychology" (op. cit. p.42) [...] "Speech and action, understood as illocutionary performance, establish the criteria according to which practice, understood as the ongoing exercise of judgment, takes place" (op. cit., p. 63).

Sustaining a critical stance in the debate regarding an anthropology of morality, Yan (2011) questioned psychological and medical anthropologists' approach to moral consciousness and the self in which the individual is the ultimate source of judgment. The emphasis on the individual elaboration has deeper historical roots in the phenomenological inquiry on the nature of consciousness and its linkages to the notion of intentionality. According to the author, the most pressing issue is, conversely, to understand moral dilemmas and justifications in processes of individuation under the neoliberal condition. Contrary to Zigon's approach to moral orientations, the focus should not be on the personal pragmatics of moral values which overlooks according to Yan the importance of the social as the basic foundation for moral behavior.

For descriptions and analyses of personal trajectories that follow in the next chapter, the relational understanding of the self will be mobilized to interpret the processes of self-cultivation computer technologists go through in order to become legitimate and skillful participants in their communities. The analytical angle afforded by the studies of individualization enables us to account for broader social and historical forces which actively shape and constrain possibilities for self-cultivation. The framework I suggest for trajectory analysis sustains that meaningful relations, such as relations of value in the context of a web of exchange and interdependence among technologists and their technical objects, are the ones sustaining one's selfhood. Ties of various orders are constitutive of sociotechnical webs one inhabits: 1) preobjective relations which constitute the conditions of possibility for engagement in exchange practices among expert computer hackers (*embodiment*); 2) order of abstract concepts as they are articulated in objective relations lived by hackers (*moral framework*); 3) relationships to form valued skills (*enskillment* as part of the process of cultivation), and, last but not least, 3) antagonistic relations: self-reflection and political practice to sever ties of dependency or affiliation with entities that are perceived as evil, wrong, or misguided (*ethical problematization and political action).* A relational approach, thus, accounts for the level of relations between concepts, the observable relations between persons and between persons and technical objects, and the preobjective relations which constitute subjects and technical objects that are qualified and judged adequate (or not) to enter relations. These three dimensions allow for studying trajectories at points of intersection between histories of computer technologists and histories of technical projects.

From the preceding discussion on space, place, personhood, and social ties we are now in a better position to treat the question of "who counts as the right person in hacking." This is an important question due to the fact that it speaks not only to the process of the self-cultivation of a hacker persona but also to the conditions for cultivation in the first place—cultivation of skills that are necessary for one to become an agent and a subject of technological development through exploration, that is, a *bona fide* computer expert.

The study of morality opens up a new theoretical horizon which surpasses the sociological understanding of morality as a set of norms for social cohesion. It allows for us to pose a set of questions regarding the role of social scientists as moral arbitrators in the last instance, that is, those with the privilege of the critical stance to say the truth about the social. As Strathern puts it, "sometimes it is assumed that the anthropologist is making claims to know more than those he or she works with, although I do not know any practicing fieldworker who would ever put it that way" (Strathern 1999:10). Moral interpellation is as important as ideological identification and unconscious under-determination: it refers to the active development of an ethical self toward an opening for new possibilities. From the standpoint of an anthropology of moralities, the study of hacking affords a new lease on the question "motivation" which frees itself from the language of the egotistic or profit-seeking interest and away from the tradition of what Sahlins (1972) described as the “anguished prism of scarcity” of the utilitarian and neoclassic liberal tradition in economics and political philosophy. We are constantly being reminded by the ideologues of this generalized and misguided spontaneous sociology that our food does not come from the benevolence of producers as our software and hardware running critical infrastructures does not come from benevolent developers but ultimately grounded in selfish motives or attempts at maximizing utility or any form of economic gain. Morality, in our case, is the general guise for the study of mores and motivations for action in the context of a historical, experiential domain; a study which does not dispense, but rather emphasizes the importance of sentiments, reflexivity, and intimate ethical struggle which are not fully expressed or accessible by the ethnographer, but which constitutes the moral and the ethical dimension of social life. This space of acting, pondering, thinking with and through technical objects and communities of technologists is created in between mores and motivations—space of “agency” (Ortner 1992) or the space of autonomy as ethical self-reflection in the context of a historical *dispositif* (Foucault 1978; Robbins 2012). This is the subject of the next chapter which is dedicated to the examination of computer technologists' trajectories *vis-à-vis* the trajectory of their technical projects.

CHAPTER 2

Technopolitical Narratives of Digital Computing

> "Magic haunts technical activity like a shadow; or, rather, magic is the negative contour of work" – Alfred Gell, *Technology and Enchantment*

The historical formation in which hacking assumed its contemporary contours was shaped by discourses and practices of computing bridging the nascent IT industry with academic domains of research and informal spaces for knowledge exchange. Before the advent of commoditization and personalization of digital computers, hackers were perceived as the "expert other" in small, fringe groups of engineers and curious explorers. Whether through the exploration of telephone systems or for the purposes of state surveillance and intelligence gathering, it encompassed in its brief history a whole series of practices which have been constantly reinvented for, at least, half a century.

In this chapter, I explore key events in the sociotechnical trajectories of digital computing in the Euro-American context with the goal of highlighting fundamental changes in practices and narratives of access. I first revisit the literature on the history of computing to discuss events of particular interest for the contextualization of hacker narratives in subsequent chapters. I offer a recapitulation of historical formations in which computing was contextualized in particular ways: from the heavy computing machinery for war efforts to an industry of business machines for the systematization of bureaucratic orders; as a commodity for entertainment, small businesses, and personal use; as a gateway for underground forms of socialization and cultivation in computing; and, last but not least, as a political tool for collective organization and intervention in the context of the global political economy. To help guide the interpretation of subsequent chapters, I introduce the constitutive threads of the web of computing (Kling and Scacchi 1982) in its infrastructural role for the emergence of alternative forms of expertise. This approach is meant to offer an alternative to a formalized and systems-oriented with a relational and pragmatic study of expertise. In order to discuss the circulation and reappropriation of symbols with the globalization and alter-globalization of hacking outside the Euro-American context, it is first and foremost necessary to describe the ways in which the narratives of hacking were historically constituted and addressed in the literature.

2.1. Early Computing for War Efforts and Bureaucratic Governance

The context of the World War II provided the official budget justification for the development of massive, automatic computing machines as warfare apparatuses in the United States. The wartime also represented a period of accelerated temporality under a pressing arms race in which automatic computers figured as one out of the many applied technoscientific tools that took priority given their capacity to largely outperform human computers (Virilio 1999). Despite being a dominant area of application, ballistics was not the only purpose for the design of digital computers. The aspiration was to create a general-purpose automatic machine. The perception of computers and their potential future applications was heavily influenced by scientists, engineers, and mathematicians in the United States and Germany such as John von Neumann, Herman Goldstine, Konrad Zuse, Howard Aiken, John Mauchly, John Presper Eckert, among others who conducted the development of early electromechanical and digital computers. As we are reminded by scholars of the social history of computing, they were hardly alone in their knowledge- and instrument-making enterprises.

Before the term "computer" was attributed to machines by mid 1940's, it was used to identify a human occupation. Not only computers were human, but their activity was mostly carried out by women in key but often unrecognized and invisible positions (Fritz 1996; Light 1999). Active recruiting of women for "human computer" positions led to the creation of a team of women programmers for the ENIAC project. Several reasons account for what Light identifies as the "feminization" of the work of ballistic computing and, with the advent of computer machines, that of the "computer operator." The shortage of men of whom a large contingent was enlisted for the armed forces is one of the reasons for the opening of positions which were traditionally reserved for men, but also the division of labor among scientists and military men, who worked as designers and managers, identifyimg the computer operator position as something akin to clerical work. "It is a curious paradox," Light ponders, "that while the War Department urged women into military and civil service and fed the media uplifting stories about women's achievements during the war, its press releases about a critical project like the ENIAC do not mention the women who helped to make the machine run" (Light 1999:473). Both Light and Fritz depicted what artifices were used to render women invisible, despite their centrality in training new operators as well as documenting, operating, and maintaining the ENIAC. The practice of rendering women invisible went as far as to crop women operators out of the publicity images of the machine (Light 1999; Ensmenger 2010).

In this context, Grace Hopper played a key role in creating the conditions for the expansion of access to computer machines by facilitating the means of programming. She brought to the male-dominated domain of scientific and engineering computing practice her experiences as a mathematics teacher, which later helped her to bridge the elite world of scientific and military computing with the creation of programming as a civil and non-academic occupation. At the Harvard Computer Lab where the Mark 1 computer was housed and used for several projectile trajectory calculations including the bombing of Nagasaki in 1945 (Beyer 2009), Hopper struggled to learn, document, and maintain the computer, achieving a high degree of mastery, publishing in 1946 the "Manual of Operation of Mark I." Hopper's role in the Association for Computing Machinery (ACM), created in 1947, was crucial in fostering a common language for the nascent field of computer science and the career of computer programmer for the nascent industry (Beyer 2009).

The 1950's was marked by the application of general-purpose computing to business and industrial settings, having as early adopters the nascent commercial aeronautics and the communications industry (Ceruzzi 2003). As electronic computers start to reach beyond the limits of academia and the military, the problem became that of programmable machines for new industrial and business applications. General computing is, then, displaced as an engineering problem beyond its technoscientific domains of knowledge and practice. Programming becomes an established, prestigious, well-paid occupation by math- and engineering-trained personnel, knowledgeable of computer hardware (Beyer 2009:265).

In 1952, Hopper published the ACM paper "The Education of a Computer" advancing the state-of-the-art in the design of compilers, which was developed coterminously by Heinz Rutishauser at Eidgenössische Technische Hochschule (ETH) in Zurich (Goldstein 1993:337; Hopper 1952). This is the period of a shift in programming oriented toward programmers instead of the hardware (Beyer 2009:234). In spite of emerging disputes over patents and prior art concerning the ENIAC, knowledge sharing was common among engineers, government staff, and a network of inventors working on its commercial successor, the UNIVAC: "the fact that Hopper wholeheartedly welcomed non-UNIVAC personal to learn about the A-2 compiler sheds some light on her beliefs concerning intellectual property. Hopper did not view software as a commodity to be patented and sold. She took her cue from the mathematics community" (Beyer 2009:242). As Beyer also suggests in his biography of Grace Hopper, a communal view of information was sustained by a network of engineers and scientists working to solve similar problems to advance computing. Despite the fact that the A-2 compiler was created during her off-hours given that it was not supported by her employer at the time, Remington-Rand, the A-3 was supported because A-2 was a great success. As Beyer suggests, "the social effect of the compiler was an important step in displacing the control of a caste of 'computer priests' with an exclusive position of intermediaries between users and computers” (Beyer 2009:242). Another important step toward increasing the accessibility of computers was the creation of the Common Business-Oriented Language (COBOL) in 1959. In face of the popularity of IBM's FORTRAN language, created by John Backus and a group of engineers from IBM and government laboratories in 1957, Hopper started to work with her group on a new programming language employing common English words used with higher frequency in business settings. In order to make programming easier to the new context, Hopper conducted a survey with her assistant, Mary Hawes, on English terms used by various businesses. The research yielded multiple terms for similar procedures, so Hopper decided to use variables to define business expressions. Based on Hopper's work, another historical shift took place in the practice of programming as a solitary pursuit to a team/group-oriented activity: Hopper's role in creating COBOL, for the nascent field of computer science and the industry computer engineering research and development.

The cold-war research budget in United States increased substantially by 1950 with the creation of the SAGE (Semi-Automatic Ground Environment) defense project for the North American Aerospace Defense Command (NORAD). As part of an offensive strategy due to the widespread notion of the impossibility of defense of an external nuclear strike, Paul Edwards suggested “the Air Force especially feared that emphasis on air defense would reduce budgets for the nuclear-offensive Strategic Air Corps (SAC). But it was essentially forced by political pressures to produce something that looked like an active air defense in order to assuage public fears of nuclear attack”

(Edwards 1994:10). Digital computers, investment in computer networking, storage, video output, and enhanced input are advanced in the context of the SAGE project which had its first implementation in 1958. As Edwards discusses in his analysis of this period, the military efficacy of the project was minimal. What it did, in fact, was to create a sense of security in face of nuclear threats for the civilian population, as well as to guarantee the budget for development in war technology which was mainly viewed as a response to the perceived necessity of increased command and control. As computation made inroads in banks, insurance corporations, and, more generally, office work, it served a dual purpose of being another tool in the productive forces and a tool for controlling the workforce for the capital (Edwards 1996; Zuboff 1988).

According to the historian of computing Nathan Ensmenger (2010), the concept of "software" was only introduced in the late 1950's with the expansion of commercial computing and an increased sense of the imminent crisis of supply of programmers for the booming industry. The craft of computer programming was perceived as "highly idiosyncratic" as an "art form" and personal qualities were attributed to writing code, leading to the widespread notion that programmers were "born, not made" (op. cit., p. 19). The establishment of the computer industry and professionalization of programming created the space for the creation of a managerial class which helped to popularize the image of the hacker as immature, addicted to the computer, anti-social, and without inter-personal skills. This period was also characterized by the gendering of the professional field with the rise of the "computer boys" and the creation of programming as a fundamentally male occupation. In his historical account, Ensmenger puts forward a definition of software that is similar to the notion of "web of computing." According to the author, software is "what links the powerful technology of digital computing to larger human actions, agendas and interactions" (op. cit., p. 240).

Early experiments in electronic and digital computing were not limited to United States and Western European countries, but were also present in the former Soviet Union and other countries of the Soviet block, East Asia, and Latin America. In Japan, Tokyo University hosted the basic research leading to the first electronic computer in the 1950's after the design of the Electronic Delay Storage Automatic Calculator (EDSAC) developed at the University of Manchester, United Kingdom. In Brazil, the first computers were built with the help of a German expatriate, Helmut Schreyer, who found political asylum in Brazil at the end of World War II and happened to be one of the co-creators of the Z1 and Z2 electromechanical computers with Konrad Zuze in the 1930's (Cardi and Barreto 2012). As described by Cardi and Barreto, with the "Plan of National Development" in the mid-1950's machines such as the UNIVAC and B-205 were imported to the country. "Lourinha" was the very first analog computer build in Brazil at the Military Engineering Institute (IME) in 1956, followed by ITA-1, nicknamed "Zezinho," which was built in 1961 at the Aeronautics Technical Institute (ITA), and "Patinho Feio" built ten years later at the University of São Paulo, Laboratory of Digital Systems (LSD) with a comparable compact size of the DEC PDP-8.

2.2. Dispute for Control and Exploration of Computer Systems

From the late fifties and the sixties to the present, the practice of organizing groups of enthusiasts, specialists, and tinkerers of information and communication technologies has become common place for and beyond commercial and governmental applications. An important milestone in the history of computing was the formation of users groups around products of major computer companies. By the late 1950's, software users groups started to be organized such as SHARE, the IBM Users Group formed in 1952, and DECUS, the Digital Equipment Computer Users Society in 1957. These groups were responsible for organizing volunteer associations for sharing software and information about computer systems, even among engineers of competing businesses (Akera 2007; Pearson 1992). These groups were the precursors of contemporary forms of organization for informal, non-professionalized technical training in telephony and computing that ensued, increasing in scale and social relevance from the 1980's to the present.

By the end of the fifties an important finding was made by Joe Engressia in the United States, who became widely known among early explorers of phone systems as the “grandfather of phone phreaking.” Engressia was born blind and gifted in his ability to hear, memorize, and reproduce sounds within a wide range of frequencies by whistling. In his work on the history “phone phreaking,” Phil Lapsley (2013) narrates the key event of discovering the entry way to the exploration of the telephone system: the discovery of the tone that was used by Bell Telephone company to give access to long distance calls. The frequency of 2600 Hz, as Lapsey describes it, was the key to the “phone company's heart.” The discovery was used later by engineering university students to build an equipment, the Blue Box, which generated the key tone to allow for free and unregistered long distance calls. The equipment became popular by the early 60's among engineering students, the nascent “phone phreaking” community, and among members of the organized crime who used Blue Boxes in order to obfuscate the trail of their activities. As one of the early pioneers in personal computing recalls of his experience of putting together his own Blue Box:

> “I had grown up very shy and often felt left out of things. But for me phone phreaking was a place in the world that I was like a leader. It was a place where I could blossom. And it’s not that I could blossom as a criminal—it wasn’t that we had lots of people to call or had giant phone bills or really wanted to rip off the phone company or anything. It’s just that it was so exciting! When I went into a room and showed off phone tricks with a blue box, I was like a magician playing tricks. I was the center of attention. That was probably partly what drove me. But it was also the fascination of doing something that nobody would really believe was possible” (Lapsley 2013:I).

Lapsey's account calls attention to a fundamental aspect of phone phreaking: a shared experience in which the telephone became the very embodiment of curiosity, and the phone network, a space for exploration, discovery, and socialization. As “party lines” became available for free use, a nation-wide community of “phone phreaks” was constituted for sharing technical information.

From early to mid-1960's, building, distributing, and using the Blue Box became a popular affair. The growth in usage was soon detected by AT&T and, by 1962, several users were prosecuted, including a famous case Lapsey describes as the “Harvard Five”, involving four students from Harvard and one from MIT who were using special phone numbers to make long distance calls. They were eventually caught and asked to write a report to Bell Telephone Company on their techniques (Lapsey 2013). From 1964 until

1971, a massive surveillance program was also carried out by AT&T, recording and analyzing 33 million long-distance calls and finding out about more than 25 thousand cases of illegality as pointed out by Lapsey. The practice of phone phreaking was situated by then in a legal gray area, putting AT&T in a difficult position due to the illegality of its surveillance program. It anticipated in a number of decades current programs of mass surveillance in several countries, most notably the United States given the range and diversity of their activities as well as industrial power, technoscientific expertise, and communications infrastructural control.

The early period of phone phreaking is relevant because it one of the earliest articulations of hacking as technical practices and autonomist values begin to converge in the exploratory practices of young engineers and political activists. One of the first occurrences of the term "hacking" was noted by the philologist Fred Shapiro in his book on the history of American English Lexicon. In 1963, the MIT student newspaper "The Tech" published a front-page article "Telephone Hackers Active, Services Curtailed." The article describes the usage of the MIT's PDP-1 computer for war-dialing, as well as using the Institute phone lines for long distance calls, which exemplifies the early convergence of phone phreaking and computer hacking which substantially increased as computers began to get interconnected using the phone network. The professor who was responsible for the phone system at the time was reported to have said: "we do not have too much trouble with the boys, we appreciate their curiosity." Also commenting on the case, the author quotes an "accomplished hacker" who states "the field is open for experimentation."

The experimentation is taken even further into other realms of activity beyond technical exploration and youth pranksterism in the height of the 1960's. Part of the radicalization of the hippie movement with the Yippies involved articulating other forms of restricted knowledge, such as lock-picking and a series of formulas for obtaining or “liberating” things as exposed in Abbie Hoffman's “Steal this Book” (1971) with techniques of phone phreaking. Phone phreaking becomes mainstream information in this period according to Lapsley. After the publication of an article on the Blue Box by Esquire magazine in 1971, the practice of phone phreaking gained numerous adepts who saw in it a hobby as well as a political tool. The year of 1971 was also the year in which the “Youth International Party” (YIP) line was created, giving phone phreaking an overt political project: not only a community for the insatiably curious and technically-inclined but an anti-establishment motive for phone phreaking. As Jason Scott, one of the native historians of the computer underground and maintainer of an impressive archive of historical documents (textfiles.com) suggests, the Youth International Party Line followed a genealogy which linked more radical elements of the counterculture, the anarchist new left of the late sixties and seventies: “Abbie Hoffman's 'Steal This Book' reads with all the humor, prodding, profanity and clear-eyed instructions of the best of the later BBS-era textfiles[26].” The YIP line morphed into several publications and initiatives, being one of relevance for the history of hacking the creation of the Technological Assistance Party (TAP) in 1971, a Bulletin Board System (BBS) service which changed its name in 1979 because they could not open a bank account without being a registered political party in the US, thus renaming

26 Source: https://archive.org/details/20080718-jscott-hpprimer (accessed 04/15/2014).

it to Technical Assistance Program, which published, according to Lapsey (2013), 91 issues until 1984, when it gave way to the creation of an influential and long lasting hacker zine, the 2600 Hacker Quarterly.

The mid-seventies was a period of change for the phone phreaking community which increased in number of participants due to the publication of TAP. The period was marked by rampant prosecutions carried out for AT&T. More importantly, it was defined by a shift in the meaning and metaphor[27] of computing. The counterculture movement displaced cybernetics from the context of cold-war research and computation for war efforts to inform the organization of new age communities (Turner 2006). Computer and communication technologies were resignified as communitarian tools by the example of the collective involved in the publication of the Whole Earth Catalog and their experiences with cyberspace sociality in the Whole Earth 'Lectronic Link (WELL), which provided a bulletin board system in 1985 and served as a vibrant space of online sociality (Rheingold 1993).

In the last fifty years, we have witnessed a transition from large-scale, military-grade computer infrastructures to distributed personal computing power with massive network integration in the Euro-American world. In particular with respect to the issue of access, the early manifestations of hacking are of particular interest. In the Euro-American world with student uprisings, re-emergence of autonomist politics and

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27 The concept of metaphor is applied here in the same sense Roy Wagner (1976) and Paul Ricœur (1975) attributed to it, respectively, the extension of a domain of symbols and meaningful practices through "the rhetoric process in which the discourse liberates the power to re-describe reality" (Ricœur 1975:11, my translation). Metaphors function by offering one expression for another and promoting a symbolic opening to re-render experience.

identity-based social movements, a general sentiment of discontent with the military-industrial-university complex led students to protest, marching with punch-cards around their necks as a demonstration against the control that computer systems afforded to institutions (Turner 2006). IBM was identified as the "big brother[28]" in the now classic TV commercial by Apple Computers produced by Ridley Scott in 1984. Anticipating this critique with acute sensibility regarding its context of production, Jean-Luc Godard science-fiction, *noir* film Alphaville from 1965 depicts a city controlled by an IBM mainframe computer, Alpha 60, responsible for controlling not only the city, but language, perception, and behavior of its inhabitants. In his influential manifesto zine "Computer Lib," Theodor Nelson (1974) writes: "it is possible to productively work in computer field and completely avoid having to work with IBM-style systems. Many people do" (Nelson 1974:56). These cultural manifestations in politics, mainstream media, film and computing represented the starting point of a major shift in the meaning of computation: from large, powerful, mysterious, inaccessible computer systems to the promise of individual empowerment with personal computing, carrying the Marshall McLuhan's promise of a "global village" as an emulated free society to be organized electronically (and virtually).

In the late sixties and well into the 1970's, aspirational electronics projects met autonomist politics to create a utopia of liberation with the aid of personal computers. Digital computers became the object of a transformation in the 70's and 80's into tools for the people and not only a privilege of corporations and governments. Computing

28 "Big Brother" is the most famous IBM moniker, but, as Ted Nelson described, it has been affectionately also known as "International Brotherhood of Magicians," "Institute of Black Magic," "It is Better Manually," among other names (Nelson, 1974:52).

entered a new set of relationships transforming the perception of its application. In this context, computer collectives became instrumental in providing conditions for sharing software among professional programmers as well as computer hackers from the 1960's to the present. Volunteer organizations made Euro-American history because they started the now familiar practice of organizing computer users to form independent, interest-driven collectives for technologists. The practice of organizing volunteer groups started with IBM in the late 50's and Digital Equipment Corporation in the 60's and with the now famous Homebrew Computer Club in the 1970's. The collaborative work around hardware in the 1970's created an important historical precedent that will be only replicated around the 2000's with the idea of creating community spaces for software development and hardware tinkering worldwide, inspired by the experience of European computer clubs. The early hardware hacking and software sharing communities created the conditions for another important transformation: the distribution and installation of a large base of personal computers offered the possibility of computer programming to flourish at home as a hobby, as well as the commercial exploration of available computer platforms for the nascent software industry.

Parallel to the hardware hacking community in Silicon Valley was the experience of a caste of computing high priests at MIT and Stanford who are regarded in the literature on hacking as "the last true hackers" or the last ones who deserved to be called so (Levy 1984; Stallman and Wall 2002). From the MIT Artificial Intelligence laboratory came the narrative on hacking as a technical culture that is defined by information sharing, technical collaboration, exploration and openness—but also the presentation of the hacker as a virtuous programmer who is obsessed with his technical challenges and quite oblivious to the massive industrial-government-military complex under which he gathered the basic conditions to cultivate technical skills and circumvented local restrictions to access computational resources.

2.3. From Virtuous to Outlaw Hackers?

The context of computing in the 1980's was marked by series of conflicts over intellectual property as software became a profitable commodity—it is not meant to be shared as it was in the context of the MIT AI lab, computer clubs, or the UNIX community around the Berkeley System/Software distribution. In the mid-1970's the copyright regulation in United States is reformed, introducing “software” in the scope of copyrightability of intellectual works (Kelty 2008). Another distinctive event of this period was the popularization of computer networking through the usage of telephone lines. The so-called “BBS scene” was responsible for the early socialization of computer enthusiasts and the formation of several hacker groups using Bulletin Board Systems (BBS) for communication and information exchange. The term “cracking” was widely used in this context to describe the practice of breaking copy protection mechanisms of copyrighted software. The term is now current among certain hacker groups to distinguish “hackers” as those who do not use their knowledge to break into systems from “crackers” who are invested in exploring computer systems' vulnerabilities for personal gain[29].

29 Since the 1980's the term “cracker” has been widely used to identify “malicious” attacks to computer systems. One particularly telling example of usage of the term can be found in a popular article written by computer security experts in the mid-1990's. The article offers a description of common assumptions about “crackers”: “A young boy, with greasy blonde hair, sitting in a dark room. The

The 1980's was also a period of change for the hacker and phone phreaking communities with increased criminalization and spectacularization. The perception of "hacking" changed with a transformation in discourse, infrastructure, and technical practice. One of the events in the public sphere regarding the term was popularized after the release of the movie "War Games" in 1983. It was anticipated and followed by a series of news articles on the topic of hacking as mischievous exploration of computer systems at hospitals, banks, companies, universities, and research centers, including the Los Alamos national laboratory. One of the earliest hacker collectives gained prominence in this period, the 414's, propelling the enactment of the "Computer Fraud and Abuse Act" by the US congress in 1984. In the same period, the journalist Steven Levy published "Hackers: Heroes of the Computer Age" (1984), intended as a corrective to the mediatic criminalization of computer hacking. In his book, Levy describes the context of hacking at the MIT Railroad Club of the 1960's, the experimental systems development at MIT AI lab, and the pioneer work of the early hacker collectives around the Homebrew Computer Club in the Bay Area, California of the mid-1970's, including

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room is illuminated only by the luminescense of the C64's 40 character screen. Taking another long drag from his Benson and Hedges cigarette, the weary system cracker telnets to the next faceless ".mil" site on his hit list. "guest -- guest", "root -- root", and "system -- manager" all fail. No matter. He has all night... he pencils the host off of his list, and tiredly types in the next potential victim..." The authors then proceed to describe with the help of Nietzsche's *übermensch* what yet another influential computer security expert has summarized as the "fear sell" constant in security discourse: "This seems to be the popular image of a system cracker. Young, inexperienced, and possessing vast quantities of time to waste, to get into just one more system. However, there is a far more dangerous type of system cracker out there. One who knows the ins and outs of the latest security auditing and cracking tools, who can modify them for specific attacks, and who can write his/her own programs. One who not only reads about the latest security holes, but also personally discovers bugs and vulnerabilities. A deadly creature that can both strike poisonously and hide its tracks without a whisper or hint of a trail. The uebercracker is here" (Farmer and Venema 1993). Expressions of computer-assisted power have been a constant in the public discourse on hacking. For our discussion here, it is interesting to observe how this power is perceived and mobilized by hackers themselves, which is a topic we return in the next chapter.

the development of the computer game industry with prominent cases from Northern California. It was only in the 1980's that the experiments of the Homebrew Computer Club were converted into mass-produced commodities, bootstrapping several computer hardware businesses. The book has circulated widely and translated to many languages, including Mandarin. One of the lasting contributions to the debate regarding "hacking" in the contemporary has been given by Levy (1984) in his summary of the "hacker ethic" as a technopolitical ethos that involves the imperative for practical experience with computer machines, the "hands-on imperative," access to information and computational resources, and sharing of information on technical systems involving, first and foremost, the dispute against the centralization of bureaucratic power and control.

Parallel to the commercialization of the previous experiments in computing of the so-called pioneer hackers, the 1980's was a decade in which personal computing went mainstream with the establishment of the software industry. Hacking was stigmatized and identified with those of software "pirates" trading software online, phone phreaks, social engineering with forms of deception, "dumpster diving" for documents and records, credit card slips, as well as rampant exploitation of existent network systems for security flaws. The reaction to the software industry was embodied in a series of attempts at safeguarding a domain of virtuous software development in the context of the Unix community. Since the 1970's, a vibrant community of computer scientists, engineers, and software developers was created around the development of the Unix operating system in which, by virtue of an informal practice of exchanging tapes, was transferred out of the research space of Bell Laboratories into universities for testing, patching, and circulation. This event contributed to the creation of a software sharing community, serving as an important precedent for the Free and Open Source Software communities of the late 1980's and 1990's (Weber 2004; Kelty 2008).

In his influential book “Hacker Culture,” Douglas explores this context with descriptions of the underground adolescent practice of computer exploration. He draws from Levy's depiction of the early virtuous hackers of the 1960's and 1970's to depict a new generation of hackers of the 1980's and 1990's. His discussion about the historical genealogies and constitutive relations of hacking as technological culture is very perceptive in digging the media archives and identifying a common discursive matrix from each shared practices of hacking were defined and interpreted, reading influential publications of the hacker underground of the 1990's. Douglas' historical reconstruction operates with a distinction between technology, culture, technology and technology as material culture, which he criticizes as an instrumental approach. This distinction is less productive for an anthropology of technology as it privileges the symbolic over the material and experiential with his focus on the relationships that were forged in the context of hacking as “culture” through the circulation of media. It is less productive because of the very tools of hacking which embodies histories of technoscientific groups. Instead of dismissing the instrumental and practical aspect of hacking, it is more fruitful to unpack this very instrumentality into a set of ways of interacting with the practical dimensions of hacking—as embodied skill, education of attention, intimacy in tool use which are crucial for understanding and engaging with computer collectives.

The instrumentality, in effect, is constitutive of hacker sociality. It is one of the means of gathering or attracting people around projects and around techniques and ways of being together with others for identify formation (Turkle 1984), public spheres and politics around group formation (Kelty 2008), and agonistic and playful dimensions of the experience of Free software development with its own lifeworld (Coleman 2013). One telling example comes from the essay "Confessions of a Happy Hacker" by Guy Steele (1993) in which we learn about dispositions one ought to cultivate in order to become the right person—from (computer) language practices to sleeping, eating, socializing habits:

> "There are certain traits that are typical of hacker. The cardinal qualification is that hackers like to use computers. The word CYCLE, as used by hackers, refers to the fundamental unit of work done by a computer, so we say that hackers crave cycles. The more cycles available, the more a hacker gets out of the computer. As a direct result of this craving, a hacker will frequently wake up at dinner time and go to bed after breakfast, or perhaps get up at noon and sack out a 4:00 A.M [...] Hackers do this because the computer has its own circadian rhythms to which hackers willingly adjust themselves [...] Hackers will therefore work late into the evening or night, when other computer users aren't competing for cycles. It's more fun, after all, to use the computer when it's responding at split-second speeds. Most such hackers are single. Hackers do get married, but the responsibilities of family life don't always mix well with typical hacker life style. When I was at MIT, I would sometimes work nights for a month at a time. Now that I am married, I find that I can hack only in spurts, one or two days a week [...] The truly dedicated hacker does little else but eat, sleep, and hack. Of these activities, eating is the only social activity, so rather than eat at home alone, a hacker will usually go out to eat with his hacker friends" (Steele, Guy apud Raymond, Eric. "The Hacker Dictionary: A Guide to the World of Computer Wizards", 1993).

A peculiar sense of time and being constitutes distinctively the experience of computer hacker collectives, informing perceptions, self- and peer evaluations and practices as well as specific elaborations on personhood. The rhythm of work (and therefore of the field), closely linked to the computational power of the machines (measured in cycles), gives us a sense of how enmeshed technologies and technologists are in the objective/subjective relations of computing/competing experiential worlds.

2.4. Inventing Free and Open Source Software

Free Software—as a software development practice and political project—came into existence through the experience of a technical and a moral breakdown (Heidegger 1962; Zigon 2007). As its origin myth goes, the project started at the MIT AI laboratory in the early 1980's with a malfunctioning printer (Williams 2002). We are told that an MIT operating systems programmer, Richard Stallman, wanted to use his engineering prowess to fix the printer, but he was not allowed to do so because he was denied access to the source code for a particular piece of software driving the device. The denial of access went against a common practice of software sharing among peers at the lab. The annoyance of a failed network printer gave the opportunity for Stallman to realize that the very "original affluent economy," to use Marshall Sahlins' felicitous expression, of software production was fundamentally changing around him. From a minor technical disruption in his workplace, Stallman diverted his attention to yet another of a more serious and profound kind: having his access to information denied represented a major disruption of the moral fabric sustaining elite communities of virtuous computer technologists. The denial represented a form of betrayal:

> "Being a hacker at the Artificial Intelligence Laboratory at MIT meant that his ethical code was driven by progress in the code for the computers – was wrong and almost evil to save code and computational resources for yourself. Hackers respected each other because they were good at what they did, not because they had titles and money. This led to deep conflicts with other ethical systems, particularly those who gave primacy to individual ownership of ideas. From the hacker perspective, to keep an idea or a new program for you was the same as spitting in the eyes of all others" (Wall and Stallman 2002).

As software intersected gift and profitable commodity forms along the 1980[30]'s, his fellow engineers from MIT and other research institutions started to agree upon the practice of signing Non-Disclosure Agreements (NDA) to work on software that was not meant to be shared, but to be bought and sold. In a response to this social and technical change, Stallman started to recreate several pieces of software himself on a hectic sprint to create a public, UNIX-like free operating system. The very question of “freedom” in the context of software has ever since inaugurated three decades of debate about and practice of software sharing in many parts of the world.

Software development skills became a form of cultural capital that was highly valued and pursued which could potentially be converted in economic capital. Computer hackers seemed to respond primarily to the logic of the field of computing, which is frequently expressed in allusions to the “art and joy of computer programming” and to the disinterest in financial compensation. In the 1980's, the economic drive for the enclosure of software code and its subsequent commercialization became the hegemonic orientation. In his active membership at the MIT AI Lab, Stallman engaged in software sharing, fostering an ethical commitment to “information freedom” of a particular kind. The adherence to this foundational principle of the software development community allowed him to later elaborate his groundbreaking

30 Kelty (2008) described the creation of the GNU General Public License (GPL) in 1992 by Richard Stallman in the context of substantial changes in intellectual property laws in the U.S., particularly in the period from 1976 to 1980. Before 1976, the practice of software development was regulated by trade secrets and patents. With the change in Intellectual Property laws, software became an object under protection of the reformed copyright law. According to the author, the core of the problematization resided on the definition of the scope of "copyrightability" and the definition of software *per se*. This context formed the backdrop for the creation of copyleft licenses, such as the Emacs Public License and the GNU GPL by Richard Stallman from the mid-1980's to the early 1990's. For a discussion of the history of software industry, see Ceruzzi (1996) and Campbell-Kelly (2003), and Ensmenger (2010).

Free Software manifesto:

> "I consider that the Golden Rule requires that if I like a program I must share it with other people who like it. Software sellers want to divide the users and conquer them, making each user agree not to share with others. I refuse to break solidarity with other users in this way. I cannot in good conscience sign a nondisclosure agreement or a software license agreement. For years I worked within the Artificial Intelligence Lab to resist such tendencies and other inhospitalities, but eventually they had gone too far: I could not remain in an institution where such things are done for me against my will" (Stallman, Richard; http://www.gnu.org/gnu/manifesto.html; accessed 12/05/2013).

Stallman's "GNU Manifesto" was written in 1984 and published in Dr. Dobbs' in 1985, describing the scenario of increased software commercialization along with the transformation in the intellectual property regime to include software under the protection of copyright law which meant the enforcement of legal restrictions to hamper an economy of software sharing. Through the angle of the symbolic economy of software, the cultural event of "Free Software" as a disruptive symbol was possible due to the internal rupture and a subsequent transformation of the order of symbols and meanings referring to software in the 1980's. As a symbolic good, software was the craft of a small community of skilled developers, computer hackers engaged in sharing code in an academic mode of information and knowledge exchange: there was a tacit agreement that credit should be given where credit was due, but, regardless of attribution of credit, products of technical work would have to remain open and accessible to peers as a condition for the field to be advanced. Driven by an emergent commercial orientation, computer programs were successfully repositioned in the cultural order: they became symbols of a stand-alone, dedicated application, efficiency and productivity for an ever increasing number of newcomers to the realm of computing. In this context of popularization and expansion of the field of computing, Free Software emerged as a counter-cultural manifestation, creating a sharp contrast between "ethical" software practice and "proprietary" practice, classifying forms of software production and distribution in secretive, closed-source format as unethical. By the virtue of a manifesto and a social movement-building rhetoric, Free Software was successful in promoting the rearrangement of software as a symbol, from its previously stabilized value of software as commodity to software as a means to achieve "freedom" for technologies and technologists:

> "We maintain this free software definition to show clearly what must be true about a particular software program for it to be considered free software. Free software" is a matter of liberty, not price. To understand the concept, you should think of "free" as in "free speech," not as in "free beer." Free software is a matter of the users' freedom to run, copy, distribute, study, change and improve the software. More precisely, it means that the program's users have the four essential freedoms: The freedom to run the program, for any purpose (freedom 0); The freedom to study how the program works, and change it to make it do what you wish (freedom 1). Access to the source code is a precondition for this; The freedom to redistribute copies so you can help your neighbor (freedom 2); The freedom to distribute copies of your modified versions to others (freedom 3). By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this". (Stallman, Richard; http://www.gnu.org/philosophy/free-sw.html; accessed 12/05/2013).

The efficacy of this "act of institution" of Free Software rests on the prestige and trust that Stallman obtained by contributing to the early hacker community (Bourdieu 1981). In relation to the historical development of the computer industry, Free Software stands out as a curious mixture of political movement and economy of software sharing. The legal and political definition of Free Software and its critique of individual and corporate appropriation of knowledge through a clever inversion of copyright had as a backdrop the emergence of neoliberal States in the late 1970's and 1980's. Harvey (2005) identifies in this period a tension between the theory of neoliberalism (with the justification for market orthodoxy combined with a discourse on individual freedom) and the “pragmatics of neoliberalization” with neoconservantism mixed with the rhetoric of freedom. Contrary to the prospects of the (alarmist) analyzes that equated neoliberalism with the extinction of the state, a new conformation of forces (state, financial and industrial elites) shaped new labor relations and the role of the nation-state as a highly selective enforcer of economic deregulation policies. From this period to the present, state apparatuses in rich countries “favored strong individual private property rights” (Harvey 2005:64), as well as played an active role in the international “free” trade agreements. This process led to the expansion of the Intellectual Property regime worldwide through US-led trade organizations in partnership with developed countries and strong corporate-backing, creating conditions for the expansion of markets for tangible and intangible goods protected by Intellectual Property in several areas: copyright, patents, trademarks, industrial design, among others. Hacking, in this context, emerged with increased social force over time as a manifestation of political dissidence, pointing to alternative forms of knowledge production, management, and sharing. Intellectual property enforcement was substantially increased throughout the period, reaching a draconian and expansive phase in the 1990's and 2000's.

The distinction between “communitarian” and “proprietary” software signaled symbolic boundaries dividing two domains of practical experience with software development, having different ethical orientations and contexts of production. This distinction, however, started to get blurred as Free Software became a corporate reality and common practice among major IT companies in the late 1990's. In the realm of experience, the politics of affiliation and identification among persons and things—developers, users, hackers, groups, and software projects with their technical objects—is rather intricate. This is what attested one of the major transformation of the international Free Software community with the creation of the Open Source Initiative (OSI) in 1998. The concerted efforts of Free Software developers and North-American company representatives around OSI were directed to fundamentally change the narrative of Free Software from its emphasis on moral obligation to a narrative of technical superiority of Free Software as a collaborative development and business model, which were strategically devised to promote Free Software in the corporate sector by renaming it to "Open Source" software (OSS). This initiative went as far as to constitute a parallel coalition to promote Open Source in the US federal government, "Open Source for America" thus serving to foster collaboration between Open Source companies and the state. Open Source at the turn of the past century became a fad in the Silicon Valley and investors turned their attention to it as nascent start-ups relied on Free Software technologies to bootstrap their infrastructures. What was initially the work of a small community of researchers and university-affiliated hackers, creating Free Software alternatives to closed-source software, grew considerably with several companies providing services related to the Free Software operating systems, as well as users groups and Free Software conferences in Japan, Brazil, France, India, Spain, Germany and various other parts of the globe.

2.5. Hacking for Privacy and Social Change

In the 1990's, hacking was re articulated with renewed forms of political activism. The term "hacktivism" emerged in this context to express a form of protest which used computer techniques, such systems penetration and website "defacing" to display group and personal signatures alongside political messages, and virtual sit-ins with Denial-of-Service (DOS) attacks to render a government or corporation website or service unavailable on the Internet. In this period, hacking was identified with a form of "electronic civil disobedience," despite having its precedents in the late 1960's experience of the Youth International Party. Solidarity between groups of hackers and social movements, such as the Zapatistas, became common place as mobilized by a group known as the Electronic Disturbance Theater as well as many activist groups around the Independent Media Center network in various countries of the Global North and South, constituted mostly after the demonstration against the World Trade Organization (WTO) in Seattle in 1994.

Another organized group of the 1990's was the "Cypherpunks" of San Francisco Bay Area, composed of a small sect of computer security specialists, mathematicians, and activists who posited the need for defending the value of privacy through the development of secure means of computer-based communication. The theoretical foundations of public-key cryptography, developed by Whitfield Diffie and Martin Hellman in the mid-1970's, represent one of the major stepping stones for civilian access to military-grade cryptography. The other stepping stones were the implementation of public key cryptography by Rivest, Shamir and Adleman with the RSA cypher and the Pretty Good Privacy (PGP) software, which made cryptographic technologies available to computer users. As suggested by Coleman and Golub (2008), PGP became known at the time when the US government attempted to prevent its distribution through its classification as "ammunition." The PGP developer, Phil

Zimmerman, is known for this statement at the time he was indicted for creating the cryptographic system:

> “If privacy is outlawed, only outlaws will have privacy. Intelligence agencies have good access to good cryptographic technology. So do the big arms and drug traffickers. So do defense contractors, oil companies, and other corporate giants. But ordinary people and grass roots political organizations mostly have not had access to affordable 'military grade' public-key cryptographic technology. Until now. PGP empowers people to take privacy into their own hand. There's a growing social need for it. That's why I wrote it” (Phil Zimmermann 1991, https://www.philzimmermann.com/EN/essays/WhyIWrotePGP.html, accessed 10/10/2013).

Computer technologies such as PGP were rendered as a shield for the individual so to secure communications was to guarantee a fundamental, liberal and modernist, right to privacy. From this period is the influential Cypherpunk manifesto[31] telling the story of the advancement of political forces to curtail individual liberties. The solution is identified in the need of “writing” software to fight corporate and government command and control of individual electronic communication and expression:

> “[...] We the Cypherpunks are dedicated to building anonymous systems. We are defending our privacy with cryptography, with anonymous mail forwarding systems, with digital signatures, and with electronic money. Cypherpunks write code. We know that someone has to write software to defend privacy, and since we can't get privacy unless we all do, we're going to write it. We publish our code so that our fellow Cypherpunks may practice and play with it. Our code is free for all to use, worldwide. We don't much care if you don't approve of the software we write. We know that software can't be destroyed and that a widely dispersed system can't be shut down. Cypherpunks deplore regulations on cryptography, for encryption is fundamentally a private act. The act of encryption, in fact, removes information from the public realm. Even laws against cryptography reach only so far as a nation's border and the arm of its violence. Cryptography will ineluctably spread over the whole globe, and with it the anonymous transactions systems that it makes possible. For privacy to be widespread it must be part of a social contract. People must come and together deploy these systems

31 As pointed out by Lievrouw (2011), hacker manifestos are key instruments of technical politics delineating a shared history of alternative computing. In their narrative compositions, we find a clear depiction of the other of hacker collectives: the alienating school environment in Mentor's “Hacker Manifesto” (1988), the corporate practice of information hoarding in Richard Stallman's “GNU Manifesto” (1989), the response to the institutional attack on personal privacy with Tim May's “Crypto Anarchist Manifesto” (1992) and Eric Hughes' “Cypherpunk Manifesto” (1993) and, more recently, Meredith Patterson's “Biopunk Manifesto” (2010) which draw from this very genealogy to demand the decentralization and end of gate-keeping practices in the domain of biological sciences.

> for the common good. Privacy only extends so far as the cooperation of one's fellows in society. We the Cypherpunks seek your questions and your concerns and hope we may engage you so that we do not deceive ourselves. We will not, however, be moved out of our course because some may disagree with our goals. The Cypherpunks are actively engaged in making the networks safer for privacy. Let us proceed together apace. Onward." (Eric Hughes, 1993, http://www.activism.net/cypherpunk/manifesto.html, accessed 04/018/2014).

Cryptography became the very object of a dispute in the 1990's which led to the creation of a sociotechnical domain of information security with a very peculiar type of computer expert. In political terms, it was perceived as the "wire cutter" (as in Tim May's Crypto Anarchist manifesto fitting metaphor) of corporate and governmental "barbed wire" with the encroaching process of intellectual property enclosures. The hacking underground was fundamentally reshaped by the public knowledge and tools of cryptography.

2.6. Hackers and/as Magicians

There are, at least, three aspects one could explore comparatively in respect to the boundary-making work around hacking and magic more generally. One elementary point is that magic, and to the same effect hacking, constitutes a particular form of authority based on a peculiar type of expertise. Magical powers are attributed to distinguishable professional groups, which is also patent in the case of hacker groups. Demands from professional life set individual persons apart from other members of society, and this segregation, as described by Mauss (1950), is one of the main sources of magical and technical authority. Hackers and magicians "have one role in life which is corporate discipline" (Mauss 1950:36, my translation). There are numerous instances throughout the history of computing in which computer programmers and engineers were defined by their "black art" as wizards and magicians (Ensmenger 2010), which amounts sociologically and pragmatically to the creation of a symbolic boundary with the fetichization of their techniques and tools. The language act of "di-vision" (Bourdieu 1996) can help us interpret the symbolic acts of separation, performing the separation of hackers from non-hacker Others by giving visibility to a new technically-empowered collective entity. The recurrent discourse on technical virtuosity and occultism—despite not being the narrative mode some collectives employ—creates the exterior boundary of hacker groups making visible certain shared characteristics, endowed with magical properties and a sense of collective duty, while rendering invisible others.

Another important aspect regarding technical magic refers to the magician and his/her double. This aspect, when illuminated by the ethnographic experience, elicits the importance of the intimacy with computer machines and technical systems, representing another key parallel between hackers and magicians: the ability to use his double, an exterior spirit or entity, acting in the world and onto another machines or people on his or her behalf, representing his/her thoughts, needs, and volition. Magicians reach out for laypeople as hackers reach out for technical systems and communication networks. The dream of technical control and perfected translation of human desires to computing machines among hackers is widely shared, as they draw their power from intimate association and control of computers and networks, as much as magicians draw prestige and capacity to interfere in social, biological, cultural, and political affairs from their association with (super)natural and animal powers.

The cultural logic of hacking has yet another parallel with magic. Mauss suggested in his essay on magic (1950) that the belief in magic is mandatory and sustained, at once, by individuals and their collectivity. In respect to this specific issue, we can leave aside the question of scientific *versus* magical beliefs, or even the problems of collective consciousness and social morphology for the French sociological school, to only point to the fact that we find both in hacking. That is, beliefs informed by scientific practices, which respond to criteria elaborated outside the domain of hacking, but fostered and identified, hybridized with it, as well as a more general and widespread belief in the technical efficiency of machines as integral to social life, informed by a contemporary high-tech capitalist cosmology. As Mauss suggested in his essay, themes such as *group history*, *revelation*, *predisposition*, and *consecration* are all shared elements in the lifeworld of magicians, which are also to be found among hackers. Revelation and predisposition point to the widespread idea that virtuoso programmers and hackers "are born, not made" (Levy 1984; Ensmenger 2010). In terms of consecration and recognition of one's worth, legitimacy as a hacker generally stems from peers as self-identification is not legitimate if it cannot be supported by public demonstrations of technical achievement.

2.7. Archival Instance of Hacking as Magic

> "... It is probably appropriate that gentlemen such as yourselves are the ones who come forward and demonstrate that the *emperor has no clothes*, so we appreciate you coming here, especially in the line of fact that the Washington Post describes you as the rockstars of the computer hacking elite". Senador Liebman for the Government affairs committee; US Senate testimony at congressional hearing with the L0pth group, 03/19/1997 (*emphasis added*).

On May 19th, 1997, a group of young computer hackers in full suits testified before the government affairs committee of the United States senate creating an important precedent of hackers serving as expert witnesses instead of being the ones on trial. Each member of the group identified himself by his nickname and promptly launched into a description of their areas of expertise, dropping names of systems, devices, protocols, techniques, and areas of research and activity. They were all members of an early private hacker club in Boston called "The L0pth[32]" which became notorious due to their activities around computer security research and hardware hacking in the 1990's. The entire congressional hearing was led by demonstrations of what L0pth hackers knew and could do *versus* what other IT professionals and companies did not know and could not do. Some of their statements were questioned, but most had a strong impact overall, bearing the weight of magical revelations, given that they were followed-up by questions of disarmed, technically clueless congressmen. As a consequence of the L0pth hackers' public statement that they can interfere with the provision of basic services by tapping into and altering computer systems, the following questions were directed to them, which I provide here in the edited form:

> "[...] I am informed that you think that within 30 minutes the seven of you could make the Internet unusable for the entire nation. Is that correct?"
>
> "If a foreign government was able to assemble a group of gentlemen such as yourselves, pay them large amounts of money, and got them here or hire them here, to [cause] as much havoc in this government as they could in terms of infrastructure, government operations, whatever, how much damage could they do?"
>
> "Can you get to the command structure, command signal to position satellites? Could

32 The L0pth was created in 1991 in a shared office space in Boston. The original members of the group started an IT consultancy company which later was acquired by the now gigantic IT security company Symantec. Some of the members became very famous and went to work for the National Security Agency of the United States government, which has been jokingly referred to by other members of the community ever since as "selling-out," recuperating the memory of the early days of the L0pth when their members (as well as other hackers) sported T-shirts which carried ironic phrases such as "I LOVE FEDS."

> you relocate them? And [disrupt] the whole system, not by destroying it [...] but by taking them out of their position?"
>
> "Can you transfer federal reserve funds to some place?"
>
> "Can you blow up a computer? Can you overpower it? Can you put enough material in to just blow it? Can you do that?"

On a symbolic plane, a momentary inversion of power was exercised right at the meeting room with identifiable effects: computer experts demonstrated control, therefore power, over technologies which the entire state, its basic services, departments, and institutions were running on. This was a brief but effective demonstration of the ability to exercise power over state operations by a very small group of young and curious technical virtuosos in their early 20's. Their tone was not only of revelation, but it also carried a denunciation of practices of covering security and design flaws by major United States IT companies, compromising users' data and privacy. The L0pth members flipped the non-hacker discourse on hacking upside down, not by disputing the imaginary of hacking as criminal activity, but by offering a public description of the state-of-the-art in the techniques of exploitation as well as the most urgent security flaws in the context of information technology. They demonstrated publicly—contrary to the public understanding of hacking as the computer expertise gone rogue—their willingness to collaborate with the government and IT corporations to fix the problems they identified.

This official encounter with state authorities represented a watershed moment in the history of hacking by changing the relationship between sectors of the hacker community and the US government, carving a new space for collaboration on security research, and spawning a new sector of the industry with a dedicated focus on computer security. This key exchange between hackers and government representatives revealed the magical efficacy of the boundary between experts and their others, sustained by the public demonstrations of expertise and technical power, reinforcing the very basic distinction between the magician and the subject of his/her magic: hackers, makers, and engineers, and their others, such as government agents, federal police officers, IT professionals who probably hate their jobs, "n00bs," "lamers," and incautious users. As Gell (1992) argues in respect to the field of art—which serves can be applied in our discussion to the domain of computing: "the technical activity which goes into the production of [computer technologies] is not only the source of prestige [...], but also the source of its efficacy in the domain of social relations" (*ibid.*, p. 56), that is, by rendering visible group boundaries, creating social relationships, and making clear which social ties cannot be made.

In this instance of what I call "fragile and temporary inversion of power" one is able to access fleeting events in which power relations between State authorities and ordinary citizens, endowed with magical/technical powers, are inverted. This inversion is initially sustained by the act of "di-vision" (Bourdieu 1996) by hackers, that is, through the means of language acts in which a symbolic boundary between hackers and non-hackers is created and made visible, dividing symbolically expert insiders and non-technical outsiders. As part of the act of boundary-making, it is important to observe that its efficacy depends as much on enchantment as it does on technical mastery. Conspicuous demonstrations of technical excellence are efficacious for laypersons because they transcend their forms of reasoning and understanding which allows for the very technical act to be endowed with a magical aura. What seems to be one of the most evident boundaries between the domain of magicians and that of laypersons lies in a form of naive or enchanted pragmatism: it just works, it functions as expected and promised, therefore it dispenses with further exploration for the reasons why. The curious and inquisitive mind of those who question every aspect of why and how a particular piece of technology works all too often crosses the boundary to enter into the world of hacking practice, even if he or she does not identify as such and is not seen as one by peers. This "practical idea," to apply Mauss' (1950) term, of inquiring why and how of every piece of technology establishes a common threshold for the domain of hacking. Hackers as *bricoleurs* tear things apart in order to look how they function, going as far as taking government technologies and corporate systems apart to see how they work or, quite often, why they fail to do so. Enchantment assumes different forms among hackers as well. Computers technologies can be fetichized, for instance, as much as the dancing chairs in Marx's explanation of commodity fetishism. They exert centripetal force, drawing uncountable hours of attention with hyper focus from hackers, whereas the conditions of production of various other components of IT infrastructures are effaced from commoditized artifacts. To make an alternative use of Gell's metaphors for technical enchantment and to diverge from his primary goal which is to desacralize art and place it within social and technical processes, hackers tend to dominate the "computer technologies of enchantment" instead of being themselves subjected to the "enchantment of technology" (Gell 1992). In sum, one is able to find both the belief in the magic of computing, the joy, and fascination in discovering how technological systems work in various degrees and at various capacities within hacker collectives. The internal boundaries of various hacker groups also become evident as we change our focus from the interactions between hackers and non-hackers to the disputes and boundary-making practices within the hacker communities in their local and transnational manifestations. Despite having "disenchantment" as the modernist condition of binding hacker collectives and for the creation of the distinction between hackers and non-hackers, there are limits for the dis-mystification of technology as some of the practices in hacking are products of unconscious appropriations, automatism, atavistic dispositions, and unconscious participation in discursive regimes. There is no total, complete de-fetichization given the complexity of the field of computing and of its technical objects. Hackers themselves are demystifying certain aspects of their lifeworld which is composed by technologies, but not others, despite their disposition toward exploration and discovery which always leaves the possibility of de-fetichization open as a valid possibility.

The attribution of magic to technical accomplishments is also a common and informal parlance among hackers but the term is using half-jokingly for illusory effects or for background mechanisms that are hidden from the user of a particular piece of technology. It is also used to simplify explanations, functioning as a "black box," when certain mechanisms do not have to be unveiled for the understanding of a particular system. I have encountered examples in various instances of face-to-face interaction and at "show and tell" sessions at hackerspaces when a technologist demonstrates a project which involves hidden mechanisms and optical or sensory effects that are counter-intuitive (such as the mechanism of plateau-Rayleigh instability applied to a water fountain to give the impression that water drops are frozen in the air, or for the case in which Oliva, whose trajectory we will discuss in the next chapter, suggests that his technical work for the project GNU involved some *“black magic,” or to put it better terms, “white magic,” since there was some magical things the scripts* [he] *wrote would do for the user that took a bunch of black magic in the background*. Magic, therefore, delineate collectives and provides a “negative contour” for the very technical work hackers as magicians perform in order to find themselves in communion with humans technologists and non-human computers.

2.8. Hackerspaces and the (Global) Recreation of Hobbyist Clubs

The experience of the L0pht with its computer magicians was not an isolated one. It represented rather an early form of a hacker club that would become popular world wide with a network of community spaces concentrated mostly in global cities of the North Atlantic and the Pacific rim.

The contemporary notion of a community-led space for computing, electronics, and tinkering called “hackerspace” was popularized in the United States after the encounter of European and North American hackers during the Chaos Communications Camp in the summer of 2007. An influential document was put together by European technologists to describe patterns they observed in their communal spaces. The “Hackerspace Design Patterns” became a key document influencing to a great extend the recreation of North-American spaces and igniting several other spaces far and beyond the United States and Western Europe. The document describes organizational and interactional patterns, such as consensus decision-making for governance, voting (when consensus cannot be reached), “sudo leadership” (which metaphorically stands for the avoidance of having ranks and distribution of administrative power in the space by self-appointment), good practices in volunteering, debate culture, avoidance of long discussions over minutiae details and reserved, private, mediated talks when problems cannot be solved in open meetings. The Design Patterns emphasize the importance of fostering “creative chaos” whereas raw materials, tools, parts, and old pieces of electronics and computer hardware should be available for tinkering and repurposing. It is suggested that spaces should store enough materials for unrestrained technical experimentation, but also try to save room for more permanent fabrication and computing equipment. Access, being one of the most controversial topics, is suggested to be granted widely with the distribution of keys, allowing members to use the space without imposing heavy restrictions. Energetic drinks[33] are considered a must-have in availability, so members can work with a tight focus for long hours on their projects. In sum, the “Hackerspace Design Patterns” describe a set of parameters for creation and maintenance of hackerspaces worldwide and emerge quite often as a topic of discussion, exerting strong influence in local evaluations and decision-making processes. In comparison with the so-called “maker spaces”, hackerspaces tend to accommodate more independent and politically organized groups and activities. In everyday parlance, the two terms are either used to mark a political positioning or used

33 A very specific recommendation is made for hackerspaces to acquire pallets of a German-produced *Ilex paraguariensis*-based soda drink called “Club-Mate” which is imported in small quantities to the United States and usually identified as a “hackerspace drink” among the Euro-American community. Mate (also called “chimarrão”) is a traditional drink of the American Southern cone. It was briefly described in respect to its taste by Lévi-Strauss (1996) and properly contextualized in relation to Gaucho culture by Oliven (1996). This is the beverage for long work hours of the anthropologist as well.

interchangeably as synonyms.

The definition of “maker space” was first introduced by the print magazine “Make” launched in 2005 and popularized with the expansion of a network of shared, membership-based workshops across the United States. Make is dedicated to the promotion of tinkering with a goal of ultimately breaking out of the mass-consumerism with STEM outreach, which includes the organization of a large-scale event akin to a science and technology, family-oriented fair called "Maker Faire.” Its founder and key executive, Dale Dougherty, explains the origin and his preference for the term “maker” in opposition to “hacker” with a description of a conversation he had with his daughter (Cavalcanti 2013; Lindtner et al. 2014). As explained by one of the technical writers for the magazine, Gui Cavalcanti[34], Dougherty intended to call his magazine “HACK” but his daughter was not convinced by his explanation of the positive connotations of the term. He tried to explain to her that hacking could be much more than computer programming, but she could not be persuaded to accept it was a good name for the publication. He finally settled for the term “maker.” While being accepted by his daughter, it seemed to be much more inclusive without suffering from discursive disputes as the term “hack” and the unpopular figure of the “hacker.” In the span of a decade, Make magazine managed to establish itself as an authoritative source of information in world of electronics tinkering, extending its prestige and reach abroad through the international expansion of hackerspaces as well as through its position as a subsidiary of O'Reilly media, a very prestigious publishing company in the field of

34 Source: http://makezine.com/2013/05/22/the-difference-between-hackerspaces-makerspaces-techshops-and-fablabs/, accessed 05/25/2013.

computing and one of the main voices in debates regarding Open Source and Open Data. In 2013, Make formally left the portfolio of O'Reilly to spun off an independent media company and e-commerce store, Make Media, which expanded internationally through contracts for the usage of the brand "Maker Faire" and the creation of big events in various countries, including Italy, Japan, China, France, among others. In its most popular iterations in the Bay Area and New York city, the event has attracted since 2006 from ten up to a hundred thousand participants per event. The demographic distribution of the attendants is comprised by those who identify themselves mostly as hobbyists, tinkerers, engineers, programmers, crafters, and makers[35]. At the moment of this writing, Maker Faire is being organized to be hosted by the United States White House. In an interview to the White House on June, 2013, the founder of Make Media digressed over who gets to count as a maker: "Once we understand who Makers are, we can find them in history. People like Benjamin Franklin and Henry Ford might be considered Makers. Apple founders Steve Wozniak and Steve Jobs were also tinkerers and designers, creating a personal computer that grew out of the Homebrew Computer Club and was first showcased at the West Coast Computer Faire. We consider them Makers. Today, we have a new generation of inventors, tinkerers, and product designers who will also become known for what they make[36]."

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35 In 2012, a survey was published by Make Media on its biggest event the Maker Faire Bay Area. More than 50% of the attendants identified themselves as "hobbyists." Most of the attendants are male with an average age of 46, most of them are well employed (making more than one hundred thousand dollars per year) and own their house. They all have college degrees and more than 40% have post-graduate degrees. More than 65% are married and almost have of the attendants have children under 18-years-old living with the family (Maker Faire Bay Area Attendees Study, produced by Karlin Associates, source: http://cdn.makezine.com/make/sales/maker-faire-bay-area-survey-09-2012.pdf). Another survey was executed for the year 2013 and presented similar results in comparison to the previous year.

36 Source: http://www.whitehouse.gov/blog/2014/06/13/5-questions-making-and-white-house-maker-

2.9. Translating the Free and Open Source Software to Open Hardware

In the past decade, hardware engineers, artists, and hobbyists started to converge around the tentative idea of extending similar legal and moral injuctions of Free Software to promote circulation, study, transformation, and redistribution of hardware design files. The technical work on Open Source Hardware (OSHW)—or Open hardware as it is also commonly known—has been sustained by the increased access to computer numerical control machinery (CNC), computer-aided design (CAD) software, and the collective experience and common pool of information technologies that has been created in the past three decades with Free and Open Source projects. Part of the promise of creating a global sharing economy around design tools and their intangible outputs with fabrication equipment and shared workshops is the imagination of a future in which most tangible goods and processes, from food items to civil construction, will have digital sources that could be shared before being materially rendered. For issues of information security, the ability of auditing hardware has substantially increased the appeal of Open hardware alongside mediatic, communitarian, and capital investment on educational, artistic, and commercial opportunities it potentially affords.

The earliest attempt to systematize an OSHW proposal was launched in the late 1990's with the event of Open Source as a new business model in the United States. One of the first definitions was elaborated by the same proponent of the "Open Source Definition," Bruce Perens, an important contributor in the promotion of Free Software

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faire, accessed June 13, 2014.

projects with key contributions such as the Debian Social Contract and the earliest OSHW proposal, "Open Hardware Certification Program[37]." At stake was the necessity of establishing agreements with hardware companies to have their products publicly documented, so FOSS developers could write software to interface with them. The proposal has never gotten traction among hardware companies. There were other initiatives as well in the late-1990's to create Open hardware through distribution of design files that could be studied, modified, and used for different purposes. These initiatives did not manage to gather community support and disappeared from the landscape of FOSS-based projects.

The main discussion fora for the OSHW definition involved key participants of nascent Open hardware businesses alongside Creative Commons representatives to debate legal, technical, and commercial issues as well as necessary practices for increasing participation in collaborative hardware development. The first gathering was called "Opening Hardware: a workshop on legal tools" and took place in an art gallery in New York City. By 2010, the definition reached its debut version 1.0 having as its short definition: "Open source hardware is hardware whose design is made publicly available so that anyone can study, modify, distribute, make, and sell the design or hardware based on that design. The hardware's source, the design from which it is made, is available in the preferred format for making modifications to it. Ideally, open source hardware uses." By drawing a comparison between the Open Source definitions for software and hardware, we can highlight the fundamental changes that were

37 Source: http://www.oshwa.org/research/brief-history-of-open-source-hardware-organizations-and-definitions, accessed 12/03/2013.

implemented:

Open Source Definition, v. 1.9	Open Source Hardware Definition, v. 1.0
1. Free Redistribution	**1. Documentation**
2. Source Code	**2. Scope**
3. Derived Works	**3. Necessary Software**
4. Integrity of the Author's Source Code	4. Derived Works
5. No Discrimination Against Persons or Groups	5. Free Redistribution
6. No Discrimination Against Fields of Endeavor	6. Attribution
7. Distribution of License	7. No Discrimination Against Persons or Groups
8. License Must Not Be Specific to a Product	8. No Discrimination Against Fields of Endeavor
9. License Must Not Restrict Other Software	9. Distribution of License
10. License Must Be Technology-Neutral	10. License Must Not Be Specific to a Product
	11. License Must Not Restrict Other Hardware or Software
	12. License Must Be Technology-Neutral

Table 1. Comparison between Open Source Software and Open Source Hardware definitions

As the GNU GPL license instituted four "software freedoms" with an allusion to the US constitution and Franklin D. Roosevelt's famous speech on "four freedoms," the Open Source definition had its "ten commandments," and the Open Source Hardware definition drew inspiration and direct legal guidance from both. The Open Source Hardware definition carried over most of the items of the Open Source Definition, adapted a few to reflect hardware development, and added three items: "documentation," "scope," and "necessary software." These provisions are related to the perceived need of having well documented hardware that can be studied and understood to facilitate collaboration and tinkering: one has to be able to understand the functional, mechanical, and conceptual aspects of a project in order to be able to contribute back valuable modifications. Free and Open Source tools to study, design, and modify hardware (whether in its tangible or digital form) are fundamental conditions for the process: without Free Software, it is harder to disseminate the basic conditions for collaboration, not to mention all the other political and ethical aspects that are related to secrecy of technological black-boxes. The provision under "scope" curiously does not enforce the moral and legal injunction of the GNU GPL: it basically prevents the Open Source Hardware to impose its licensing to other parts of a piece of hardware that might be licensed with different restrictions or permissions.

The other so-called "ten commandments" of the Open Source Hardware definition map onto the legal, economic, and moral space of Free Software and the "social contract" that is established among developers and contributors to develop information technologies in a collaborative fashion: for a piece of software to be categorized as Open Source it has to allow for redistribution and potential selling; make its source code available and free from closed protocols, interfaces, and repositories; allow for derivative work; maintain "integrity" of the original source, so to distinguish between "base source" and derivative versions; do not allow restrictions to be placed against persons or groups; do not restrict any form of usage; do not request that additional licenses be required in addition to the Open Source license; and, last but not least, a piece of Open Source software cannot impose any of these provisions onto other pieces of software that are part of a particular system.

The space of online and offline interaction for drafting the first Open Source Hardware Definition involved companies, hardware engineers, designers, and project representatives from Western Europe and East Asia. Most of the initiatives and enterprises involved were mostly concentrated in United States. As we will see in the next chapter, the encounter of Chinese engineers with the Open hardware community helped to bootstrap one of the biggest and most influential Open Hardware manufacturing companies in mainland China, which has also brought to the region a discussion about Free and Open Source licensing and development.

2.10. Struggle for Information Liberation

In the morning of January 11th, 2013, the programmer and political activist Aaron Swartz was found dead in his apartment in Brooklyn, New York. Soon after the news have reached the Internet, series of manifestos, online gatherings, and hacking marathons were organized to celebrate Aaron's political and technical work for Internet freedom, Open Data, and Open Access. In a matter of weeks, parallel events were organized across the United States, finding solidarity with activists internationally. This collective effervescence elaborated on a narrative projecting the future of information systems, helping to frame the past and project the future in respect to Aaron's accomplishments and indictment for computer crime.

In the West Coast, the Noisebridge hackerspace in San Francisco was the natural choice for the organization of a hackathon to celebrate the memory and the work of Aaron. Some of its original founders had close ties with Aaron. It was also one of the key instances for a narrative composition framing the past, present, and future of information technologies and the Internet which brought various technologists and activists to Noisebridge after Aaron's passing.

The case of Aaron Swartz brought to light key events in the recent history of dispute over enclosure versus electronic liberation of intellectual work. Not by accident but in virtue of an accident charged with accusations of abuse of State authority and legal overreach, Aaron's life construed under the light of contemporary technopolitical struggles has become the inductor of a narrative on information freedom and openness. In a moment of rupture, the tragic loss of Aaron's life magnified the ongoing disputes in the domain of academic publishing, copyright reform, and, more broadly, an ongoing struggle against the enclosure of public goods and intellectual work—a dispute which assumed different contours in different fields of cultural production.

The place of Ricœur's phenomenological hermeneutics in the treatment of memory advances Henri Bergson's and Maurice Halbawchs' work by situating itself in between language and life as experienced by the subject with the goal of working out the tension subject-object. Turning primarily to the narrative as a form of action, analyzed through the hypothesis of time becoming “human time as it is articulated in a narrative mode” (Ricœur 1984), the author inaugurates a new interpretative gesture which occupies itself of the relation between the activity of narrating stories and the temporal character of experience. This relation is theorized through the concept of “triple mimesis” based on the philosophical problem of experience of time in St. Augustine and in the analysis of narrative compositions extracted from Aristotle's Poetics. In challenging the chronological and mechanical conception of time, the present is imploded in a triple present—the present of the past (*memory*), the present of the present moment (*attention*), and the present of future (*expectation*). The triple mimesis of narrative compositions consist in three analytic steps: 1st. practical experience in which temporal aspects are pre-figured in memory; 2nd. weaving of the narrative, configuration of its basic elements (who, where, how, why) drawing from pre-figured elements; and 3rd. reading and interpretation, when “refiguration” takes place, combining, as the author suggests, the world of the text with the world of the reader. These three moments correspond to a synthesis of heterogeneous elements and to a practical, experiential articulation: “what matters is the way in which the everyday praxis ordinates, one and relation to the other, the present of future, the present of past and the present of present, because it is this practical articulation that constitutes the most elementary inductor of the narrative” (Ricœur 1984:96). Ricœur's narratology offers a rich framework for the study of language practices in the context of the contemporary politics of information and knowledge. To pass from a practical to a narrative understanding of action, Ricœur suggests, the relation between the two must be one of presupposition and transformation. Presupposition refers to our familiarity with a network of action (the who, what, where, how of the plot). This familiarity is organized differently in the context of the political narrative as it also contains a utopian opening, referring to the other aspect of understanding, which is the transformation brought about through the narrative composition of the reader-activist. In Aaron's case, familiarity has to do specifically with expertise in computing and the political positioning toward information openness, and the narrative configuration includes agents that are non-human automata. His composition relies upon and is exercised through technical means, such as “war dialing” (repeatedly call politicians in congress and leave them messages), “web scrapping” (collect data and structure new datasets bypassing pay-walls); and, last but not least, creating protocols for information sharing and licenses for legal content sharing (that can be read by humans, lawyers, and machines). Aaron's case, therefore, offers us a window into a contemporary form of political narrative, framing a collective memory in particular ways, interpellating new activists by describing moral-crossroads, and by engaging prestigious spokespersons, painting a technological future with a promised utopia of information liberation. At once, by narrating his time and being the sacrificed hero, Aaron became a symbol of a new form of political action and engagement: a political exercise for the defense of the sphere of (electronic) public goods "To understand a story", suggested Ricœur, "is to understand both the language of 'doing something' and the cultural tradition from which proceeds the typology of the plots" (Ricœur 1984:57).

In broader terms, Ricœur poses a fundamental question for the anthropological study of narrative action: "how can one speak of human life [...] if we cannot have access to the temporal dramas of existence outside stories told about them by others and by ourselves?" (Ricœur 1984:74). What is key is the pre-discursive quality of experience. As discussed by the author, the necessity of narrating human lives is grounded in the inevitable necessity of rendering them meaningful and dealing with human suffering and our finitude. Aaron was a narrator—a "maker of plots"—organizing of events, mending a narrative from a wide range of heterogeneous elements and incoherent facts. Aaron's death represented a reversal in the plot, transforming it from fortune—massive victory in overturning a decision of the US Congress—to a misfortune, his prosecution, and a tragedy, his self-sacrifice.

Aaron's tragedy involved the recognition of computer hackers in what he was facing before his death, and this recognition mostly led to a large participation in the collective work of emplotment and mimesis, in other words, remotely distributed gatherings, hackathons, memorials, and software projects which were started and advanced from what he left behind. According to Ricœur's definitions, emplotment involves an act of judgment and of productive imagination and synthesis post-tragedy. Mimesis provides, in a similar sense, a creative opening for the unexpected. It is not a mere copy of a pre-existing reality, but a "creative imitation"—"the artisan who work with words produce not things but quasi-things, [he or she] invents 'as-if'" (Ricœur 1984:45).

Addressing the audience at the conference "Freedom to Connect" on May 21, 2012 in Washington DC, Aaron narrated the story of a successful campaign organized by himself with a group of Internet activists, entrepreneurs, developers, and engineers to fight a legislative attempt to extend governmental control over the Internet. The "Combating Online Infringement and Counterfeits Act" (COICA) under scrutiny and criticism provisioned domain names could be locked by authorities under any evidence of intellectual property infringement. Aaron and his collaborators responded by starting an online petition, launching a non-profit organization called "Demand Progress", snowballing IT industry contacts and among activist circles, and using interpellation strategies to raise awareness with the usage of pedagogical texts and videos. In Aaron's conjunctural analysis, the bill reflected an ongoing battle orchestrated by the entertainment industry, "a battle to define everything that happens on the Internet in terms of traditional things that the law understands. Is sharing a video through BitTorrent like shoplifting from a movie store? Or is it like loaning a videotape to a friend? Is reloading a page over and over again like a peaceful virtual sit-in or a violent smash of shop windows? Is the freedom to connect like freedom of speech or like the freedom to murder?" The high risk and probability of having the bill to pass, the audience was told, would amount to the attack of the Constitutional first amendment right, "freedoms guaranteed in our Constitution, the freedoms our country has been built on, would be suddenly deleted[38]". In a strong wave of criticism, several demonstrations were organized on and off-line around the issue, construed as a new governmental and corporate attempt at Internet censorship. Echoing past events of Internet denizens around the banner of "Net Neutrality", the campaign proved itself effective in opposing two other iterations of the bill, revised and reintroduced for voting under different names, such as "Protect IP Act" (PIPA) and Stop Online Piracy Act (SOPA). Internet activists within big corporations and key foundations and non-governmental agencies, such as Reddit, Google, Mozilla, Electronic Frontier Foundation, and Wikimedia were vocal participants in online protests. A "black-out day" for the Internet was planned and carried out on January 18th, 2012 on websites of Wikipedia, Craiglist, Mozilla, Boing Boing, Tumblr, Megaupload, and Reddit, which suspended their availability for a day, displaying instead of their regular landing pages how to participate informing the public about the bill. After months of mobilization and public pressure, most members of the Congress gave in, deciding to indefinitely postpone voting the bill. This collective victory was preceded by a major personal defeat in the story of Aaron's life: his arrest at MIT and indictment under the Computer Fraud and Abuse Act (CFAA) only a year before. Monitored by police officers using security cameras, Aaron was caught wiring his computer and an external hard drive to a router of the MIT network. According to a (heavily disputed) police report, Aaron launched a

38 Source: http://www.youtube.com/watch?v=Fgh2dFngFsg (accessed on 01/28/2013).

simple script program to perform bulk downloading of academic articles from Jstor. Approximately 70 gigabytes were downloaded accounting for more than four thousand articles. Just a few months before his arrest, Aaron launched a manifesto and a website "Guerilla Open Access Manifesto" in which he called for direct action: "We need to take information, wherever it is stored, make our copies and share them with the world. We need to take stuff that's out of copyright and add it to the archive. We need to buy secret databases and put them on the Web. We need to download scientific journals and upload them to file sharing networks. We need to fight for Guerilla Open Access. With enough of us, around the world, we'll not just send a strong message opposing the privatization of knowledge—we'll make it a thing of the past. Will you join us[39]?"

Deeply invested as a friend, activist, legal scholar, and collaborator, Lawrence Lessig narrated Aaron's prosecution over bulk downloading as a case of legal overreach, systemic corruption, and abuse of power triggered by the civil disobedience act of a young man, "who was a hacker, but not just a hacker, he was an Internet activist, but not just an Internet activist; he was a political activist, but not just a political activist. He was a citizen who felt a moral obligation to do what he believe was right[40]." As Lessig offered his rendition of hacking as the "application of technical knowledge for public good" at the occasion of his appointment as the chair of Harvard Law School, Aaron's heroic quest was brought to light against the backdrop of moving images containing iconic figures such as Martin Luther King, Gandhi, Buckminster Fuller, Einstein, and others among those who, Lessig contended, thought differently, despite

39 Source: http://openaccessmanifesto.org/ (accessed 01/18/2013).
40 Source: http://www.youtube.com/watch?v=9HAw1i4gOU4 (accessed 03/12/2013).

the ironic fact there was nothing Aaron would have wanted less than having his image associated with a TV commercial by Apple. The question of how can one speak of human life posed by Ricœur points to the necessity of narrating human lives, grounding this necessity yet on another condition of possibility, which is a first order need to render disruptive events meaningful and dealing with suffering (in face of inexorable finitude). The drama we are told in narrative actions surrounding Aaron's life involves three phases in a span of thirteen years: his activism pre-copyright, on flexible copyright, and beyond-copyright. The first phase is described as his precocious involvement in collaborative development for organizations such as World Wide Web Consortium (W3C), doing substantial work to create the specification of "RDF Site Summary" (RSS 1.0) for syndication of website data and metadata in machine readable format. The second phase involved the recognition of Free Software (and the figure of Richard Stallman) as an important moral, political, and technical force in the landscape of information technologies. Working as a technical consultant, Aaron was identified as a key participant in the foundation of Creative Commons, which adapted the Free Software logic to a set of flexible copyright licenses meant to promote an unrestricted flow of cultural production. Aaron's collaboration with Creative Commons' volunteers came in handy as they relied on him to create new flexible copyright licensing terms which could be read not only by lawyers or lay persons, but also by machines. The third and last phase of Aaron's engagement, which started a few years before his suicide, involved activism and direct action on social justice issues, such as access to knowledge and political reform to tackle systemic corruption in Capitol Hill. After the announcement of Aaron's passing, close friends with connections in hackerspaces around the country as well as in key activist non-profit organizations, such as Internet Archive, Creative Commons, and Electronic Frontier Foundation, planned a series of online activities, two memorials to be held on the East and the West coast, and hacker/software development marathons. An online effervescence gained momentum as people got together on IRC to discuss possibilities and help to edit a shared document with a list of projects, volunteers' contact information, and goals which were either directly identified with Aaron's own projects or software he would have liked to work on himself. As the list grew, a wide range of activities were carried out involving information openness, encompassing Open Libraries for public use, liberation of Jstor articles, removal of watermarks in PDF files downloaded from from pay-walled repositories, visualizations of governmental data, among other projects. Solidarity was shown also internationally as volunteers organized events for Internet anonymity and data liberation in Canada, Germany, Lebanon, Austria, India, Iran, and Serbia.

My ethnographic rapport initiated when I started to follow a flow of messages and spontaneous formations online, through IRC, mailing-lists, and blog posts around the necessity and urgency to celebrate Aaron's memory and spread the word about the injustice of his legal case. The tone of the torrent of public notes from close friends, family, collaborators, and admirers suggested that Aaron was, akin to neologism coined by Antonin Artaud, "suicided by the government". There was a widespread sentiment of loss, but of a politicized and radicalized kind. Most people involved in public demonstrations did not know Aaron personally, but they felt as if they did. From a wide spectrum of political and technical positions, from anti-copyright to flexible copyright proponents, to libertarian socialists to liberal reformers, privacy and cryptography experts to young mobile phone “app” developers, the injustice was felt as if we were all part of one and only inflicted body. There was something about this instant solidarity and collective effervescence around information openness and among a very diverse group of technical and political agents.

As I walked to Aaron's memorial service at the Internet Archive in San Francisco, a former church now hosting clustered servers and numerous Open Access and public domain collections, I was instantly captured by the half-mast flag of the earth on a black background in front of the building. It immediately triggered memories of discourses on the Workers' International, the cover of Whole Earth Catalog and the birth of a narrative on “cyber” community and sociality (Rheingold 1993; Turner 2006), standing as a symbol of the Internet as a potential embodiment of international solidarity, despite stark inequalities in access, bandwidth, and equipment (DiMaggio et al. 2004). The memorial felt like a political convention as it created the opportunity for close friends, collaborators, and influential Open Access publishers and activists to discuss their interpretations of Aaron's tragedy and politics. The most influential and heated talk was given by Aaron's collaborator Carl Malamud, who started the RECAP project to liberate PACER, a paid-per-view (public) database of court records. In what has become a widely circulated Internet video and text, Malamud offered a speech entitled “Aaron's Army” in which he reiterated that Aaron was not the only one, but a member of an army of Open Access combatants: “when I see our army, I see an army that creates instead of destroys. I see the army of Mahatma Gandhi walking peacefully to the sea to make salt for the people. I see the army of Martin Luther King walking peacefully but with determination to Washington to demand their rights because change does not roll in on the wheels of inevitability, it comes through continuous struggle. When I see our army, I see an army that creates new opportunities for the poor, an army that makes our society more just and more fair, an army that makes knowledge universal. When I see our army, I see the people who have created the Wikipedia and the Internet Archive, people who coded GNU and Apache and Bind and Linux. I see the people who made the EFF and the Creative Commons. I see the people who created our Internet as a gift to the world[41]." Sitting right beside me in the audience was a person who I first noticed online and came to identify later, only after all the invited speeches were given and the microphone was open to the audience. A line formed at the far end corner of the Internet Archive's theater. Several members of hackerspaces, Internet businesses, volunteer associations, and Free and Open Source projects were there. A young man—who supposedly was responsible for publishing thousands of JSTOR articles on Piratebay right after the announcement of Aaron's suicide—approached the microphone and read a portion of the "Hacker Manifesto" from his tablet—written by "the Mentor", a hacker who was arrested in 1986 under charges of computer crime, and published by Phrack, a hacker zine which is one of the canonical pieces that is always referred as a source of inspiration. Speeches were followed with reverential attention and pointed to a particular way to frame the memory in regards to past battles as part of an ongoing struggle against knowledge privatization—from Free Software to Creative Commons, to Aaron's Open Access manifesto to Greg Maxwell's statement for the liberation of academic production on Pirate Bay, and a series of software-based initiatives to liberate academic publishing, linking memory, actuality,

41 Source: https://public.resource.org/aaron/army (accessed on 01/27/2013).

and utopia in very specific ways; or, to put in other words, bringing past events into light to illuminate present events, pointing, at once, towards a vector of societal transformation in the implosion of the present into a three-fold temporal experience conceptualized by Ricœur.

Next day after the official memorial service at the Internet Archive, a community-led memorial "hackathon" was carried out at Noisebridge hackerspace in San Francisco, as well as in other hackerspaces in Boston, Vienna, Berlin, New York, Washington DC, among other locations. At the very first meeting, we were in a group of 15 participants. The group was composed by young developers, who launched immediately into the discussion of projects they would like to carry on, so a preliminary list of proposals was put up on the wall with post-it stickers and later transferred to a publicly shared spreadsheet document. The post-it stickers described ideas and skills each person had to contribute. Proposed software projects included: creating a science graph to help navigate academic publications and areas of interest, building a better interface for governmental public data, using census data to highlight social inequalities, and building an Internet-based "suicide hot-line" to reach out for hackers suffering from depression. I proposed a NSF watch-dog project: to scrape data on projects funded after the new Data Management Plan (DMP) of 2011 in order to ensure they yield raw, public, and usable data to the benefit of other research groups. In the span of three days of sporadic encounters and fluctuation in the number of active and inactive participants, most projects ideas did not stick, including mine, and most projects were not worked on, except for two of them: a website for visualization of US Census data, and individual work from a volunteer who ported the RECAP plug-in to work on Google Chrome browsers. Noisebridge kept a strong influx of visitors, informal and parallel talks took place during the whole hackathon. Several volunteer presentations were given on Artificial Intelligence and Machine Learning, hacker activism, depression and sentiment analysis, book scanners based on vacuum cleaners, web data scrapping—a technique often used by Aaron himself—and one key presentation on the history and legacy of Aaron by an activist from the Electronic Frontier Foundation.

Similarly to Lawrence Lessig's speech, the EFF's activist talk at Noisebridge helped to frame a group memory as much as it helped to project new forms of political activism from the spontaneous gathering of random groups at Noisebridge. In the backroom mainly used as a classroom at hackerspace, his presentation attracted a large group of activists, developers, and Bay Area hackers. Drawing a map of the Internet activist initiatives of the past decade, he suggested a different view of Aaron's life, not a revolutionary or radical activist, but a rather moderated one, not a libertarian socialist, but a Keynesian reformist. We were told Aaron studied economics, and got interested in sociology during his brief period at Stanford, before dropping out to start his own Internet company, Infogami. We were also told Aaron was an adept of "weak Artificial Intelligence": he was not to be found defending or even entertaining the position that machines could think and act intelligently, but only mimic algorithmically intelligent human acts.

The notion of "openness" as a condition to be achieved and fostered through hacking reveals a useful entry point for the discussion of rather disparate political, technical, and corporate alliances. It has served as a symbol and a centripetal force for a wide variety of practices: from Free Software development and activism to Open Data for governmental transparency and/or profitable businesses; from “Open Innovation” platforms of networked firms morphed from what was previously identified as “Open Standard” (Kelty 2008) in consortia of IT companies. These contemporary sociotechnical arrangements constitute domains of experience and practice, putting into evidence fields of possibility surrounding information technologies. What they have in common is a loose identification with “hacking” pragmatically functioning as a rubric for a wide variety of practices surrounding information openness. Aaron's life as narrated by himself and his collaborators offers a rare example in which a personal trajectory stands for the experience and the political struggle of a whole heterogeneous collective. From the dream of a future web in which information will be heavy interlinked and interpretable by machines, allowing wider circulation and sharing to the dream of copyright reform, to political activism beyond the Internet, but mediated by it, on fundamental issues, such as political reform, Aaron's life and tragedy offered the opportunity for a wide range of agents to temporarily converge on questions of openness and social justice.

2.11. Conclusion

In describing the trajectory of computing as a metaphor, an infrastructure, and a culture *pace* Leigh-Star (1995) we position ourselves to better understand the formation of computer hacker collectives and their political, moral, and technical practices. From the post-war period to the present, we saw in this chapter how computing was practiced and transformed into an object of discourse for wider access, encompassing distinctive infrastructures, technical practices, and metaphors. In its trajectory, hacking has oscillated in its moral valence between a virtuous, heroic and abnegated dedication of hyper-focused pioneers to advance computing and an obscure, proscribed practice of pranksters which eventually was criminalized (as digital trespassing and, later, as circumvention of IP rights) and institutionalized as a form of addiction, therefore marking the body of hackers as object of punishment and control (Douglas 1992).

In this chapter we discussed distinctive contexts in which technical exploration was manifested as a dispute against bureaucratic control over computing machines. The participation of engineers and early computer programmers was made possible first through the creation of accessible tools, such as compilers and high-level programming languages, allowing for the possibility of abstracting fundamental aspects of computation so as to unlock the general-purpose potential of digital computers. As participation and access increased so did the dispute over the control of computer machines and infrastructures, creating the conditions of possibility for the figure of the hacker to emerge as a wizard, identified erroneously as an antisocial magician who embodies the required knowledge for casting technical spells. This figure of the computer wizard—and its variants of the "hacker" and "computer bum"—is, at once and paradoxically, the docile body of the military-industrial-complex of the post-war for not questioning the end products of his technical inventiveness, but also the disobedient, reckless figure of the brilliant research staff or computer laboratory fixture who is fiercely opposed to academic discipline. The irony of the contemporary is that—to put it metaphorically—the very "tools" that the builders would naturally refuse to build an industrial society would eventually become the fundamental ones. Forward to the present, hackers would be cast as the ultimate agents of political change, regardless of the understanding and means of the political, irrespective of the political project for social change. The deep understanding of computer machines that early hackers attained through countless hours of focused attention, exploration, and tinkering would eventually break out and away from universities and business settings to find its way into households (through personal computers) and informal gatherings (through computer clubs) across the globe. Hacking found its early expression in the context of the late 1960's in which the question is how to conduct ones life (and not merely *make a living*) at the borders or with what is produced in excess, gathering what can be obtained for free, from books to university courses, transportation, food, shelter, non-puritanical forms of intimacy, and long-phone distance calls with the expansion of phone-phreaking as one of the main genealogies of hacking in the Euro-American context.

The political atmosphere of the "new social movements" of the 1960's promoted a substantial shift in the history of computing as we saw: from the prosperous Silicon Valley with its military-backed and well funded technoscientific projects personal computers became the object of hobbyist and counter-cultural groups leading to a tectonic shift in computation—from a tool for bureaucratic governance to a prosthetic device for personal liberation and enhancement. The 1970's hardware hackers are sung in popular narratives of global range today as pioneers of personal computing who built the basic building blocks for a new industry with accessible programming languages, TV computers, and operating systems for novices. In this period, education was reimagined in various countries, such as the former Soviet Union, France, and United States with programs for computer training which aimed for forming the children as the new workers and citizens of emergent “informational societies” (Boenig-Liptsin, n.d.).

In the 1980's the opposition between hackers and their other is transformed from the centralizing power of the mainframe to the nascent software company. It is through the exploration of flaws and circumvention techniques applied to copy-control mechanisms of software products that electronic communities organize using personal computers and telephone lines to access BBSs. This period was marked as we saw by the substantial increase in the number of underground publications for information sharing on computer and communication systems which is followed by a strong wave of criminalization of hacking. The backdrop is the well-known development in the mid-to-late 1980's within GATT of the agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) creating a global framework for intellectual property law enforcement and maximalist rights imposition through global trade.

All of these historical threads culminate with the return of the “virtuous hacker,” embodying the Free Software developer and, later, an Open hardware engineer. The autonomist politics of the late 1960's found reverberation in the electronic disobedience of the mid-1990's hacktivists. And, fast-forwarding to the present, the hacker underground ironically if not predictably gives way to the enrollment of former hackers in government intelligence agencies as well as in profitable information security companies. Not merely a generational shift, but a massive political shift as well. This is the context in which the dubious label of “ethical hacker” has been applied to circumscribe a domain of professional training and certification. Hacking has become part of formal curricula and businesses.

We also attended to the narrative compositions before and after the event of Aaron Swartz' tragic death. The goal was not to suggest a discontinuity in the recent history of Internet activism or the dispute against the transnational intellectual property regime, but to point to creative (and mimetic) reconstructions of a narrative in which Aaron figured as story-teller and protagonist, the hero of a tragedy that is recounted as a means for political mobilization. Aaron advocated for direct action on Open Access issues[42] by enticing "those with access to these resources—students, librarians, scientists— you have been given a privilege. You get to feed at this banquet of knowledge while the rest of the world is locked out. But you need not—indeed, morally, you cannot—keep this privilege for yourselves. You have a duty to share it with the world[43]." What renders the globalization and alter-globalization of hacking important, in sum, is the dispersion of meanings and practices in the present and at intersecting transnational scales. The following chapter is dedicated to the contemporary elaborations on hacking from the standpoint of personal and technical trajectories at intersecting scales and cross-cultural contact points.

42 It is important to ask in this regard what is the responsibility we bear as anthropologists endowed with the privilege of access? Aaron's manifesto charges all of us with the responsibility and urgency of changing the very ways in which our academic production is archived and distributed. It calls for sharing the responsibility of creating alternatives to the corporate management of what we create, stifling what seems to be one of our few consensual goals of bringing and bridging other groups and traditions of disciplinary work in anthropology together, overcoming an academic digital divide, and allowing world anthropologies to flourish with wider circulation of information and knowledge.

43 Source: http://archive.org/details/GuerillaOpenAccessManifesto (accessed on 02/13/2013).

CHAPTER 3

Trajectories, Moralities, and Ethical Reasoning

In this chapter, I explore the moral idioms and ethical dilemmas in which computer hacking is articulated based on narratives of personal trajectory. Under the guise of moral demands for technical cultivation I discussed previously, I contend that little attention has been given in the literature on hacking to local idioms and forms of ethical reasoning[44] of computer technologists in respect to the conditions for cultivation of technical skills beyond Western Europe and the United States. Despite a growing body of empirical work around political aspects of computing (O'Neil 2009; Coleman 2012; Chan 2013), there are still important dimensions to be addressed with respect to the globalization and alter-globalization of computer hacking both beyond and in connection with the Euro-American axis.

This chapter is particularly focused on the ways in which those who self-identify and are identified by peers as computer hackers respond to one of the major

44 In relational terms, ethical reasoning is the practice of self-reflection regarding a set of relationships one is confronted with and through which one is, might, or ought to be implicated (Zigon 2009; 2011). It is a form of coping and dealing with contradiction and conflict experienced in everyday life as well as addressing existing relationships among concepts, subjects, and objects and their binding forces in face of deeds and responsibilities.

impositions of our contemporary moral experience with respect to the ongoing global process of individualization (Beck and Beck-Gernsheim 2002), "for each of us is taught", as the philosopher Alasdair Macintyre suggests, "to see himself or herself as an autonomous moral agent; but each of us also becomes entangled with modes of practice, aesthetic or bureaucratic, which involve us in manipulative relationships with each other" (Macintyre 1984:68).

In recounting personal trajectories of computer technologists alongside their technical projects, we place ourselves at a vantage point from which to describe how moral dispositions and highly valued forms of expertise are articulated on a local and personal level through global practices and widespread discourses on technical openness, autonomy, and collaboration. While the sociological framework for the study of individualization is useful for the analysis of self-cultivation, overemphasizing conformity in cultural practices can foreclose the study of emergent forms of political action which are exercised in hacker projects through the means of moral cultivation. In other to balance its benefits with the important of attending to the hacker embodiment, I will draw from the definition of the body as the locus of culture and primary nexus of temporal experience (Csordas 1990).

As described in the previous chapter, the understanding of hacking has fluctuated in its moral valence in the past four decades with historical narratives and structural transformations in the computer industry and computing infrastructure around notions of politically-motivated exploration of communication systems, computer-aided criminality, juvenile inconsequential curiosity, technical virtuosity, and active citizenship mediated through digital technologies. Drawing from life-history interviews I conducted among prestigious software and hardware hackers, I invite the reader to redirect his or her attention to an overlooked dimension of their allegorical practices: their distinctive grounding and positioning in shared technical landscape for cultivation of expertise. Articulating global discourses on technical openness and autonomy with local moral contexts and ethical forms of coming to terms with the meanings of one's deep involvement with hacking serves us analytically as a conduit for further understanding contemporary forms of participation in gift economies of software and hardware. Each trajectory brings to light the experiential grounding of the symbols of openness and autonomy for technologists in their local circumstances *vis-à-vis* the transnational domain of collaborative work in which they operate as influential participants. Identifying oneself and being identified as a hacker implicates and demands the cultivation of a personhood[45] defined by a particular set of practices, embodied skills, and sensibilities as much as by the intimacy with prosthetic extensions, such as computer machines, information networks, and alternative legal devices rendered in alternative, flexible copyright licenses. Examining how moral idioms, ethical reasoning, and sociotechnical ties constitute the hacker person beyond the Euro-American context has the benefit of providing an interpretative register from which to study the extension of global collaboration networks and advance an understanding of the contemporary ethical plateau of computing.

This chapter offers distinctive accounts of hacker selfhood by describing how

45 The question of self-cultivation is treated in this chapter in terms of the process of *personification*, that is, the formation of a particular personhood crafted out of a particular set of relationships and (moral) evaluations of existing ties binding persons and objects (Strathern 1995; Ingold 2001). This approach to the constitution of the person through personal and technical trajectories is intended to help us navigate the historical, the experiential, and the technical aspects of hacker experiences. Another key reference is the work of Maurice Leenhardt (1947) on the Melanesian personhood.

computer technologists engage in practices of self-cultivation and conceptualize their moral commitments. What are the moral sources for the perceived need for communion, which operates, at once, as a moral imperative of hacker collectives and a basic condition for technical self-training, organizing, at once and for one, political action and collaborative technological production? For the discussion that follows, ethical problematization will be used in the sense of a practice of intimate reflection and orientation in a world of conflicting and contradictory values. As Lambek (2010) suggests, the importance of the study of moral and ethical practices resides in providing social theory a way of accounting for complexity and unpredictability in social life.

For the conclusion, I discuss the ways in which the cultivation of hacker sensibilities depends as much on historical discourses of technical, political, and moral practices as it does on the experiential space-time of ethical reasoning which is elicited in accounts of personal trajectories. I also address specifically the pursuit of technical knowledge and community building in terms of its contractions: the demand for self-training and incorporation of skills (the demand for competitive excellence) and the injunction of autonomy for advancing Free and Open Source technology (the demand for inclusivity and openness of an imagined unbounded meritocratic order of virtuous technologists).

3.1. Personal Trajectories

Oliva

Oliva grew up in a family of doctors, his mother, a trained physician, immigrated with her family from Ukraine to Brazil, and his father, an anesthesiologist, came from a family of Portuguese descent from the country-side of São Paulo. Various other members of his family hold doctorates and positions as university professors and scientists. In the technical field, he was the first to obtain a masters degree and start a PhD in computer science, which, since 1996, he decided to put on hold to dedicate himself to Free Software activism and software engineering for a US-based multinational IT company.

Growing up Oliva was highly influenced by his maternal uncle and his father, who were both enthusiasts of *informática*[46] in Brazil. His earliest experiences with computing machines trace back to his elementary school years. His uncle, trained as an economist, bought him first a "Tele-jogo", a Brazilian clone of the game Pong sold as an electronics kit. Shortly after he purchased a TK-80, a Brazilian Z80-based personal computer and Oliva's gateway to world of personal computing. They spent countless hours playing games and studying programs as they typed code copied verbatim from domestic computer magazines' software listings. His first program was an implementation of the theory of supply and demand for the management of a hypothetical orange trade, an idea suggested by his father and meant to be played with his siblings. Oliva wrote this program on a Sharp programmable calculator his father acquired when he was 7 years old. By the mid-80's, he was already familiar with personal computer machines, such as the CP-500—a TRS-80 clone assembled by Prológica in Brazil—and got his first temporary jobs: to program a management system for an apartment complex and a patient database to automate the output of

46 "Informatics" is a general term for the field of computing in Brazil. It serves in the country as a common nomenclature for hobbyist, commercial, and academic work around digital technologies.

prescriptions for the surgical center where his father worked. His uncle and his father saw an opportunity to start a business in computing and partnered on a software company offering services for clients in the medical field. At the time, Oliva worked developing systems for hospitals with his first IBM-PC to help the family business. *It was with this machine that I learned to live without various operating systems I learned to use on the CP-500 and I started to program in other languages, from Clipper to Assembly. With the desire to learn how computers work, I started to learn about low-level* [programming] [...] *At the time, there was one program with a pattern of accents and another program with another pattern, so I wrote an application to switch between patterns using key-combinations. It was very fun. I learned C at that time also. It was a language I learned at the beach. My father came to the beach with this book about C* [C Primer]*... at the beach, we did not have much to do, so I started to look into it. That was the language I have been searching for my whole life!* The extent of his interest extrapolated the field of computing and started to be applied in other areas as well. For his school assignments in mathematics, Oliva created notations as short-hand expressions that would resemble C syntactically, because it made a lot of sense to him.

His father invested in a modem by the time the BBS scene started to take shape in Brazil of the late 1980's. Oliva had access to *Cirandão,* a BBS that was maintained by the national phone company, Embratel. *I spent an infinite time playing with it. It formed a community. In Curitiba, we used to meet to eat pizza every month. There was a BBS in São Paulo, "Sistema Sampa" in which I had a few friends and in Curitiba, we adopted the same system, then, the system was renamed to "Sampa Sul"* [...]. *We would exchange messages between BBSes and we would communicate "nationally" so to speak. This was* *before the creation of BBS with Internet connectivity. At this time, the frontier between the virtual and the real did not exist yet. The people we knew from the BBS were the same group we met every Saturday.* The creation and dissemination of the BBS represented the first experience of computer and electronic community networking. It served as a central location for accessing information and software, and to discuss various topics in a community of shared computer interests. *I remember during the BBS era I had my first contact with Freeware, not Free Software* [...] *I think it influenced me in, at least, two ways. One, that idea of software sharing. It was a way to promote software, right? It was a cool thing. I started to write programs like that. I wrote a few for the BBS* [...] *It was really good to see that people were using the software I made* [...] *The* [other story] *I wanted to tell: there was one user who gave me a copy of the program she used to access the BBS. I was in 7th grade. I got home and started to use it. So, I decided to write to the author to thank him, "this is a really nice program you wrote!". Then, trouble ensued... because he wrote the program to sell and make money. So, he wrote to my father and said "how can you let your son do this?" and also wrote to the lady who gave me a copy, etc., the confusion was created. But... "I was saying good things about your program!". I think this was my first contact with someone who felt thwarted. He only felt it, because he was not actually thwarted. I would absolutely not buy his program. This event affected me. What a crazy thing! What a – not only silly – but also mean attitude, blown out of proportion. Looking back, this was one of the experiences that affected me. If people are going to treat me this way, I do not want to have anything to do with it.*

In this period, Oliva was introduced to various computer systems. Some of his friends had Amigas, others had Apple II clones, and he had experience at home with a

TRS-80 clone and a Commodore-64 his father bought from a Brazilian importer. His childhood period was characterized by the market reserve for computers and electronics in Brazil, a marked transition from the military dictatorship regime to the democratic opening with the transformation of science and technology policies. Oliva accompanied the rise of the domestic industry of personal computers and commercial software in the country as an active participant. Companies put computer machines together basically by copying the technology from US and British firms (Marques 2005) or by licensing their technology, such as the case with the US-Japanese MSX system. *I heard my friend talking about things they did for Cobra Tecnologia. They were building one of the first Unix systems in Brazil*[47]*. It was Brazilian technology. I trust him that they were working hard and make it happen. Not only in software, but also in hardware. But the "assembling" companies, they were only assembling projects they imported. It generated, however, a software industry. I remember "Redator," an application for word processing which was entirely developed in Brazil.*

One of his dearest memories from this period is that of a programming contest he joined at the local university, Federal University of Paraná, for writing applications for MSX computers, which were very popular in Brazil during the period of market reserve. *I remember well. The "adults" there were probably undergraduates* [...] *I was 14 or 15... there were teams, teams of four, and an employee of our company called us to join, so I went.* [The judges] *asked us to write programs that were really stupid, such as asking for two numbers and calculating the greatest common divisor of the two. Duh! I knew the*

47 Marcia de Oliveira Cardoso (2013) wrote the history of SOX, a Unix-compatible operating system designed and written from scratch in Brazil in the 1980's.

algorithm! I was studying that in school. We won, and it was [a sensation] *"Oh! A boy beat our* [university] *students!" It was clear that my team was helping, but I was at the keyboard. At this point, I already knew I was made for this... that my destiny was to scrub bits* [escovar bits]. *The calling was too natural for me, it was too easy. That was my territory* [...] *It is really good when we discover what we really want, when things make sense to us.*

Oliva enjoyed his school years and was always cast among those with the higher grades in his class. He was not particularly dedicated, he invested little time studying, but still managed to get the best grades. Especially in the natural sciences and mathematics, Oliva did not need to apply himself because he felt that somehow the subjects made sense to him. *There was no barrier, I did not have to dedicate myself.* He did not enjoy his studies in humanities, they were far less intuitively meaningful to him. *My impression was that I only had to memorize a bunch of things. Only later did I come to realize that, given enough accumulation of factual information, things would start making sense.* Some disciplines were less intuitively easy to him, so he had to study. *I came into terms with these disciplines later in life* [...] *Clearly, I had a bias toward the hard sciences. Today I see I have much bigger concerns which have to do with the humanities and ecology, which were totally off of my radar before.*

His school, a private institution founded in the early 1970's in the Southern capital of Curitiba, is known for its intense curriculum based on course readers, tailored compendiums to prepare students for the university entrance exams. In comparison to other private schools of religious vocation, "Positivo" was defined by its lay education, catering to the upper middle class and the rich in one of the biggest urban centers in the South of Brazil. *Looking back, I can see that my family had a very privileged situation, but I remember looking around at school and feeling poor.*

His parents were both non-practicing Catholics who never baptized Oliva nor his brothers. *They made the decision of letting us decide our religion, which was very nice of them. It took me a while to find interest in religion, but when I did I started to research all sorts of topics, but only during college. I had the luck of sharing a dorm with a friend who was exposed to various religions and studied a lot, so I read some of his books. I can say today with confidence that I do not follow any religion. I am a spiritual person, I have a strong spiritual side, but I haven't found a religion that I identify myself with* [...] Oliva strongly relates, however, to people who share the belief in Spiritism ["Espiritismo"], a doctrine that was imported to Brazil from France with a syncretic orientation combining Christianism, Positivism, and a naturalistic stance on reincarnation. Being a sympathizer but not a practicing Spiritist furnished him with an understanding of Spiritism, but also of other religions as well. *I remember in school, I was 16-17, a friend lend me books on Christianity. Later on, I came to discover he was a member of the Opus Dei. Yes, let's just say I did not like his approach. I did not run any risk of being co-opted. It did not attract me in any way. I was suspicious from the beginning. Despite his approach being something I disliked, I really liked the teachings I have found in Christianity. The idea of respect for the other, the moral foundation of Christianity, I would say, is universal.*

Politics has been a taboo topic in Oliva's family circle. His life before college was, in his own parlance, very apoliticized. *I was not interested in history and I was the offspring of the dictatorship so to speak. I started my studies during the regime, there was that context of patriotism, there were courses at school, such as "morality and civic* *orientation"* [...] *I think there was a* [generalized] *apathetic attitude, and I was subjected to it as well; it was not conscious* [...] One of his major and earliest political influences came from a high-school history teacher. *My teacher was a leftist and he managed to instill the interest in history and lots of ideas that still resonate with me. In the year that I studied with him, I can say that, at some point, a seed was dropped on the ground and germinated afterward. Today I am a revolutionary. I have a revolutionary spirit. I was already a person who wanted to fix something that was wrong, a person with determination to fight, but it was on a micro scale. It was personal. Looking around beyond my little world, I learned about things that were wrong. The same impetus to fix, to fight for justice, flourished.* His parents would not touch the issue of politics for various unspoken reasons. From the outset, there was the dictatorship regime and its rule conflating conformism, veiled State violence, and nationalism; from the inside, his mother's family were Ukrainian refugees, so politics in general was much of a taboo. His mother's side of the family left Europe for being persecuted, so the topics of history and politics were deemed inappropriate in his household.

When asked to address the question of "hacker ethics" to an audience of thousands of Free Software activists at the International Free Software Forum in 2011, Oliva offered an account of one of his earliest memories of hacking as a practice of *doing good to others*. The memorable event he recounted involved helping a girl who had a motor disability due to complications during birth. The girl's grandfather was a patient of Oliva's father. The girl could move, but had a disabling difficulty with fine motor skills, so she could not use a typing machine or a computer keyboard, nor attend regular school and use pens and pencils. Her grandfather at the time was trying to invent something to help her to communicate. [Her grandfather] *was a hacker, he made the elevator of their house to bring the girl from one floor to another, he made all sorts of things to help her and also made a numeric keyboard that would go around her body with enormous padded buttons. Cool, she can write numbers! But… how do we transform that in communication? Well, I had at the time just learned ASCII. If I want to write an A, I just write, let's say, the number 65 in a memory position. I wrote a little program to let her write the numbers and convert to letters. She memorized the ASCII table with the blink of an eye. It was impressive in so many ways to me… she did not know how to write or the read, she did not learn the alphabet, I am not sure. I think she was 8 or 9 years old like myself* […] *it was very impressive to see how she started to write words right after we taught her to use the conversion program. It was very touching for me: my computer abilities can help other people! I cannot say I think about it all the time, this is something that gets effaced in one's memory, but it was a moment that touched me deeply, not consciously, but as some sort of substratum. Everything has been influenced by this* [experience] *ever since*. Several years after this memorable event, Oliva, by then a university student, received a package in the mail with a book, whose author's name was Adriana. He, then, asked himself "who is Adriana?" Later on he received a phone call from his father who asked: "did you received the books from that girl you helped long time ago?" *Oh, gosh! Then, you suddenly feel the skies falling over your head and you think, my god, she wrote books! And now I can show it to my daughter and tell her this story. This is really neat.*

Oliva had role models but not active mentors growing up. His uncle and his father would give him all the available materials and provide him with conditions to study, but he perceives himself as being the one who veered toward the study of computing topics. He recalls his father complaining about role inversion as Oliva would give his father instructions when he sat at the computer, whereas his father felt he was the one who was supposed to give instructions instead. *It was natural to me* [...] *I was a sponge for knowledge. People joke that "sponge" has another meaning, that of a drunken person. But in a certain sense, it was inebriating. I wanted to know, I needed to know, and at various moments I found myself with the problem of lack of documentation and information. At this time, it was not a big problem, because things were more transparent. There were no layers with protected modes, etc.* [...] *I would look at the code, see the operation, and then write mine. There was not much of a secret, which is not to say that there were not people who wanted to create secrets; there were, but... I like the image of the movie Matrix when Neo perceives in the world of agents trying to shoot him the green characters falling; the moment in which he perceives how that world worked. These things were like that for me at that time. How does this work? OK, so you look at it, you see the green characters falling. OK! It was easy, software was small, computers were small, the things we could do were limited, comparing with today, it was another universe.*

College was a period of personal transformation, it helped him to transition. Not much of a transformation in terms of his activities and technical interests, since those were part of a constant throughout his life. It was, instead, a journey of revelation and discovery. He felt lost at first for having the ability to make choices for himself for the very first time in life. *There were a few things that happened at UNICAMP that actually changed my life. Maybe what has changed my life the most was not the technical, this was already present and super well developed in the sense that it was excessively developed.* His experiences as an undergraduate student and his fame at the department of Computer Science at UNICAMP were no less than stellar. As early as his second semester, he was already appointed as an assistant to the network manager of the department. *I had two initial tasks after studying the manuals to avoid doing stupid things, one of them was to install software* [...]. *The other task was to create a back-up system. These two tasks took me to the world of Free Software. For the task of writing a back-up system, I coded a set of scripts to write the backups on tape, divide them in volumes, and then reconstitute them. I publish it on UNICAMP's FTP. It was not with the intent of making it into Free Software. I did not have this notion yet, but I saw that in the Unix environment there were an uncountable number of available software. This was before the Internet as we use it today with the Web. We only had access to it at UNICAMP via email. There was an email to which we forwarded requests for software, which would then be sent to us in small pieces. I used this service a lot to download GNU software* [...] Via direct engagement with a software sharing community, Oliva came to naturalize the practice of publishing, downloading, and testing software with an active international group of developers. *I was amazed by the fact that there were lots of amazing programs on the Internet. How cool it was to have a bunch of people who write software and make it available to everyone! It was obvious to me that for the backup software I wrote, I should do the same. Everyone does it this way, I should do it to! There is no question about it* [...] *it was the habit, it was the culture. It was a continuation of a culture that I experienced with my friends from the Apple users' group, the computer clubs, the BBS culture in which we shared software that was legal to be shared. It was not a choice, "I will publish source code", no, it was only possible to publish source code. So, I published it. It was the first Free*

Software I wrote. I do not remember putting a license statement, I did not know about it at the time.

His contact with the wealth of resources in the context of software sharing around Unix systems led him to gradually become acquainted with practices and discourses of an early moral economy which operated under the rubric of hacking. *For the installation of GNU and other Unix software from the Internet, in the transition from SunOS to Solaris 2, lots of GNU software were not yet ported, so they would output an error during our attempt to compile. What does a hacker do? He fixes it! But… do I keep the solution to myself? No, there are other people having trouble with this, so I would publish it. It was not an obligation: "I must send it back." No, it was just ridiculous to entertain the idea of not publishing the solution back to the software maintainer* […] *In the next version of the software, there would be a "thank you" note for me. How cool! Billion patches that person receives, but there was a "thank you" note for me.*

Since his admission for the computer engineering course, Oliva became a constant presence at the Computer Science department at UNICAMP. He would spend his days and nights there and by his second or third year, he had his own office. Because of his work for the local network, he was sent by his professors to study and set-up a Newsgroup server for the department which became the very first Usenet server in Brazil. The experience of maintaining and participating actively on the Usenet led him to become closer to software developers from other research institutions worldwide. Oliva avidly read the newsgroups and engaged in discussions to learn about and help tackle software issues. His early involvement with GNU C compiler community and his Free Software hacking skills started to be cultivated in this period. *I* *ran into a lot of problems with GCC because I was using it all the time. Compile this, compile that. I found an error, how can I fix it? Oh, I can do this! Or, for the new version, this problem was solved. Out of sudden, I was participating in the mailing-list for bug-reports. For the people who sent bug reports to the list, I had solutions. For some of the people. Then, the maintainer of the C++ compiler invited me to join the internal group of GCC developers. It was a closed list, a little bit cathedral as Eric Raymond puts it. We release a new version whenever it was ready and the development took place among a group of invited developers. It was something that is hard to conceive today, but looking back, it was weird. It was not something that worked well this way, no… from the beginning I was blown away. Wow, I am in the same list with all of this luminaries from Cygnus, people from the GNU project! Wow, how honored I am! The maintainer of the C++ would regularly pass me the list of bugs to fix. I was a student; I had all the time in the world and I would go through the list and try to fix the bugs* [...] *I think this is the way: you give what you have done to others and you facilitate the lives of those who help you. It is basic. This is what I did sending patches to the GNU project.* Oliva joined a team of extremely skilled developers, broke into their secret society as an apprentice magician, learned the tricks of the trade, and eventually came to be recognized as one of the group. He already had strong programming skills, but his obsession with programming opened the doors to a very select group. Due to his engagement as a volunteer and enthusiast of Free Software, he was later invited to join a company that was composed by the same Free Software group of software engineers he interacted on a regular basis online.

In 1996, Oliva had already graduated and advanced to a post-graduate research on Aspect-Oriented Programming (AOP) when a revelatory moment took place. Richard Stallman came to give a workshop in his home town. *I am not sure if I was aware of who he was* [...] *Stallman was invited to the university for being a luminary for the members of the school of informatics. The UNICAMP faculty member who introduced him stated: "he is my hero and the person who said this was not me, but Donald Knuth."* The purpose of Stallman's visit was to give a technical course on the GNU Compiler Collection (GCC), but he also took advantage of the opportunity and the attention of a group of computer experts to talk about ethical aspects of computing. Oliva recollects finding Stallman very charismatic and persuasive. At least, for a person such as Oliva and with his technical background. *This is when my life changed. I was already known at UNICAMP as the "GCC guy." I attended the course. I learned a lot, but it was a familiar territory to me* [...] *The course was not what was important. What really moved me was his talk after the course* [...] *It is really hard for me to identify what caught my attention* [...] *His form of presenting the reasons why software has to be free, why this idea of preventing others from benefiting from it, which is the control of life itself today given that increasingly computers are controlling our lives. No economic argument justifies the act of doing this to a person. This is what I carried away with me. I do not want to hear what excuses people have to rip me off. I do not want to be ripped off. You know, he does not put things in these terms* [...] *I remember thinking with myself after his talk: this is it, this is it! How come we were cheated for so long? At the same time, he felt obligated to deal with the issue. He was at the right place; he was an operating system developer. In a way, he saw a person drowning and he knew how to swim. There was no one else around and the person wasn't Bush* [laughs], *so "I am the one who has to save this person who is* *drowning, it is me who has to help and start this project." I am glad he started it! It was fantastic. How good it is that he affected me in this way!* [sigh] *To share, to help others is basic for human beings.*

The moral dilemma Stallman offered to computer experts in this particular encounter resonated deeply with Oliva and has not abandoned him ever since. By evoking the Golden rule in one of his earliest documents, the GNU Manifesto, Stallman launched the campaign for Free Software, finding sympathizers in various corners of the world his software reached. It was not this document what captured Oliva's full attention however. He read it and felt it was a description of what they usually do among programmers, the pleasure they share in the practical engagement with computing and its challenges. Everyday, natural work one does without questioning. The encounter with Stallman gave him, nevertheless, the opportunity to reorient and rearticulate his practices in terms of a moral commitment of broader scope. *There is a component of respect to the other, it is not only to the ones that are similar to us, but to the other* [...] *This is what Stallman does, he spent a lot of time thinking about this. What he talks about has so much intrinsic meaning that he is not afraid of being criticized or being marginalized* [...] *he is the person who pays the price, whatever the price is. It is impressive. And he won me over, I was captivated by him. After his talk, I thought, this is the world I want to offer to the kids I will have some day. At the time, I didn't have a kid. This is the idea of cooperation and respect that I want to foster. How lucky! I was already working with Free Software, not professionally, but I was collaborating with it. I got really happy. I found the other line of work, which is not only writing software. There is something much more important. There is a social malaise that is much graver and which* *is much more important to cure than the pleasure of writing code.* This moral dilemma was underpinned by a perceived struggle involving political and economic forces in the context of the IT industry. This moral horizon served to carve a position to be occupied by the software developer as a political agent. *It is a war. It is a war against sharing. It is a war against autonomy of people to control their own digital lives. It is a war for the possibility of hacking. I talked about the time when computers were transparent* [...] *there was not a barrier preventing me from seeing things and changing things to make them work the way I wanted. There was nothing like that. Today all the systems are constructed with a bunch of barriers, not only those which make sense for a system to be more robust* [...] *but for computers that are built to disobey their users and to follow the rules of their "real" owner, those under control. There are two options as Stallman says: either you control the computer or the computer controls you. But... it is not the computer, it is the software; but it is not the software, it is the person who wrote the software. Even more so in a society that is hyper-connected.* [Software freedom] *is absolutely essential.*

After seeing a call for mathematics teachers, he contacted the local students group at UNICAMP and offered himself to teach a course for low-income students who were preparing for the highly competitive public university entrance exams. *Mathematics is something that I breathe.* [Second nature?] *No, first actually. My second nature is my physical existence. It was really nice, I have never taught before. At first, it was hard, I did not know how to do it. There were people who depended on me to pass the entrance exam, so I forced myself to improve. I remember in school to had trouble for being shy. At the university, I do not remember being shy. I was very popular. I was extroverted. I was very playful. There was a rupture with the past. Because there were no common* *people between my past and my present, I could change, I did not have the inertia of the way I behave in front of people. Finally, I could be myself or, to the contrary, maybe I became something I could not before. I am not sure* [...] *I felt I was doing good. This social aspect of the project was really good.* Oliva taught the course for three years before quitting to concentrate on his Ph.D., which he felt stuck with and in need of moving on by solving very difficult technical problems.

Oliva's commitment to Free Software, on par with the time and energy dedicated by other hackers, was very intense as most of his waking life was dedicated to software development. *It was clearly an obsessive behavior in respect to Free Software projects* [...] *I am known for having extremely long work shifts.* From his participation in Free Software, he was offered various jobs to work for local and international Free Software companies. He ended up choosing to work with an international company because of its development team members, who were the co-volunteers he collaborated online throughout his college and post-graduate years developing the GCC compiler and various other software tools. *I remember vaguely reaching a point in which it was clear to me that I could choose the way I wanted to go. I had one offer here and two offers there. I followed my heart. It was really sad, I wrote crying to others saying, it would not happen, but Cygnus was a dream of many years. I could not abandon this dream. I started working remotely as I work until today. I came in with lots of projects and they said "no, wait, I want you to work on this project instead". Uh, OK!* [...] *All the projects I have participated involved a lot of learning. I had no idea of how to do certain things, but I learned. Oh, how cool! I grew a lot technically and professionally in this period.*

From his first early experiences of attending Free Software conferences to the present, Oliva's position shifted gradually from a liberal economics-oriented ideological positioning to a clearer articulation of the moral aspects of computer technology. *In this period, it was not clear to me that Free Software and Open Source were different things. I have read a lot of things by Eric Raymond, Cathedral and Bazaar, Halloween files, etc.* [...] *I was heavily influenced by him. In my first presentations at FISL, I wanted to talk about moral aspects and what really matters, but the arguments I used were a little bit similar to the Open Source* [narrative], *"it is better for the software, it is better for the user, it is better for the developer." My first three presentations were about the technology. I presented arguments that were not moral. I can see now from my first presentation to the present when the moral question became a seed for what has become the kernel of my talks* [...] *It is my hope that, with this kind of resource, the message is transmitted. I get to bring people to our side.* Oliva's public presentations usually offer *double entendres* with the usage of allegories to express the duality of the purported views of the negative and positive aspects of digital technologies. An example of one of his expressions, which does not quite have the intended effect in English, *If software is not free, it does not serve me.* That is, if technology does not respond, respect, and attend to its user, it is not suitable for usage. *I started to look into technological questions and, all of a sudden, I noticed the depth of the rabbit's hole was much deeper than I ever imagined. Perceiving the same phenomenon of monopolistic, powerful industries which are not concerned with the planet, society, people and consumers... and then what? How can we fix it? It is not only with Free Software that we are going to fix it. What do we need? Not only to train hackers, hackers in the sense of people who have the interest and the capacity to control technology. Hacker is the person who tries to understand how things work to make them work better and this* *is not only about technology, it is also about politics, economy, and all the areas of knowledge.*

There were problems he identified that he could fix as a Free Software developer, but to do so he would need to attend to questions which extrapolate the immediate world of software development with its own issues and urgencies. After finishing college and securing a job in a foreign Open Source company doing similar work he did as a volunteer, but with a more concentrated focus on attending to client's problems and needs, several of his interests converged in his meditative practices around his Free Software activism. *I remember that as a child I identified myself a lot with Spock from Star Trek and I thought he was awesome. More recently, when I watch the same TV show I think it is funny that they make a lot of fun of him and play with his inhumanity that I could not perceive back then. Today I identify myself with the others in regards to the inhumanity of Spock. Inhumanity is not a good word, however. It is not that he is inhumane, the fact is that he does not possess some human characteristics. So, I have a little bit in my life's building this pillar of logic and rationality that was all constructed before I was exposed to religion in fact. And there is this other side that is spiritual and human which came after and changed my ways, reoriented me, took me out of the purely technical dimension that I was and brought me a concern of a bigger scope, which, in my opinion, is bigger in terms of respect of people, respect of life, respect of liberty, which is, in the case of technology, what moves me.*

In spite of his deep interest in questions of morality as "care for others" which he initially found in his studies of religion and learned through his experiences with Free Software, Oliva never got interested in students' movement politics, which were a constant presence at the university, nor he joined political parties or other social movements, which were effervescent in the period of democratic transition of the late 1980's. He oscillated—since he started voting by the age of 16—in his support and enthusiasm with political platforms of both the liberal, right-wing and the left-leaning political parties. His understanding of his political work through Free Software was advanced further as he engaged with a group of activists to create the Free Software Foundation Latin America in 2005. *I started to study the question of Free Software and I started to look into social issues that are related to the technological question, then my scope was broadened. Is the question of software freedom essential? Yes, because our societies are technological* [...] *Today we cannot leave the bed without looking up our email on our cellphones. I think we are passing from the Homo Sapiens to the Homo Silicon* [...] *Karen Sandler* [former executive director of GNOME Foundation] *has a heart implant. She wants to see the source code of it. "I want to know when and how it will fail" she says. "No, you can't". What you mean I can't? "Because it is our industrial secret." I do not want to know if it is an industrial secret. I do not want to know what your profit margin is. This is my life, god damn it!*

One of the local campaigns carried out in the name of Free Software Latin America has been the development of a Free Software alternative for the application distributed by the Federal government for the purposes of filing income taxes. Being an application that is distributed without source code, there are no guarantees of what the software does or what it can do, so Oliva started a campaign in 2007 against the "imposed software," playing with the ambiguity of the word "imposto" in Portuguese which means, at once, "to impose" and "government taxation." *Everyone is obliged to use* *a software nobody knows what it does. We do not even know what kind of information they are sending to the other side* [...] *This campaign is one of my focus areas. Every year I have to make a new version of the software, because I am not going to use the private software they want me to use* [...] *I have the attraction to these kind of projects that are not very popular, such as IPRF-Livre* [...] *I could have betrayed my principles and... pretend the problem did not exist, but... I can't.* Along similar lines, he also has been collaborating on Linux-Libre, a project dedicated to remove non-Free extensions of the Linux kernel. *If the whole purpose of the GNU project is to allow computer users to use a computer with freedom, it is not with a little less imprisonment. No, it is with freedom, it is not with conditional freedom, it is not with a conditional sentence of a very short freedom. No, it is freedom* [...] *"You are too radical" some would say. Well, maybe I am, maybe I am just a person who sees things and wants to offer an alternative. I am not imposing this to anyone. I am trying to offer a possibility.* Oliva continues to work currently as a Free Software developer and activist serving as a spokesman for Free Software in Latin America. *Changing the world is not easy, you know? I am coming to this realization* [ironic tone]. *I am still not completely sure, however.*

Gniibe

Niibe is considered among Free and Open Source developers in Japan a strong willed, veteran developer known for his grounded and fierce opinions on matters of "software freedom." Home and abroad, he goes by the handle of "Gniibe", a nickname he adopted in which G stands for "GNU" in a direct identification of his *persona* with that of other vocal Free Software activists, such as Oliva. Despite sharing a common identity, he does not perceive nor understand political action in the terms of his Euro-American or Latin American peers. Whenever asked to elaborate on the issue of freedom [自由, *jiyuu*], he prefaces his exposition with the explanation that his position is unusual in comparison to common held arguments in the Free Software community. One of the most illustrative cases comes from his engineering and programming practice, that is, his Free Software and Open hardware development work which he does not equate with exercises of personal freedom, but active and conscious efforts of preventing himself from causing harm to others by the means of his technical capabilities.

In Gniibe's family, his grandfather was the only engineer, known for building weaving machines for the domestic silk industry. Gniibe's father is now retired from the Japan Air Self-Defense Force and his mother held different clerical jobs, including that of salesperson for a cosmetics company. He grew up in a middle-class family without economic hardship. As far back he his memories go, his upbringing was marked by parental avoidance of any form of conflict among kin. *In my childhood, it was somehow prohibited to talk or discuss or talk about topics on the news, specially political ones. My father and my mother never disclosed information of whom they voted for in the elections.* When inquired about his current position in respect to this avoidance among his immediate family circle, he agreed, he would not disclose his political preferences to his children in order to keep a peaceful household. The only preferences he would happily disclose would be those related to his hobbies, such as baseball, sumo, judo, or his favorite chain restaurant. *I support the "Yakult Swallows" baseball team. I am a fan and I do not like the Yomiuri Giants. Yomiuri is questionable. They use their power of mass* *media to control to public.*

His informal technical training started at a very young age. His mother gave him a soldering iron when he was 11 years old. Around the same time period, he managed to convince his parents to buy an educational course on electronics for hobbyists via mail order. *Perhaps it was my elder brother who started the course, but he got bored with it, and I continued. My memory is clear about the personal computer, though. It was my brother who insisted upon it. He said it was very important for my parents to buy the personal computer because it was a device of the future. My mother* [eventually] *bought one, it was very expensive at that time. There was no use for it other than hobby.* Niibe was 14 when he first used the digital computer machine, taking over from his brother who gave it up easily. *It was just difficult for normal people. We called it passokom* [personal computer] *and it came with a BASIC language interpreter.* Popular computer magazines printed code lists which Gniibe read and typed all up in order to play games. Around the same time, he learned about the Rubik Cube in the popular computer magazines, such as IO, RAM, and ASCII. *There was a special issue for the Rubik cube. At the time, I visited the local university for a festival. The HAM club had a computer there, as well as a Rubik Cube and a solving memo. This is why I visited the club.* It was this occasion that enticed his brother to acquire a personal computer. Niibe does not remember losing sleep due to an obsession with a particular computing issue, but he still carry vivid recollections of having trouble falling asleep because of the Rubik Cube.

Gniibe attended a public school in Maebashi and, later, informed his parents of his decision of attending Gunma Technical College for high school. The decision of majoring in Electronic Engineering came naturally as he already self-identified himself as a "HAM radio guy" by the time of his transference to the technical college. *Years ago we had a regulation in Japan prohibiting commercialization of radio* [...] *By building radio ourselves, we did not need to pay government tax. So, radio kits became very popular in Akihabara. We had radio kits and HAM radio. You know, for HAM radio you need a license. For just the radio, you do not need the license.* [...] *Late 70's, late electronics age, we had many interesting projects with transistors and integrated circuits. We could build many things with them. I had a such a hobby. I was thirteen years old.* Another important reason for his decision to enter the engineering department was to be away from his brother. *Our age difference is only one year and a half. I do not have memories of us playing together, but I do have many memories of us fighting each other.*

He was an applied student otherwise known for having the habit of questioning his masters. One instance was particularly memorable: his teacher's refusal to give him a technical explanation, telling him that what was important was not the mechanism but the fact that someone had invented the transistor, an explanation the 11-year old Gniibe felt to be far from satisfactory. *I remember that I questioned about the mechanism. How do transistors amplify sound? That was my question. But I was disappointed. I remember the answer. Basically, the teacher avoided teaching the 11 year old. He said it was not so important how they amplify sound. It was more important that we invented the transistor, so we can amplify sound. It was a human being who invented it!*

By the time Gniibe turned 12, he was appointed to be the chairman of the student board. He attributes this fact to his vast milk cap collection. His experiences collecting and trading milk caps are now used to shed light onto his adult life experiences with transnational Free Software communities. Through his engagement, he perceived a divide between the parallel worlds of experience in the context of Internet and in areas he describes as "real life." *When I was eleven or twelve, there was a boom of milk cap collection in this area* [of Maebashi]. *I was the king* [laughs] *I was the king! Because I invented many ways to collect milk caps. At that time, I had at least 10.000 milk caps pieces* [...] *I visited milk production plants. The power of a school student is very limited, but I went to many places around here. I had relatives who got jobs in different prefectures. So, I asked them to send me milk caps* [...] *Usually, you have the address milk vendors through their contact information on the top of the cap. So, I wrote milk vendors for other kinds of caps* [...] *I was a kind of millionaire of milk caps!* [laughs] *You know that usually kids in elementary school only get a cap a day. I got hundreds a day. But this is just half of the story. As I mentioned before, I had an allergy* [...] *My doctor used to be a milk collector 20 years ago or so. I learned that the boom was a kind of cycle. So, I got a huge collection of ancient milk cap from him! You know, ancient milk caps from Fukushima were more valuable. I controlled the market. It* [was] *a parallel economy. My principle was that milk cap is very important, we do not exchange it for other value: milk cap is only for milk cap. I could have been more rogue to exchange my milk cap power for other kinds of values, but did not do that. Because I loved milk cap very much. At that time I wanted to keep the coherence of this parallel economy as such.*

In relation to his precocious experiences as a trader what fascinated him the most in regards to computing was a deep sense of power. *The major reason is that I can do anything in cyberspace; I have absolute power in cyberspace, but my friends have absolute power too. You can create your own world, even though it is a very limited world in comparison to the real world. When I say "do that", the computer just follows that. It is* *very difficult to tell it how to do "that", even if we have power, it is very difficult to use this power. The computer does what we write not what we intend. It is very difficult to serialize or describe our intention in machine code. It has been fantastic to translate* [intentions]. *It has been challenging, but I still enjoy it.* The nexus between control and pleasure was the outcome not the point of departure of a long process of self-training with strong determination. *We need to control ourselves, before trying to control something.* Self-training involved a discipline of self-control as a condition for becoming a moral person. *When I use a computer, I feel its power. When I write code, I feel its power, too. Perhaps, that is because I am not a native computer user—I learned!—and a native programmer—I learned how to write code consciously with determination! For me, the computer is "another existence", it is not my friend.*

As a university student, Gniibe learned about low-level computing by assembling a machine from scratch based on a Motorola 68000 kit he acquired in Akihabara. He also worked on the GNU Emacs editor and collaborated on the internationalization for Japanese language input methods with other Japanese developers. Computers were incredibly expansive for domestic usage at the time, so people shared software and computing power in time-sharing and multi-user operating systems. *Back then we did not have free operating systems. Software was distributed in source form, because Unix was not that magical: for each installation we had to adjust the code. Every student did that.* In 1990, Gniibe found a bug in GNU Emacs and posted a report to gnu.emacs.bugs newsgroup. To his surprise, a Japanese developer responded to the bug report and the response was positive, but not very exciting: in the upcoming version of Emacs, the bug will be fixed. One year after this first contribution to a Free

Software project, Gniibe became the network administration and Usenet postmaster for the Mitsubishi Research Institute (MRI). *In January 1994, MRI connected to the Internet through the first Internet service provider. At that time, all machines were GNU/Linux* [...] *For me, comp.os.linux was so important. We had a "Users' guide of JUNET* (Japan University/Unix Network)*" which explained the culture of cyberspace and its "Acceptable Usage Guide"* (AUG) *but many new users didn't care and caused trouble. I got complaints from the SRA postmaster, and I thought he was right. We had trouble with international e-mail exchange, etc. Although I was the postmaster, that is, the person in charge of the MRI network by the definition of JUNET, I did not have power to educate MRI users to follow the rules of JUNET. I was just a research associate. Many people just asked me for "service" and "technology" while they didn't care about culture and rules. Perhaps, this would be the reason why I became a fighter to protect cyberspace culture.*

JUNET proved to be an important platform for participation in the Usenet, an early community-driven virtual space, self-organized around contrarian sentiments in respect to bureaucratic and top-down hierarchies of information management. Pfaffenberger (1996) described the Internet service original goal was to disseminate information on how to use Unix, later becoming a space populated by users who saw it as a new frontier for freedom of expression and discussion of taboo topics. JUNET was the Japanese gateway for the early transnational fora of technical discussion and development of which Gniibe would participate actively. *In the 90's with UUCP* (Unix-to-Unix Copy protocol) *network we had an exciting world* [...] *JUNET required consciousness to be a network member. These days no carrier of mobile phone requires this sort of thing. Users are just consumers from their point of view. When joining the computer network of*

JUNET, we had a guidebook for computer network, newcomers had to read the manual or else the members would say: Read The Fucking Manual (RTFM)! We had to follow certain rules [...] *Most people had to care about the network itself, people had to care about cooperation. People had to understand how engineers were working behind the network. These days no consumer cares about the engineer behind the net. People think it is a consumer right to demand. So, the practices and the standards are totally different.*

From 1993 until 1999, Gniibe worked as a Linux Kernel developer, maintaining drivers and porting the operating system kernel to work with a low-cost Japanese chip, the SuperH processor for embedded applications manufactured by Hitachi. By mid 2000's Gniibe became disillusioned with the Linux development community because of its positioning in respect to more general questions the Free Software Foundation posed regarding to the relations between computing and society. He decided to quit Linux development because, in his words, *the project was not not based on philosophy; it is technology-centric.* Another reason for quitting was the decision of the project leader of adopting a proprietary software, BitKeeper, as a source code management solution for the development of Linux[48]. *When I joined a club of Kendo in junior high school, my expectation was a kind of philosophy, more than technique.* [...] *When I joined the Internet, we were taught about its philosophy. For me, it is the same for Free Software and the GNU Project. I realized that I was totally wrong about Linux. I found that I expected something similar* [as philosophical] *when I joined Linux. Linus'* [Linux project leader] *interpretation of GPLv2 is peculiar to me. He only focuses on his buddy developers, and...*

48 See Kelty (2008) for a description of the internal debate of the Linux development community regarding the proprietary source code management software, Bitkeeper.

in my opinion, ignores the power of software developers over their users [...] *I think that important technology comes with important philosophy.*

When Gniibe speaks of his experiences with different Free Software communities he does so in terms of a parallel with his experience as a milk cap collector and trader. *A similar thing happens around the Linux kernel. It is kind of a parallel world. At least at the beginning of the Linux phenomenon, no one thought about the real business of kernel development. At least, not Linus, who started the Linux project as a hobby when he was a student. We exchanged our code and we believed it was quite valuable, but for me, it was sort of a milk cap exchange. If I was Linus, I would have as a principle not to exchange the value of the kernel in real business. But Linus had a different idea. For me, milk cap exchange and source code exchange look similar. You know, it is only boys who exchange milk caps and source code.* In other words, a gendered experience which involves engaging in argumentative quarrel on the register of masculine performances of technical prowess and public display of technical knowledge through exchange of software contributions.

The question of computer security—which occupied a significant portion of Gniibe's career—involved, in his words, *caring for human beings not only caring for computers. What are the most common errors programers make? For those things we have to analyze human beings. This area is a bit difficult to me.* In 1999, Gniibe became chief of computer security of the Japan Computer Emergency Response Team Coordination Center (JPCERT/CC). From his vantage at the high caste of international Free Software developers and enthusiasts contributing to the GNU project and the Linux kernel, Gniibe had the opportunity to contemplate various forms of hacking. The practice itself from his point of view could be defined by the criteria of inventive usage of available technical means, not trivial, reproduced and mimicked technical practice. *I spent less than a year at JPCERT/CC team and based on that experience, I could not find any hacker among crackers. They just mimic! Basically, they are script-kiddies, we should never use the word "hacker" to describe people who just mimic. Hacker is the one who does creative things* [...] *People who just mimic are not hackers, it is not creative. It is important to just follow and copy at the beginning. It is important activity to mimic the things which were already done in order to learn.* The evaluation of an activity to receive the qualifier of "hacking" should not be done in terms of influence or effect, as it is common to identify the power of a single person, usually a young person, in bringing down the service or the network down, rendering momentarily powerless a huge corporation or a governmental body. The contemporary enactment of the mythical battle between the young hacker David and the powerful corporate Goliath does not met the criterion of a hacker practice as *poeisis* is not necessarily there to be found.

Even though he identifies himself with Zen Buddhism and Shinto, he does not readily recognize a significant influence of his religious ideas in his day-to-day technical practices. *I think I am a typical Japanese. I go to the shrine and I go to the temple and I do not distinguish the two too much. I do not identify or distinguish my practice or ideas if they come from Buddhism or Shinto* [...] *I carry other values, but it is not because of Buddhism.* Elements of his moral guidance, as he elaborates on them, consciously come from his Buddhist spiritual discipline found in the Soto school. When it comes to his work as an engineer, Gniibe applies the approach of not using his technical powers. He does not impose or try to influence people's decisions in adopting

Free Software technologies. *For me, expecting or asking others to have same internal condition of mind as myself is a sort of violation of human dignity. On the other hand, keeping same internal condition of myself is a matter of coherency and integrity.* His work for Free Software involves what he calls an "indirect way" of engaging in a social movement: it is by building technologies which do not trap users that people get invited to participate. It contradicts a notion of relationship in which programmers and users are as vendors and consumers are to each other. *Our power is programming so we do our best with our tools. Our purpose is the social movement. We do not force users to use the GNU operating system. So, it is not that I think it is an exercise of our power, we do not enforce, it is up to user to select the GNU operating system or not. It is OK for user to just use and not join the movement* [...] *We do not exercise our power over users* [...] *at least, not me.* This commitment to the "no usage of power" has other ramifications in Gniibe's life. It extends to his immediate family circle and the way he deals with the education with his children as well as with their forms of entertainment. In the occasion of a visit to his house and dinner with his family, I noticed how much he disliked Disney themed toys and cartoons as entertainment for his children. He affirmed he would not prohibit them, but would not encourage nor invest in Disney products either. He reasoned that Disney is one of the key corporations lobbying in the United States for the advancement of copyright extensions, which are also being forced upon other countries via international trade agreements as we saw in the previous chapter.

The experience with the Linux community was also a source of unpleasant memories to other developers, mostly women and novice who feel threaten by the antagonistic environment created by argumentative expert programmers: *my worst* *experience was during SuperH porting project. We had a conflict involving the Sega Dreamcast console support. The technical information was not easily available. Basically, only engineers who signed the NDA could get the information from the manufacturer. We got mysterious contributions from anonymous persons and we had discussions about how to include them. I was concerned with the source of the contribution and* [his/her] *responsibility. What if we are sued by Sega? We had a flamewar in various spaces. Some people even talked about the quality of the code. You know, each person had a different viewpoint. It was a hard experience. We did not get any result, the result was just bad feelings toward each other. Sometimes it is easy to demand, but tough to do things. Around the Linux kernel some people think rogue, aggressive attitude is cool. I do not think so.*

Gniibe's perception of collaboration in the context of Free Software development is, in his own terms, unusual. An early event in Japan exemplifies the atypical character of his position on this foundational issue. Given his substantial contributions to various subsystems of the Linux kernel at a time when he was one of the most active Japanese developer working with a transnational community, Gniibe was invited to give a talk about his work at the Open Source Lab meeting in Tokyo in the early 2000's. Disappointed with the unbalanced focus of the talks on technical aspects in detriment to the moral dimensions of collaborative development, he decided to give an entirely different talk on how to dig wells. It was an awkward moment for the audience, which was expecting something else as Gniibe digressed over the conditions under which he managed to collaborate with his brother in the task of digging a six meter deep well. *I explained that sometimes it looks very difficult to communicate with engineers from abroad or engineers with a completely different background, business, or culture. But, see* *this example. At that time, I did completely gave up communicating with my older brother, but it was actually possible as long as one has enough passion, a clear goal, and some sort of model. If communication is not that good, it is still possible to cooperate*. They have never in his lifetime cooperated with each other, but they were both at something in which friendship was not a prerequisite to accomplish efficiently the task at hand. This was a lesson he wanted to convey to the audience in respect to his participation in collaborative, Internet-based software development. *Most of the time, whenever I am invited to Asian countries to talk about computer technology, they do not ask about the history of Free Software or history of its practice. They care about technology and skill. I think morality is as important as skill.*

In 2002, Free Software Initiative Japan (FSIJ) was founded by a group of computer professionals and a business professor in Tokyo. Since Gniibe got involved FSIJ, his activities for the promotion of Free Software in East Asia have been a constant struggle as well as an opportunity for ethical self-reflection. When it comes to the dispute between Free Software and Open Source over tactics for attracting more participants to software projects, Gniibe positions himself on Stallman's side. *Many people abuse the term. The Open Source Software Definition itself is good. In the name of Open Source, many guys did bad things, I think.* [Such as] *hiding problems, hiding conflicts, just talk about one aspect, the good aspect of technology. These people do not talk about the practice and cause trouble. I do not think it is fair. At first, explain our practice at some* [extend]*... Most people explain good points and do not explain bad points* [...]. *In Japan people use the OSS abbreviation. The usage of OSS is a kind of a nightmare for me, because these people do not care about the definition* [of Free Software] *at all.* Japanese companies were early adopters of Free Software alongside US companies which were created around Free Software distributions and customer support in the mid-90's. The appropriation of the term "Open Source" in Japan has a different trajectory, however. It was adopted with a similar meaning, written in Katakana, based on the collaboration of local developers with US-based companies and OSS initiatives, but it also had a different trajectory within the governmental sphere. *You may know that in the past, 2002-3, when we got the funding from METI, it was for "Open Software Project," because one of the top officers did not like the Open Source and the Free Software ideology. The next year, the president of IPA understood the Open Source movement. After that, the top officer joined the project and changed the name again. It is the same as Open Source Software, but they have a different name* [Open Software, written in katakana]. *The top officer do not like an external organization to control government planning. He does not like what is not invented here* [in Japan]. During his time as a government employee, Gniibe managed to achieve a goal he had set for himself. *My challenge as a government employee was change the reputation of Free Software movement. And I managed to get some success. These days it is not considered wrong to join Free Software development. Today I can say I am doing Free Software development proudly! But 20 years ago, it was a bad thing to say.* Gniibe held his government position for ten years as a research associate. He confided he had lots of respect and freedom within the government given his technical knowledge, which allowed him to dedicate his time toward Free Software projects.

As a long time contributor, Gniibe's study of the legal code behind Free Software licenses came late in his career. It was only a decade after he first submitted the first patch to a project that he came to familiarize himself with the intricate legal details of software licensing. In 2006, the Free Software Foundation organized seminars in various countries (with key Free Software activists and strong FOSS communities, such as Brazil, India, United States, Spain, and Japan) to discuss the update of the General Public License to its third version. Gniibe not only organized and managed to get funding for the meeting in Akihabara, Tokyo, but also participated in all the seminars and in the training in New York with the lawyer Eben Moglen, director of the Software Freedom Law Center. When questioned about his relationship to his work in terms of ownership, he expresses it in terms of an unusual case in face of other commonly held opinions among FOSS developers. Certain forms of naming, but not ownership, are consider acceptable in cases that are similar to those in mathematics, where one theorem carries the name of the researcher. Naming and claiming ownership of circuits is something that Gniibe does not recognize as legitimate. Software stands in a different position: it is not completely authored as a paper, a novel, a manga, but it is not completely anonymous as a circuit design either. *For schematics and electronics, we do not put attribution for inventors. I think it is part of a culture. For me it is OK to put some attribution, it is a way to return to its author, but I do not think it is ownership, specially for schematics or PCB design. On the other hand, I feel a sort of ownership, like a story or literature, paper or technical paper, we have a sort of ownership* [...] *Software is something between the line of schematics and manga, literature or paper. In some cases I would like to demand that this is my talk, this is code that I wrote. But it is OK for me to have people modify my code. In an article, it is my opinion. It is OK to change the text to write your own opinion using my text, but then it is not my opinion anymore.* Learning about the process of revising and debating changes to the GNU General Public License (GPL) became an educational project on the challenges which the Free Software community have faced in the course of three decades. *In the process of* [drafting the] *GPLv3, I learned how it works* [for the Japanese law]. *Actually, inside the GPL we can find history of Free Software movement. We have many methods for preventing binary-only distributions, a practice of proprietary software and some terms against DRM, and some terms to workaround DMCA; some terms against Tivolization and so on; some term against software patents. We do not need to understand the legal detail, but we can find information about the history of the Free Software movement inside the Free Software license.*

Hacking is conceived as a novel, inventive practice which takes not only technical mastery but also an element of self-discipline and adjustment of one's actions in respect to the others. Gniibe's latest project illustrates his conception of hacking as embodied in the digital tools of his own making. Gniibe started working with the GnuPG (Gnu Privacy Guard) project after realizing that the lead developer needed serious help to maintain the project and soon became well versed in cryptographic functions. He also battled what he identified as a common perception in the security industry, the perception in which the user is generally considered a malicious agent. He, therefore, started to work on the implementation of cryptographic functions on a low cost chip which can be found in popular kits for engineering students of embedded systems. Using this particular chip, he designed a substitute for an industry standard Smartcard, a USB token to be used with Gnu Privacy Guard (GPG) and Open Secure Shell (OpenSSH) for authentication. The device was a hack in itself from various angles: first by transforming a device for educational purposes and using it for an application in the context of privacy and data security; second, by rending Smartcards transparent, that is, a device that can be inspected by users not to probe secrets but for educational and auditing purposes; and, finally, as a combination of Open hardware and Free Software, articulating two domains of technological development which have their own histories, methods, established communities and influential practitioners. The whole design of the USB token was made by Gniibe and then sent to Seeed Studio in Shenzhen, completing a cycle of design, implementation, and realization into a final product (which I will describe in the next chapter). The device illustrates what is at stake for Gniibe when it comes to hacking: an inventive practice that serves as a vector for transparency for the users and developers of technology.

The golden rule as articulated in the GNU Manifesto[49] has been contemplated by Gniibe in the negative form as expressed in the Confucianist tradition, *do not impose on others what you do not wish upon yourself*. This difference in moral articulation accounts for a crucial distinction in which Free Software and Open hardware development are articulated in Gniibe's experience. One of the key moments of ethical reflection on computing issues happened after his first encounter with the Japanese version of the GNU Manifesto, which he came across in the appendix of the JUNET manual around the late 1980's. The manifesto is a key document in the history of alternative computing for articulating the question of software sharing in terms of a moral injunction as we saw in the previous chapter. For some technologists, it is a foundational document, for others, the usefulness and quality of Free Software programs were the most enticing

49 From the original text in the manifesto: “I consider that the golden rule requires that if I like a program I must share it with other people who like it” (Stallman 1985).

factors turning them to collaborative software development. *Reading the GNU Manifesto, I thought about the dilemma and… you see that we have an existing practice of not distributing the source code, but I wanted to support Richard* [Stallman's] *idea. I thought it was the right thing. But the real world is different. Then, how should I proceed? That was the question.* In relation to the Japanese computer industry, Niibe personally diverges in what he assumes to be the necessity of thinking deeply about the ethical implications of his technical skill and knowledge. He identifies an inertia among his fellow Japanese developers in their avoidance of accepting what he calls the *structure of the dilemma* he found in the Manifesto. *How should I not apply my power when I write code? That is my question.*

Mitch

Mitch was born in a family of Chicago activists. His grandfather was a communist sympathizer who had lost his shop in a criminal fire by the time the mafiosi had taken the leadership of the Teamsters Union. His mother and father got involved with the counterculture movement when Mitch was young. His mother was an elementary school teacher and his father held a clerical position in the US Army as a communications officer, starting a successful architecture firm later in life. *My father loved architecture and art, so he arranged his life so he would have lot of if consumed with art, architecture, and music. I think that is the big part of why I do not have what seems to be the disease of the modern world of focusing on money. It is not the money that makes us happy. To have the life you want to live is beyond subsistence. It is not about the resources,* *it is about living the life you want to live. We did not have a lot growing up. We were certainly privileged for being white in America, white middle class.*

Mitch was encouraged to explore his material surroundings when he was a child. As the narrative composition goes for most engineers, he was also taking things apart when he was very young, learning from popular science and electronics magazines, and creating his own toy projects. He once dreamt of pushing her Mom's vacuum tube radio off the counter to see its internal parts. Eventually the radio got pushed from the table, smashing on the ground and getting its internals exposed. Mitch was six by the time he managed to realize his earliest dream of exploration in electronics. From this event on, electronics has been a constant companion, landing jobs, contracts, and currently, multiplying invitations for electronics workshops in various parts of the world.

His mother was a "Den Mother," a leader of the Cub Scouts in which Mitch took part as a kid. One of his memorable experiences with the Cub Scouts involved having access to a mainframe computer in the 1960's when computer machines figured only in science-fiction accounts or as instruments of bureaucratic management. He came to visit Sarah Lee's factory with his fellow scouts and had the first contact with a computer machine. [The factory] *made pastries with robots controlled by this mainframe computer and ran 24 hours a day, but during night time it was reduced production, and they did not need all the computing power* [...] *We would go there to punch cards. It was the first contact with a real computer. We had to learn IBM 360 or 370 assembly language, that was all we could program in. They did not have BASIC. I do not know what languages* *they had to control the robots, but I think they used assembly, otherwise why wouldn't they make us use FORTRAN? We were kinda on our own, because the computer operator showed us a little bit of what to do, gave us manuals, but they were way technical.* [...] *Boy Scouts is not just idiotic, it is horrible, they teach kids not only to be militarist but to be closed-minded and conformist, how to exclude people who are different from them, specially if they are gay. Cub scouts is part of that same organization. But Cub scouts was also about getting together and playing games, and doing stuff for the badges that was fun, they did not have the technology. We were just a bunch of geeky kids. It was lucky* [to have access to computer at this age]. *Hardly anybody did.*

Growing up, Mitch was surrounded by the debates involving his parents and their friends about the wrongdoings of the government in respect to the Vietnam War. His parents' friends would come over to his house to discuss the political issues from where Mitch had his earliest exposure to philosophical and political debates. *Throughout the 60's, my dad and my mom did environmental activism and anti-war and pro-civil rights, all sorts of cool things. Brought up in that environment, I have seen that the army really sucks.* He has recollections of having discussions about the *rights and wrongs* and being encouraged to think through political issues by himself. *What is this Vietnam war about? Why are we being lied about it? What is the point of all of this? People are living for what in suffering? And forcing suffering on others. And the stated goals were lies. Freedom? If it is called freedom why are we making this people suffer so much? Is not the point of freedom so they can live better lives? It was clearly not about freedom, the real reason was not being told* [...] *From my point of view as a young person,* *the right thing to do was to oppose it, why should we support something that is making the world a worst place? Except for some people, some more power for some people, that does not justify all the suffering, so... Growing up in that kind of environment, doing the right thing and thinking about things on a more political scale and not just about my own and bits in my bank account.* His coming of age in politics happened during McGovern's campaign in 1970. *George McGovern* [...] *was not only liberal, but actually progressive (which is as far in that direction as is possible for anyone at that level politics to be). My parents were working for him, and I was working for him. It turns out that Nixon, who was running against him, was doing everything he could to manipulate events so that McGovern would win the Democratic primary, because a progressive candidate would be easier to beat* [...] *This plan worked – although it would eventually lead to Nixon's downfall, since he was busted in the mainstream press for this. But not before dismantling so many of the reforms that were put into place by the Roosevelt New Deal programs. The CIA, NSA, and others from the intelligence community were monitoring what we were doing. All of this got me very disillusioned with the whole electoral process. I stopped putting my energies there.*

Mitch's family was based in Chicago but later, due to his parent's perception that the public school in their district was considered of inferior quality, they moved to the suburbs *where school was supposed to be better but where I got bullied and beaten up everyday, so I focused on doing geeky things, instead of interacting with people. I was terrified of people, pathologically shy.* By retreating into more individual past-times involving electronics, such as creating an inter-phone system to connect his bedroom with his brother's bedroom, he got hooked to TV shows, which he considers his very first of a series of addictions. In high school, he stopped watching TV and found a community with a group of students doing pot recreationally. *When I was not high, I was terribly depressed, and when I was high I focused on how depressed I was and how fucked-up everyone was. I had to quit that, then I went to other drugs and other addictive behaviors. But at the same time, I was focusing on forming communities and found various ways to do that.* His high school had an electronics program, which basically meant training for aspirant TV and radio technicians. There he found a community and had to venture out of himself and beyond the small circle of pot smokers. His electronics teacher created an exceptional environment for sharing among students and allowed plenty of room for exploration. *Even though I knew more than him, he was not threatened by that, he actually created an environment for me and other kids to play and explore. And made it so that we could share what we knew. Very proto-hackerspace-ish.*

An engineer in his neighborhood created a long-lasting impression and served as an early inspiration for Mitch. It was around 1950's when this engineer created his own recording studio which also served as a collaborative space for electronics aficionados from the Chicago area. The agreement was that high school students would teach the incoming younger students and they had to show up every Saturday; that was the condition for them to participate in the shared electronics lab. *I learned so much about electronics by having the resources at this lab—that and the electronics class. It was the first time I felt* [I was part of a] *community. I did not see the community as really cool back then, because there were very few things that felt worthwhile in my life.*

For being bullied in school, going through a life of torment and forced introspection, and finding himself inadequate most of the time, electronics became a safe harbor. The transition from a childhood to an adolescence immersed in electronics led to a smooth transition into an effortless electronics degree in college. Mitch attended the University of Illinois in which he soon found himself by chance working in the only laboratory which did not depended on military funding. The laboratory coordinator and Mitch's adviser was a Chilean engineer who fled to exile by the time Pinochet raised to power with the help of the US military and the Chilean elites. *When I got there he was about to get fired for lack of funding, but Intel, then a small micro-controller company, donated a million-dollar worth of computer chips, so suddenly in the lab there was a million-dollar worth of micro-controllers; nowhere else in the fucking planet had that.* Mitch soon became a lab assistant and taught various classes using micro-controllers that were easy to use and widely available. *I ended up being a teaching assistant in graduate school. I tried to make my classes—as much as possible—not me in front of people imparting knowledge and information but giving people enough knowledge and fun tasks to do, and let them go do it, so I was just a resource and a mentor at that point. This is what I did later in life by helping people come together and help them form communities.* Before advancing to graduate school in Electronic Engineering, he attended courses in psychology and anthropology, which fascinated him. He recalls asking himself *how do people work* and pursuing questions regarding the unconscious and the nature of human psychological drives. *While all the other labs were doing missile guiding systems and other stupid things, we were doing robots, flying things, or whatever, so it was just great meeting all of these weird, cool, geeky people that made all that happen. It was not a requirement, but it was socially desirable to eat lunch together every*

Friday afternoon. That was one activity we were expected to do together. My adviser would not talk a lot and every now and then he would ask some philosophical question and then not say much to encourage people to discuss.

Exploring forms of communal living after his junior year of college led him to experiment as well with alternative forms of political organization. *I explored notions of anarchy in which there were no leaders, and we all focused on ourselves to become who we are, and from there I found out about the Rainbow Gatherings from people who stayed in our houses because it was always open for guests, travelers, and all sorts of incredibly cool people.* Driven by his yearning for community, he got deeply inspired by the promise of the Gatherings and the anarchist literature of the late sixties. He read the Situationists, *Chomsky on a political side, Jerry Mander on a social side, Alan Watts on a more spiritual side*, and decades later learned about Hakim Bey and the concept of TAZ (Temporary Autonomous Zone) which he applied retrospectively to the interpretation of his experiences. [The Gatherings] *take place in the woods, two miles away from the road, traditionally where there is nothing around, just the woods, and, all of the sudden, there are thousands of humans, and, within three weeks, there is a huge city out of nothing; hot and cold running water, ovens and places to shit without poisoning ourselves, health care, and all sorts of workshops; and, three weeks afterward, the place is cleaner than when we were there.*

Another encounter through the experience of the Gatherings was key: meeting its queer contingent and political group Radical Faeries. The main proponent of the Faeries, Harry Hay, served as an inspiration. *It is not that there is something wrong with me because I am this way, but that everyone, including gay people, women, and black* *people, introverted people, geeks, and Aspergers people, everyone has a place in society if we accept each other for who we are.* [Harry Hay] *started Radical Faeries because he thought gay people are unique and have unique assets to offer society.*

Communal experiences taught Mitch over time to engage with a world beyond himself, and, in a way, to break out of his intimate worried world, and to experiment communion through recreational drugs, science and electronics, sexual and political identities. *By that time I learned about a life that was not only about total depression.* Community was soon identified as an antidote to his constant distress and feeling of inadequacy. The more he experienced shared spaces for electronics training and exploration of sexuality, the farther he distanced himself from the "blues." *All the time I have been at the Gatherings I learned about various means of this groups and sub, subgroups within anarchism and they all thrive organically and perfectly together, because it all grew organically* [...] *no one really seems to understand it all, but it is just this perfect whole; it does not mean it is just utopia, there is conflict all the time because community is hard work. All relationships are hard work.* His last experience with communal living involved forming a collective in rural Tennessee called "Idyll Dandy Arts" (IDA) which still exists to this date and presents itself publicly as a "queer land space and educational project[50]". The experience at IDA got out of hand at some point, becoming unbearable for going as far as involving physical threats and suicide attempts among a few of its members. It became, in Mitch's words, *an evil cult*, so he felt he had to part ways with the community and returned to San Francisco to work as an electrical engineer consultant.

50 Source: http://idaisida.tumblr.com/ (accessed on 09/11/2013).

Mitch's first job was in 1977 while still an undergrad. Later on, he got a computer job for the development of a flight simulator using an Apple][at a software house from Urbana, Chicago. It was a temporary summer job, but he got exposed to the inner workings of the IT industry and came to the realization of some of the underlying connections between technological development and politics. He was surrounded by *technical wizards*, who were *cool geeks* to him, but his satisfaction with the company did not last for long. *The military took the game that I developed, for which I dedicated three months of my life, and used it to make killer helicopter training simulators. First, they came and asked the company to modify it to be a killer helicopter training simulator, using the technology from the flight simulator the company developed and the game I did. The company said "yes"! So, I quit.*

Soon after leaving graduate school by the mid-1980's, Mitch worked as a professor at a local community college near University of Illinois. He moved to Boston after two years of teaching and secured a steady job making museum exhibits with micro-controllers. Even though it was considered a well-paid, stable job by his peers and close relatives, Mitch decided to quit after a year. People accused him of being irresponsible for leaving such a good job. He had settled in Boston, had his place remodeled and under rent control. He had to walk only a few blocks to his workplace, but all the niceties did not prevented him from quitting. Boston's inhabitants were perceived to be too conservative, too judgmental of alternative forms of sexuality, too cold in regards to human relations in his opinion.

Another job he held was at a company located in the central hub of the Route 128 which housed the computing industry counterpart to Silicon Valley, feeding off of the applied tech contingent of several research universities of the region. His job had a typical start-up organization. Internal in-fighting led him to quickly feel out of place. Accusations were being thrown at the top executives who gathered proof to accuse one of their partners of stealing from the company, leading to lawsuits and a very tense atmosphere. *Why am I working 10-12 hours a day, busting my ass for these arbitrary deadlines* [...] *Just for some of these people's profits? People working there were cool, but they, of course, were focusing on sales, so they were pushing* [their software and hardware projects] *to the military, which they end up doing... to sell weapon systems. This is when I quit* [...] *It was actually the second time I made a choice for myself in my life. First one was quitting television, second one was quitting my job, which I hated. I hated living in Boston, so I moved away.*

After quitting his job in Boston, Mitch decided to travel without a fixed plan or destination. *I realized a quarter of the way in my Ph.D. that it was getting in the way of what I really wanted to learn, including electronics. Because I was forced to do certain things and not others, and because those certain things took up all my time, grad school was not doing it for me.* After the experience of creating an urban commune in Urbana, Illinois, he traveled with his housemates, who had became *his extended family.* He felt he was rarely allowed to make choices for himself throughout his life, so he decided to do a road trip to Alaska. *It was the first time in my life.* [It was] *1986, I was 30. While on the road, I realized that for the first time in my life I was happy. It was because I was making choices for myself. It was just me in my van, I could do whatever the fuck I wanted* [...] *It was all up to me what to choose to do. And amazing magical things happened; seemingly magical things when you are doing things organically because it feels the best* *thing to do, rather than doing what you think people want you to do, or what you* should *do.* Upon his return from Alaska, he drove down the West coast, stopping in Palo Alto, California, to visit friends working for local tech companies.

Based on a friend's contact, an artist from San Francisco who pioneered the work on computing and art becoming well-known in the local scene, Mitch was hired to do work on MOS Technology 6502 micro-controllers for experimental applications around the project of immersive virtual environments. The company was called VPL Research, which stood for "Visual Programming Language," the technology they developed in order to create virtual environments. Mitch worked on the electronics for a glove to move around and manipulate objects in 3D space. The person who hired him and with whom he extensively discussed the possibilities of computer-generated virtual environments was Jaron Lanier, who spearheaded a project of computerized "Virtual Reality" in the 1990's. *At VPL, we actually did not know we were working on virtual reality. We were working on input/output devices for the Visual Programming Language we were trying to create. But the I/O devices became the important part, and the head of the company, Jaron Lanier, coined the term* virtual reality *to describe it. I quit VPL after the military got a hold of one of our VR machines, one that I built myself, and used it as a World War III training simulator.*

Throughout this period and until the 1996, Mitch kept returning to the Rainbow Gatherings. He allowed himself to explore communal projects as a way to ward off sadness, having outcomes he felt positive about, but also witnessing numerous practices he classified as horrible and self-destructive. He eventually outgrew the experiences with the Gatherings and the Faeries, *progressing*, as he ponders, *in his life in certain* *ways* and not having the ability to cope with certain practices he felt OK back in the 80's and 90's. *In the beginning, I was very depressed, and I wanted to know how I worked so I could fix myself, because obviously I was broken or so I believed, but, when as I learned more, I realized we are all broken! Or, it is OK; these aspects of ourselves we see as* broken, *are just part of who we are. None of us are broken, you know, we are who we are. Either we see we are all broken – which isn't very useful –, or we see it does not matter.* His parents did not know how to deal with homosexuality. They were not harshly homophobic, but not entirely free from subtle homophobic dispositions either. *I grew up with a very prudish family, liberal socially in the abstract, but not in the practice* [...] *Me being gay, growing up in a homophobic society and them being clueless in how to support me while I was being beaten up everyday for all different kinds of reasons,* [at school, people] *would beat me up and abuse me, physically and emotionally* [sigh], *so yeah, they were clueless about that.*

In 1997, after working in the Bay Area for a few years as a consultant, Mitch started a company in Silicon Valley with a friend to develop controllers of disk arrays called 3Ware. The company did financially well for a few years, but got him seriously overworked, draining all of his energy, and bringing back the blue devils. *After the VCs* [venture capitalists] *took over* [3Ware], *they tried to sell our RAID controllers to the NSA, so they could record all the information to spy on people* [...] *I quit that job before that happened. It was such a horrible place after a few years* [...] *What was I doing? Everything I did was helping make the world a worse place because it was helping the military.* There was no definition of Open Source hardware by late 1990's, but 3Ware was distributing the source code of their drivers by then mainly due to the influence of the engineer they hired to write the drivers who was a very strong Free Software advocate.

After leaving the company, Mitch worked as a consultant and saved enough money to support himself for a year without employment, so he started to search for a project to invest his energies toward something he could bring out positive usages of technology. He volunteered for several collectives in San Francisco, fixing old computers for non-profit organizations, and helping HIV support groups. After pondering over the issue of the negative and positive aspects of technological development, he came up with an idea which was suggested to him in a dream. It involved a magical device for masturbation which would provide one with immense pleasure without pain. Reflecting upon his dream, Mitch considered it really weird at first, but then he realized he could build devices with the same purposive action. *You could entice people for doing what they love with the device*, except that the device was not really necessary. It was basically a form to trick people into doing things they love that they would not do otherwise. The idea for his project *Neurodreamer*, an Open Source meditation glasses, was inspired by this revelatory dream. *When I woke up from the dream I was* [thinking]*, you know, that technology, the masturbator, was totally unnecessary – it merely gave permission, through the device, to do what* [people] *really wanna do anyway, but not giving themselves permission to do for whatever reasons. It does not necessarily have to mean getting people to buy what they don't need, but it can be used to give people permission to do what they wanna do but are not giving themselves permission to do. It can trick people into doing what they love. So, I was thinking, I could make a masturbator, but that is not really where I am at, so… what can I do?*

Another of his projects of great influence was TV-B-Gone, a universal remote controller to turn off TVs in public spaces, which helped Mitch to transform his TV addiction into something that was public in respect to its design, educational in the documentation of its design, and international in its scope as several groups wholeheartedly embraced his device as a must-need for an activist toolkit. Mitch came up with the idea for the project in 1993. During a meeting with friends in a restaurant he noticed how glued everyone was to the TV set instead of paying attention to each other. *We started to talk about TV and its effects, and I thought: wouldn't it be great if we could turn these fucking things off everywhere you go? And I realized I could. And a person came up with the name instantly* TV-B-Gone. *So, after I came up with the idea of the meditation glasses, I realized that TV-B-Gone was another one of those things. You do not need a TV-B-Gone to turn off TVs, but if you put this thing out into the world, it gives people the notion that they can turn TVs off, especially in public places, it helps spread the word that turning TVs off is fun, and also mischievous or whatever, but that is the part that makes it fun. Then, you find that it—life—is actually better when you have TVs off.* Developing the TV-B-Gone controller literally meant, in his words, *hacking his addiction* and helping people deal with theirs. More generally it also meant a form of communication through rebellion and collective action through denial of the media culture wherever one goes, wherever place there is a TV set to be turned off.

For Mitch, hacker conferences became key spaces for transformative encounters through which his past communal experiences would be channeled into renewed projects of a broader, transnational scale. Maker Faire, a large conference for inventors, artists, and electronics hobbyists in the Bay Area (and how spread out through various locations from United States to Europe and China), was one of the first events Mitch connected with people working to bridge hardware development and Free and Open Source software. In 2006, through his encounters at Maker Faire, he found other hackers and got involved in the organization of Hackers on Planet Earth (HOPE) in New York City. *It was not until I started going to hackerspaces and hacker conferences that I felt totally at home with a group. With the Radical Faeries, I did initially, but I was still terrified of the various aspects of Faery culture and its over-sexuality, which I loved, but was scary at the same time.* Creating ties with hackers spreading over North America and Western Europe led Mitch to attend his first Chaos Computer Congress, a mythical meeting ground for the European hacker scene, organized by the collective Chaos Computer Club. As an invited speaker, Mitch gave a talk on the TV-B-Gone project, which was received with great interest except for a very important diacritic signal that became the target of heavy questioning and criticism. *I went the normal route: I am an inventor and my brother is a patent attorney, so I patented it. That is what people did.* Mitch got troubled by the objections both North American and German hackers had in respect to his patent application for his product. *When I was in Germany I gave a talk based on the one I gave at HOPE about TV-B-Gone, TV and its effects, and lots of people were asking me, "I noticed in the packaging, it says patent-pending, what is that about?"* He debated with himself during the event and later and came to the realization it would be beneficial for him to go fully Open Source with his projects. *I began again to think when I got home, at the conference too, but more when I got home. You know, this has been kind of an Open Source project; all these people emailing me. I have been sharing information, they have been sharing the improvements with me, people from all over the world, for free. I would not prevent sharing what they share with me with everyone else.*

Why should I close it off? The more people do this, more people will make things that turn TVs off, which is what I really want from it anyway. So, I just made it Open Source. More and more people started helping as a result of that. When questioned about his sense of ownership and his assessment of the experience of going Open Source with his hardware creations, Mitch ponders over the existing constrains for an unbounded economy of sharing and the existing practices around circulation of intangible goods: *I tend to give all of my ideas freely as much as possible. I like the idea of Open Source licensing, people can use for whatever the fuck they want but you have to share it with the same license and you have to give me credit. People know where the ideas come from and that the ideas come to you, or it is unique to me, but it is also based on all of these ideas from these other cool people. So, it proliferates with it, and now people now where to look for more ideas from me and these other people, and if they use stuff that gets shared back with me, I benefit from it and everybody benefits. The only time that comes in trouble for me in my life and the current reality we find ourselves in is when people violate this agreement.*

At the 24th Chaos Computer Congress in Berlin in 2007, Mitch and his close friend from San Francisco, a *bona fide* computer security expert with strong international ties, attended a talk which discussed the best organizational practices for the creation of hacker clubs and laboratories. This talk was entitled "Hackerspace Design Patterns" and became a highly influential blueprint for the creation of hackerspaces worldwide. It was particularly inspiring for Mitch, who, with a group of computer experts and enthusiasts from San Francisco, went on to create an open space for experimentation with technology in the Mission district in September 2008, one year after his return from the Chaos Computer Camp. Meetings for the creation of a hackerspace in San Francisco started, however, in the summer of 2007 during the Chaos Computer Camp. Among other hackerspaces that were created in the United States and in global cities around the globe for the past four years, Noisebridge has been known for its orientation toward autonomous politics and radical openness for all sorts of activities, including workshops, gatherings, parties and the creation of technical and artistic projects. Mitch and most of the founding members of Noisebridge self-identify with radical autonomist politics, but what brought them together to form the space was not political activism *per se* but the need of a space for hacking with a shared orientation toward the political reinvention of technology and the personal transformation of technologists. *I am a libertarian more in the sense of liberty, not in the sense of a religion that you must do things in a certain way otherwise you are wrong, and if you do it this way it leads to utopia. and if you do it this way it leads to utopia. It is not utopia. This is not the planet for utopia. If there is some planet for utopia, I do not know which one. But this is my favorite planet, and this is the one I want to help. But, in order to help it, I have to help as many people as possible to live lives they love as they see it, not as I see it. I truly want people to do what they love. So, I go around helping people to form hackerspaces.* The term "hacking" itself has a more flexible and contingent meaning for Mitch, one that is more attuned to the its contemporary usage at hackerspaces, being rather different from previous historical definitions: *hackers are people who do what they do because they love it* [...] *whenever they are enthusiastic about something, they learn as much as they can, they improve upon it, and they share with the world.*

Mitch witnessed and collaborated with the transposition of Open Source narratives and technical practices to the context of hardware design and tinkering resulting in a very important event in the context of electronics and computing during the past decade: the proliferation of Open Source hardware projects, forming organizations, such as the Open Source Hardware Association (OSHA), events such as Maker Faire and Open Hardware Summit, and profitable businesses and co-working spaces. Mitch's involvement was organic to the extent that, at the Maker Faire 2012 in New York, he was awarded the "Maker Hero Award" for his "outstanding contribution to the cause of maker-related education and/or open access to technology" (Altman 2012). But the honeymoon of the nascent "maker community" did not last for long as the announcement of the acceptance of a DARPA grant by O'Reilly Media, formerly responsible for publishing MAKE magazine and organizing the Maker Faire, came with funding offers for hackerspaces and public schools. In response to the creation of this strong tie involving the nascent Open hardware community in the US and DARPA, Mitch announced on the Internet that he had decided to part ways with Maker Faire but looked forward to work together with them again whenever they no longer accepted military funding. The US Department of Defense sponsored the "DARPA Mentor" program with a budget of 3.2 billion dollars for its first year. Mitch's statement provoked a huge controversy among members of hacker and makerspaces, participants of the Open hardware community, and in various Internet fora. Soon after, Mitch was invited to publish a short article on the topic in which he summarized his frustrations in respect to the controversy: *the tools and toys we work on and play with are very powerful. And, of course, in a society where so much of the money is in the military industry, some of the best and brightest people are hired to find what's new and cool, and* *to think up ways to use it all for military purposes. In this context, the technology is not neutral. Without taking responsibility for the technology we create, because of our cultural and economic context, our technologies probably will be used to feed this industry, and feed its military purposes. And all merely for profit's sake. Clearly, this bothers me. Clearly, this does not bother everyone. But, since it does bother me, I have made choices that, to the best of my ability, minimize the help I give to the military, regardless of possible profit.* It became practically impossible to be indifferent to the debate and not being asked on which side of the controversy one would stand when it comes to funding and forms of collaboration involving hackerspace projects, governments, and companies.

One year after this controversial event, Mitch gave a talk at the International Free Software Forum in Brazil after touring the local hackerspaces and teaching people how to assemble and solder simple hardware kits, including the TV-B-Gone, and suggesting ways in which one could avoid the established work and media cultures with Open Source development. His tone was jocose and, at times, exalted but charged with charismatic flare. During the Q&A session, Richard Stallman appeared out-of-the-blue in the back of the conference room and questioned Mitch about the usage of the term "Open Source" after sharing his perception of the risks of the Open Source discourse for advancing "software freedom." Stallman acknowledged Mitch's ethical commitment in his technical work and lamented the fact that he was using the term Open Source instead of Free Software. Mitch replied saying he came in late to the Open Source community, so he did not make a distinction between the two terms. During his talk, Mitch posed the question of freedom from meaningless jobs in the IT industry by pointing to the fact that he was making a living with Open Source hardware and people could do the same or search for what they love doing. He glossed over technological production based on anti-militaristic ideals, and shared an opinion which he repeatedly invoked in his talks, interviews, and workshops in several locations around the globe. *I am really glad individuals are fighting against horrible things being perpetrated by institutions, corporations and individuals. The dominant paradigm as people call it* [...] *In fighting forces of domination we are trying to out-dominate it. I do not think it is possible. If it were possible, it would no longer be with us. My approach is to envision what positive that I want and attract more people, putting the word out to people who jive with that positive vision—that makes its stronger, that attracts more people, etc. It is not about, as I see it, resources, even though they are involved. It is not about money, although it can be involved too. It is about more people having more opportunities for living fulfilling lives they need.*

Nalaginrut

NalaGinrut, a nickname taken from spelling “Alan” and “Turing” backwards, was introduced to computing by his paternal uncle, a computer technician at the time of the debut of personal computers in the Chinese market of the early 1990's. NalaGinrut was 8 years old at the time and his past-time involved playing computer games with friends and sharing software. Concepts of copyright and software piracy were completely absent from the horizon of his earlier experiences with computing. What really mattered for him was the ability to run games and share the experience with others.

He grew up in an urban family in the city of Kunming, Yunnan province. His parents were highly supportive and caring. He recalls being an applied student in elementary and high school due to the priority his parents attributed to his education. His mother was born in Kunming, and his father in a small village of Yunnan province. His father managed to get a job in a copper mine and, later, found a position in the army which allowed him to leave his home village and move to the city, where he met his wife who held a job at a bank at the time. *My parents were traditional and affiliated with the government* [...] *I got very important experience from my father. He was born in the countryside; it was a very poor place. But he managed to work and leave to get a better job. He had no education. He learned a lot by himself for pretty much everything, reading articles and organizing people's resources, doing management; he climbed up step-by-step for me. Unfortunately, he worked for the government. At the time, it was the best thing he could choose* [...] *I can say I respect my father because lots of people respect him; he has some authority in the government* [...] *There were many bad things before. I think we are so lucky that we have freedom to talk about those things. Ten years ago you would not be able to be here to talk with me. We would be surrounded by policemen. Sometimes I think it is hard to do certain things in China, but we do have opportunities.*

Nalaginrut studied management science as an undergraduate at Chongqing University and had the experience of sharing a dormitory with students of a poor background from rural parts of China. During his undergraduate studies, he came to realize the financial struggle of his colleagues who depended on scholarships to support themselves. He was not studying to become a computer scientist or IT professional at the time, he occupied himself with other hobbies and interests which included playing soccer and music, which he acquired a special taste for in his studies of classical music in his childhood. *Actually, I was aimless during my university studies, I did not even know what I was learning at that time, although I got an "A plus" in the* [final evaluation]. After graduating, he decided to take a very competitive test and apply for graduate school, so he rented a room with the help of his parents and studied math and computer programming in complete isolation. His immersive experience with programming started fairly late in comparison to other senior programers, such as Gniibe and Oliva. He applied for graduate school in automation engineering, a degree combining computer science and electronic engineering in which he concentrated on the study of C and, later, Lisp. *Before learning about Free Software, I was an enthusiast of computer science. My curiosity and my mind couldn't stop from learning things about computer science. The chance to learn Free Software revealed that this way is the right way to* [achieve] *technical progress. It is a love I can't stop in my mind.* During his graduate school years at Chongquing, he participated in the local Linux Users Group (LUG), where he learned about some of the Free Software projects, such as Linux, Emacs, and Guile. He recollects having conversations with his professors about Free Software, who all too easily dismissed it as a past-time for hobbyists, not suitable for the industry, therefore a waste of time. He contradicted his masters' advice with determination and continued to study Free Software on his own.

His focus on self-training and participation in online communities of experienced Euro-American computer developers gave him a critical perspective from which to describe the Chinese educational system for its emphasis on examination, certification, and status seeking behavior. From this critical stance, Nalaginrut approached the question of hacking drawing a distinction between engineers and hackers, that is, in his parlance those who are limited in their knowledge in virtue of their academic training and follow the established industry practices and those who have a wide range of interests and accumulated knowledge in computing and science, being therefore able to discuss and engage in projects of wider scope and higher technical complexity. From his experiences of interacting online, he came to identify certain people in key positions in the context of Free Software projects as main sources of inspiration. He speaks highly of the mythical MIT AI group of Lisp hackers and expresses with joy that “Structure and Interpretation of Computer Programs” by Sussman and Abelson (1985) is *his bible*, which he studied thoroughly to teach himself programming. He admires Lisp programmers and characterizes them as *real hackers*. After spending time alone teaching himself, he proceeded to the study of Scheme, dedicating time on mailing lists, and on the IRC channel for Guile, an interpreter and compiler for Scheme developed for the GNU project. *In the Free software community, what I learned first was the skills. Of course, that is what I urged to learned from the real hackers. And I have learned how to talk/cooperate with hackers from a tech perspective.*

One of his current goals involves developing local projects and creating a hacker community in Shenzhen. Based on his transnational experiences with Free Software and his aspirations to foster a *hacker spirit* among local engineers and software developers, he has being active in promoting “hackathons” and “hardware freedom” events, as well as to give keynote presentations for the local “software freedom day” and, more recently, organize with local engineers around the formation of a local hackerspace, the SZDIY hackspace. *Me and my friends are guiding the SZDIY community to the correct direction in the dark environment and trying to keep our hacker spirit alive. I don't play with Open hardware just because it is hot in market.* [...] *I want to let the real hackers have the freedom to hack and share so they can survive in this world with their skills. That is what I am fighting for.*

Nalaginrut's perception of Chinese education has led him to search for alternative ways to train himself in computer science. During graduate school he witnessed a memorable if not traumatic event in which a 16-years-old programmer made an announcement to the technical community of Nalaginrut's school claiming he knew several programming languages and could address any technical question. The result was a "flame throwing fest" in which *high diploma guys* bashed the young student, directing *bad language at him* because of his age and his claims. *At this age, you have no authority to say such things or claim to know or that you have learned so many things because many guys on the other side are researchers and high diploma guys, they can do it* [as well]*... the guy was beaten! That was the feeling I got at the time. If such a young guy is treated like this, I thought, maybe I should go away, I should not stay in China anymore. This is why I liked the Guile community, because I was a naive learner at that time, but the community members were very friendly and taught me many things. I felt this was the community I should stay. For beginners who know nothing,* [it is important to] *find a place that treats you well and want to teach you things. But, in the Chinese technical community, there was no such attitude.*

Before re-orientating himself toward a different career path in computing, one that is carried out through the Internet within global communities of skilled computer technologists, he took the normal route of going through formal education, only later coming to participate in a more transversal path of training through online discussions and under the inspiration of mythical computing and computer science centers in the West, such as the MIT and Silicon Valley. *My thought is simple: if you want to be a hacker, you have be around* [other hackers] *often. And, someday you find you can contribute, naturally.* He would spend countless hours on IRC, read books, papers, search and get pointers for technical information, being occasionally encouraged by some of the more active members of the Guile community and be asked to review project proposals and contribute code.

His organic involvement took roughly three years to put him in a position to contribute code to the project, and he was praised for the contributions he gave over time, which provided even more of an incentive for him to persist and pursue a job as a Free Software developer working remotely for a German Open Source company established in Beijing. He continued to be actively involved in the activities and regular meetings of the Shenzhen Do-It-Yourself group (SZDIY) and the Shenzhen Linux Users Group (SZLUG), having helped to bootstrap various events and a shared laboratory for the group. *It is amazing to have such communities in Shenzhen. Everyone here is a reasonable person. They are not idealists. This city is reasonable and very practical, you have do to real work for money. Actually, there is no utopia or pure idealism here.* In his view, Free Software is not to be confused with the practice of gift-giving [lǐwù]. *If it was a gift, it would be free. Most Chinese don't think they have the ability to contribute back, but many of them are willing to advocate Free Software and help others try Linux. We* [have been] *comfortable with this in last 5 years, I think it's Age of Enlightenment for the*

Chinese Free Software movement.

Before landing a well-paid position as a software engineer in the research and development division of a German Free Software company rendering IT services in China, he held technical positions in small and large scale, private and public companies. Fresh out of graduate school, he worked as an intern for ZTE in a sector that was dedicated to mobile communications. His interest and knowledge of Free Software was well-known among his co-workers to the point that he would be visited often by engineers from other sectors to troubleshoot GNU/Linux systems. Working under a boss he described as *clueless* and technologies he saw *no future* led him to give up his job. He, then, used the money he saved to support himself while he worked on his own project, a small operating system written in Scheme. He counted with strong support of his partner, who became his fiancee, even though his professional life was uncertain. He attributes this experiment to his willingness to make sacrifices in order to keep his hacking time well alive. *My hacker life forces me to avoid letting it die, I would do anything for it. I would do everything for its survival. You know,* [another hacker] *once told me that he was born a hacker, so he never cared about losing his hacker life. This is the answer to my question. What if someday I lose my hacker life? That was my question to him. And his answer was interesting: "my hacker life forces me not to lose it and never will," and never will... I would do many unbelievable things for it. The spirit is very important for a hacker because sometimes you must have a very strong reason for the things you do. Sometimes you do things 90% and some weaknesses will occur in your mind, so you must have a very strong spirit to face such weaknesses* [...] *it is a regular practice, everyday, for the belief.* The conception of a "hacker life" takes precedence over other domains of social life. *Sometimes* [hacker life] *pushes me hard. I am sleepless. You know, the guys in the Guile community have the same problem. Sometimes I see some people on the IRC, and I say: "is it very hard for you to sleep?" and they respond "I can't sleep, I have to hack something". All of us have the same problem about sleep. The extreme case is* [one of the key contributor of the Guile project]: *he told me his schedule was highly optimized for his hacking. It is very different for normal guys. He hacked himself, I think.*

Nalaginrut's second job, a temporary contract with a small embedded systems manufacturer, was not exciting and challenging for him, but considerably better than the one he had at the large public company ZTE as he got to work on his own GNU/Linux operating system which he compiled and configured from scratch. *I started to get involved with Guile, write Guile code, and started to work on my operating system project as a night job. It was the only hope, the only happy time I would get. We had less money, but it was a happy life when I got home. I do not think I got so many things from that company because, you know, I do not think that a company doing embedded hardware gets to improve everyday. If they can sell things and get money everyday, OK, that is enough for them, there was no improvement* [...] *I learned industry management in my undergraduate* [studies], *so I knew their production process was nice, strictly controlled. It was good, but for an R&D guy, it was not so cool. Many companies in Shenzhen are in the same situation. There is good manufacturing process, but no technical skill. They have good products but less technique. So, I told my wife by the end of the contract, I will get twenty four thousand Yuen, that is enough for my operating system hack for a month, I mean, for several months, to what my wife said "so, do that!"* Nalaginrut's contract expired and he came to talk to his boss. The company had no long-term plan for him, so he decided leave. Throughout this time, he kept investigating and studying the topic of operating systems design independently. After quitting his job, he gathered all the information for the OpenCourseWare (OCW) at MIT on Operating Systems (6.828 "Operating System Engineering") and dove into his project, not as a side, night project as it was before, but as a full-time one while he was unemployed. *I think I have very strong skills to teach myself. Well, maybe that is one of the reasons why I am not a regular engineer. Maybe that is one of the reasons.* After 2 months unemployed, he found out about a job and submitted an application for the German Open Source company, which was accepted without much of a delay in responding. Some of the employees at the company knew about his work, as he hypothesize, they probably learned more by performing a web search and finding his public repository of code with a copy of his unfinished operating system.

In his domestic life, Nalaginrut describes himself *lucky* for assuming he has a partner who appreciates when he is hacking after work and after hours. He is married to one of his former colleagues from the management program at Chongquing University. *Guys always ask me, "you spend more time on hacking, how does your wife feel?" The answer is too simple for me. My wife enjoys it. She once said that men is more sexy when they are focusing on something. For me, it is hacking. It is sexy. What she enjoys is when I am hacking. She would make some nice food and drink and watch me eat. It is a very simple life for her. She enjoys that. I can't say I told my wife I organized my family around a hacker life, this is not true.* After graduating college, his wife decided to study computer game design and soon after found herself disappointed and hopeless with a job she did not like. *At that time* [of his last employment with the embedded hardware company], *I got depressed and I had no courage but I listened to a song everyday from an American band. The song goes like this: "I dare you to move." It is by a Christian band.* [Out of impulse] *I sent her a text, after not being in touch for three years. I asked her, what are you doing? She said "I am learning game art".* [The night before] *I thought I should write a PSP game... this guy who is very famous wrote a game and his wife was the designer. At that time, I admired such a family. At night I had the idea that I could have such a family, wow! So, I talked to her and, well, you know, we* [got together]. *I still can not explain why I sent her a message with that question.* [Eventually] *I told her my situation, and she answered me with the words I told her: "you should pursue your dreams..." then, I talked to my boss I wanted to quit.*

NalaGinrut also dedicated himself to the task of informing the Chinese IT community of the importance of looking elsewhere for the history of their current interests. In a text he published with a friend, a teacher in one of the local elite schools of Futian in Shenzhen and member of the Shenzhen DIY group, "Trace the Origin of the Geek and Maker Culture[51]" they offered an interpretation of the "Maker movement" which started in the United States with the popularity of the magazine Make, a contemporary version of what publications such as Popular Electronics in United States represented from the 1950's until it went out of print in 1999. Their narrative draw mainly to the origin myths of heroic hacking in the North American context. By putting bits and pieces of information together from movies, books, and following links on Wikipedia pages on topics such as "Do It Yourself" (DIY), they described the figure of the "maker" [创客, *chuàng kè*] as a self-reliant and anti-authoritarian "entrepreneur"

51 Source: http://www.leiphone.com/chuangkewenhua-szdiy.html, accessed 11/12/2014.

[创业者, *chuàngyè zhě*] whose "freedom of thinking" [自由思维, *zìyóu sīwéi*] and practical ideas are meant to be exercised to bring forth novelty in the world of technology. The historical events they describe culminating in the figure of the "maker" revolve mostly around the notion of Do-It-Yourself (DIY): it all comes together with the avoidance of consumerism, albeit as a pre-constructed discursive element, as "makers" are depicted as tinkerers *par excellence* so as to emphasize the re-purposing technologies. "Isn't it fun", the authors ask while projecting a perceived collective goal, "that a few active brains will find the nexus of creative work and public demand while enjoying the fun of creating, and proceed to invest into the process of transforming their original words into products, thus progressing from being a maker to be an entrepreneur?" (NalaGinrut and Danfei 2012).

NalaGinrut's activism for Free Software is also expressed in his search for ways to foster a local community through the help of other members of Shenzhen DIY group. In his vision, it is necessary to articulate commercial interests of companies with the activities of the local community. *Many good CTOs, founders of companies in China, may get the meaning of Free Software. I always try to show them a different way to contribute to the community. If you tell a business guy, "OK, you use Free Software but you have to pay back" they definitely will not hear you. But, if we choose another way: "OK, you try this Free Software and you get profit; OK, your products are well priced and you get good money, maybe donate some money to the community and you get prestige". Why would we do it like that? Because their education is like that. If you want them to do some contribution in technical way, they just can't. But for money, they can buy reputation. Today many Chinese rich men like to pay for reputation.*

The development strategy in China for hardware and software under the guise of Free Software and Open hardware as practiced by Western engineers is also meant to attack the problem of education and the issue of copycats [山寨, s*hānzhài*], or, as perceived in the West, the Chinese "copy culture." *Chinese education is very bad. If you expect* [people] *to do real creative things, that is a dream. Very good engineers go abroad to be a regular company engineer* [...] *The environment here is very bad. It is not a joke. Maybe* [people just] *try to survive. The irony is that, while these really outstanding* [engineers] *go abroad, others who are not really outstanding are rejected by universities or research institutes here. The* [local] *IT companies will just copy.* [This is a] *very important thing: we do not have a community to lead people to explore their inspiration and hacker spirit* [...] *The only way I can contribute to solve this problem is to try to build a good community. That way we will lead outstanding guys to develop their aspirations. If we do not have outstanding guys, our spirit will die. There is no question.*

Fighting the widespread perception of hacking as criminal activity is a challenging local issue. The use of metaphors over the Internet are common technique to avoid filtering and censorship crawling performed by the State to enforce the Great Firewall of China (REF). *In China, many words are polluted, just like "young lady" or "mistress"* [小姐*, xiǎojiě*] *now means prostitute. Another word is hacker* [黑客, *hēikè*]*, which is specifically used for crackers* [骇客, *hàikè*]*, illegal crackers. Tsinghua University will teach every student again and again, "Do not be a hacker! It is very bad!" Free Software and Open Source, especially Free Software in China has such a hard time for this reason. People think "well, freedom, whatever you want to do is OK". Freedom in the Chinese context may mean that you do not have to pay it back or contribute it. Just get it.*

So, you know, many guys do not know they have the duty to contribute and pay back. Not to mention that software is not free. Free Software is not free. Maybe they have to pay for it. The question is more profound, because of its binding nature, than the dilemma that is presented by media portraits of hacker activities in China and in other parts of the world where hacking is equated with computer-based criminal activity. For Nalaginrunt, it involves a demand for responsibility instead of being mere software development. *Last but not least, is the real freedom. This is a metaphor not only in software, but for all my life. I'm seeking it everywhere I can go. So, what is the real freedom? It's not to allow you to do anything what you want to do, it's not freedom, it's self-indulgence. The real freedom is that you can (or have the ability so no one can stop you) to do the things you SHOULD do. If I want to share the knowledge with my neighbor, this is what I should do. Jesus told me to love my neighbors. If some laws/rules prevent me to do that, it breaks my freedom. It is just protecting the profit of someone, although the fooled people always think it's right.*

For the members of his generation growing up under Deng' s political and economic reforms, politics is an unbearable topic. *I think I have no special interest in politics. Many young guys in China heard too much about* [politics]*, they just get it reversed. They just hate such a word... too much politics.* When asked about his work for Free Software and its political importance, he would reconsider his positioning and cast it under a different light. *When I get involved in Free Software, maybe I am just playing a role as a political figure, an activist. Well... you know, I can only answer this question in a religious way.* Nalaginrut is a devout of christian faith and identifies himself as a New Calvinist. His church *is not a church, but it is a church,* that is, it looks more like a person's house. It is a big rental room in Shenzhen where they assembly for cult and bible group readings near Huaqiangbei market. His priest is well connected with the official State religion local representative, so they are not to be bothered with the official party line. *I have a duty not to just mention Free Software to the other guys, "oh, it is good." I have the duty to practice, to make people in this land to learn about it. My duty is to be the messenger. I am not the hero because there are too many guys in Free Software and Open Source world who are heroes. They can influence many things beyond our expectations. I just cannot do that. Maybe my kids will be able to do something more than me. For now, I am just a messenger. I have to work to practice and do something for other people.* Growing up there was no discussion about religion as it was identified as a source of *evil.* Even to this day the topic of his new found religious belief is not discussed in his family. It has become a taboo topic after an initial conversation he had with his parents by the time of his conversion.

When questioned about his reasons for engaging with Free Software technologies, Nalaginrut would elaborate on the importance of creating a new future for his children. *What I wanted to tell you is... why am I hacking! All the hacker things, all the knowledge, all the books I have read are meant for hacking for the children. Yes, for me, the final hacker purpose is the educational purpose. I cannot say it is for all educational purposes or for other kids, but it is for my kids. Once a guy told me this phrase: "the most valuable thing a father can give to his kids is his experience about life". Not assessment or money or house, they are nothing*. His overall view on hacking is explained using metaphors his experiences of reading martial art novels, one genre in particular describes the virtuous martial art of ancient China, wushu [武術]. *The* *metaphor of* [武, *wǔ*] *means "to stop conflicting". This character* 武 *means to stop fighting, and it describes the tools and functions of fighting: fight to stop fighting. This one here is very important word for Chinese people* [侠, *xia*]. *Not everyone with martial art can be called hero* [侠] *but those who have good reputation and very high Kung Fu can do good something to stop bad things. So, you can imagine Stallman, he could be very rich because he has very good skills, he could hire the highest Kung Fu guys, but he is doing it not because he is ambitious, to earn something. This metaphor means a man who intends to be mediocre, not to be outstanding. He is dedicated not to be outstanding, but he is really outstanding.* The usage of the metaphor of the martial arts hero describes a position of a person who is respected in society because of his accomplishments without the need of displaying his skills. *The metaphor contains a very profound philosophy* [of what it means] *to be a real man, because if you are really outstanding and you try to show how outstanding you are, people will be jealous of you and you will have few true friends. This is part of the art of xia. So, you will get many friends and you will not have big pressure to find work, pressure on your hacking. This is called wushu. So, this is the metaphor I use.*

3.2. Conclusion

What these four narrated trajectories describe is not only the personal commitment to the collaborative advancement of software and hardware but the questioning of technology in the form of an ethical problematization which subordinates orientations toward efficacy, economic return, and final purpose of technical systems to issues of their applicability and suitability for a good life. Whether justified by the injunction to retribute to and support a particular collective, these life histories evoke what is at stake and can only be realized for oneself in the realization of the other. We find in the previous personal accounts the tension between the adjustment of dispositions to a hacker moral order and dissent with respect to transnational, hegemonic technical, educational, and political regimes, being this very tension a major opening for ethical reasoning.

In the four trajectories there are points of convergence and divergence to highlight. For this purpose, it is opportune for us to return to the question of which I opened this chapter: *What are the moral sources for the perceived and narrated need for information exchange and communion in technopolitical projects?* To respond to this question, I applied the theoretical framework introduced in Chapter 1 for the study of *personification* with a focus on intersecting moral and sociotechnical orders.

In terms of their similarities, all of the four technologists started at a very young age in distinct contexts of computing of the 1970's, 1980's, and 1990's. They had close relatives and friends whose guidance they relied upon to access computer machines and technical documentation. Discovery of computing involved play and puzzle-solving. Despite the purported need for individualized and solitary study in programming, their experiences unfolded in particular sociotechnical orders with the exploration of computer technologies in factories, research laboratories, computer clubs, households, and early online communities. Their conditions of technical cultivation had yet another similarity: computing was invariably accompanied by a strong emphasis on the moral and the political, either against military applications or as a means for communion and social change. Interestingly, each trajectory culminated in transformative experiences of communion through Free Software or Open Hardware development. As we saw in this chapter, transformative experiences rendered visible through the articulation of dilemmas regarding digital technologies as either manipulative or liberating powers.

In terms of contrasts, the four trajectories expressed four ways of articulating dilemmas from different moral sources in respect to hacking.

Gniibe's coming of political age happened in the early days of computer networking of the 1980's and formation of Internet communities in the early 1990's. Online spaces in which one was supposed to present him or herself through public discussion contrasted with Gniibe's experiences growing up under the norm of preserving harmony in the family at all costs. He was supposed to avoid discussing politics among family members and keep to himself his opinions about political issues. His father's position in the Japanese Self-Defense forces was a taboo topic within and outside of his family circle. In contrast to his North-American Free Software collaborators, liberalism was, at most, a vague memory of a lecture he attended in college not a source of moral guidance or political identification. It was crucial for Gniibe's formation the opportunity to experience the so-called “golden era” of consumer electronics and semiconductors in Japan of the 1970's and 1980's. In this context, he learned from electronics kits and popular sources of information of the local scene of radio tinkering of the post-war period (Takahashi 2000). Radio was a popular hobby during the consolidation of the consumer electronics industry in Japan, which kept its market dominance until the late 1990's but not without the exploitation of poorer Southeast Asian countries. It eventually lost its position as the Asian center of gravity for electronics production as an increased number of Western companies moved manufacturing plants to Taiwan and mainland China (Chandler 2005; Ong 2010). Economic stagnation in Japan was partially curbed by the globalization of the Japanese cultural industry with TV shows, animated series, games, magazines, and electronic gadgets in the 1990's (Allison 2006) supported by a governmental directive to extend IP provisions and enforcement mechanisms based on the US example to recreate the "nation built on IP" (Takenaka 2009). Gniibe's deep involvement with counter-initiatives to the global advancement of the IPR was facilitated by his position as a network administrator and his intimacy with computer architectures and programing. He held a privileged position in the Japanese government with more autonomy than usually granted for being appointed as a researcher, which allowed him to allocate most of his paid-time to Free Software advocacy. Gniibe's positioning was rather peculiar in regards to the understanding of the moral implications of his technical practices. The point of developing Free Software and Open Hardware technologies for him was to prevent himself from exercising his power. Drawing from the Confucian version of the golden rule, Gniibe consciously attempted to refrain from imposing his technical power onto others. He espoused a Zen approach to computing in his refusal of dividing producers and users, himself and the collectivity with an outright denial of posing ethical issues issues in terms of a sovereign "I" as the center in relation to an external "you" and "we." For his Free Software activism, it has been a very difficult position to sustain as it involves tensioning established social arrangements, speaking up to confront established powers in the name of technological alternatives.

Under different but dire forms of interdiction and control, NalaGinrut dealt with tacit prohibitions for being a child growing up during the period of liberalization and introduction of the draconian “one child policy” with advancement in scientistic policies in mainland China (Greenhalgh 2008). Having parents who held positions in the central government led him to embody a common position of his generation: they heard so much about politics, he would tell me, that they did not want to talk or even hear about it. Our conversations about the subject had to be kept private or, even, deleted from the transcripts. In a radically different context for learning digital computing, NalaGinrut experienced the scarcity of hardware, software, and information regarding computer systems, but had the privilege of an urban Chinese upbringing with economic stability, having the means to be tutored and to get his own computer during Deng's *Nanxum,* a period of economic liberalization with strong State centralization with series of reforms involving property rights (Greenhalgh 2008). His first computer, an Intel 486-based machine assembled in China, became popular among urban families by the 1990's following the acceleration of global production of domestic computer technologies outside the United States (Dedrick and Kraemer 2006). Growing up during Deng's reform created possibilities as well as constrains for NalaGinrut's trajectory which were summarized by researchers studying the process of individualization in the country: increase in voluntarism among young Chinese in urban areas; importance of the family in defining personal identities; and the shift from collective-oriented to individual-oriented values (Hansen and Svarverud 2010; Yan 2009). Whenever I insisted in suggesting that a great number of Chinese engineers had comparable skills in relation to their Euro-American counterparts, NalaGinrut would outright reject my position, launching into a description of how unskilled the local community was in comparison its Euro-American counterparts: *those guys*, he sentenced, *have everything*.

Speaking of the “Age of Free and Open Source Enlightenment” in China, NalaGinrut interprets the stages of (technical) development which is a recurrent form of explanation for the process of modernization with Chinese characteristics, that is, a modernization that does not dispense with Confucian paternalism, observation of established hierarchies, and familialism [*jiazuzhuyi*] in its current form of “*guanxi*-based” capitalism (Nonini and Ong 1996). Ties with transnational Free and Open Source projects are considered not only valuable, but highly desirable, and crucial in organizing symbols and public resources for mobilization of communitarian initiatives of great importance for local training. Free Software for NalaGinrut's moral practice can be thought of as a form of soteriology. It is through his service as a *messenger* that ordinary Chinese engineers will be converted into hackers. NalaGinrut's rendition of protestantism is applied in his work as a Free Software evangelist. He describes being elected as one whose mission was to create conditions for a hacker community to flourish in China. His duty was to spread the word of Free Software and its mission in the local community. In his definition of hacking as a heroic quest, akin to the literary genre of *wuxia* from which the hacker embodies the figure of the epic hero, the possibility for women to be hackers is foreclosed as they are—until recently—denied the role of *xia.*

In contrast to the East-Asian experiences of both tacit and overt control of one's expressions, Mitch described a liberal familial context with lively debate involving his parents on topics such as the wrongdoings of the government in the Vietnam war. He was not only not impeded to talk, but actively asked to position himself regarding a variety of political issues. Growing up in an atheist family and instructed to make rationally-informed choices by himself served Mitch later in life to rethink and exercise his ability to act upon himself. One of Mitch's transformative experiences involved being confronted by Euro-American technologists at a hacker conference in Germany with respect to his creations which led him to reconsider his assumptions of the *natural path for protecting one's work* through intellectual property titles. His recounting of the event evokes the symbolic efficacy of hacking for bind computer technologists, while severing ties with the intellectual property regime on an ideational level. It is not an easy decision for one to outright reject legal authorship in the context of the egocentric Euro-American tradition, despite strong campaigning and effective action to flexibilize and circumvent IP restrictions. In virtue of his creations and his past experiences with communal forms of living, Mitch was drawn to the domain of hacker sociality by European hackers who perceived with admiration the technical and political implications of his projects. At the same time, he was acknowledged as an important contributor as he became widely known for traveling the world to promote the idea of hackerspaces as convivial spaces as well as for teaching the novice how to solder with Open Source hardware kits. His numerous global encounters with hacker communities has served ever since to create transnational ties among technologists in detriment of ties with the IT industry, the military, and with those created through a form of symbolic participation in the public sphere of commercial, mainstream media. Turning off TVs in public spaces using Mitch's TV-B-Gone signals, with infrared light patterns as much as through a political message, a denial of participation, a negation of connivance with commercial media, identified as the primordial vehicle of mass consumerism. Ties with the military, the computer industry, and the media are the ones which are meant to be hacked. Fostering ties for new forms of production and conviviality around information technologies goes hand-in-hand with the perceived need of severing other ties that also constitute the experiential world of computing. In his quest for community and communion, he dealt with a constant struggle of realizing himself in relation to others. He celebrated himself in a tradition, as we saw in Chapter 1, from Walt Whitman to Henry David Thoreau.

In the Southern hemisphere, Oliva grew up under two forms of interdiction of political voice: one from his immediate family, given the burden of their memories of emigration from Europe due to geopolitical disputes and inhumanity in the context of World War II, the other, given the ubiquitous surveillance and control of the dissidence by the military state during the dictatorship regime in Brazil. This period was also characterized by the market reserve for electronics and computer technologies (Schoonmaker 2002; Marques 2005). This closed environment created the conditions for local production and distribution of computer clones, giving rise to a small domestic software industry. His privileged socioeconomic background guaranteed him access to computer machines and technical documents in English at the time when they were not easy to come by as they had to be obtained with importers or friends who had the privilege to travel abroad. His contact in college with various religious systems, his encounter with low-income students at the volunteer-run preparation school, and his participation in a gift economy among expert computer programmers in the early computer inter-networks placed him in a position of having privileged conditions for active learning, which eventually led him to reflect deeply upon his work and what he could do to improve the world around him with his special technical abilities. His formative university years created a dilemma for him: to what use should he dedicate his skills? In studying different religious systems, he identified a common spiritual precept anchored in many variants of the Golden rule, which years later would be attributed to a "natural attitude" he reproduced in the context of the Internet-based software sharing.

What we learn from these four trajectories is how contrastive moral sources shape exercises of ethical problematization and elaborations on hacking. Despite sharing the transnational symbols of openness, collaboration, transparency, and inclusivity, there are specific ways in which technical experiences weight on each trajectory. Mitch, for instance, only came to resignify the influence of his parents in his early purchase on rationalism and atheism later in life. It was only as an adult that the personage of Mr. Spock from the TV series Star Trek came to be identified as overly dysfunctional given his excessive rationalism. Mitch expressed this change in his perspective in terms of a balance between his emotions and his usage of logic, the discovery of a form of spirituality he identified as his own. In many ways, he sought out for meaning by quitting job after job due to his employers' involvement with the military and in favor of his quest for self-realization through the conviviality of autonomist collectives. Oliva, in turn, subordinated his volunteer efforts and wage labor to a notion of negative freedom from control of technology over users and producers. In his trajectory, he described going through an intimate transformation by also using Mr. Spock as an example and pointing out the role of spirituality in situating him in the world after the *pillar of logic and rationality* was already firmly placed in the constitution of his sense of self. Conversely, Gniibe and NalaGinrut found ways to accommodate their religious and technical practices without conflict: for the former, through an integration of the spiritual and the technopolitical; for the latter, by interpreting his technical dispositions as a religious calling. The sense of duty both NalaGinrut and Gniibe described when justifying their work on software and hardware is evoked, however, for distinct reasons. Gniibe identified hacking mostly as *poiesis*, a form of creation which brings forth novelty into the world of technology. NalaGinrut defined his volunteer work as a project to create the conditions for his offspring and the future engineers of China to develop their technical skills and aspirations as hackers.

Cultivating a hacker personhood involves learning how to embody and perform reliable and desirable technical knowledge, whereas the performance is that of a form of masculinity informed by a broader gendered context of institutional training in science and engineering. In NalaGinrut's experience, *there are women hackers out there* but he has not encountered any in his work and especially not in China, despite the existence of women working for Chinese companies of various sizes and at various capacities but at lower positions, such as product management, circuit board layout, assembly, and quality control. In contrast, Oliva expresses interest in the question of gender and acknowledges the absence of women in various areas of technical endeavor, including his own area of concentration and strongest expertise: software compiler engineering. Mitch, contrary to the strong tendency of eliciting differences and attributing the body a minor importance[52], is outspoken about his sexuality and his

52 This topic was explored early on by Turkle (1984) and Levy (1984) in their pioneer studies of MIT hackers. Based on life-histories, Turkle, in particular, situates the topic of “hacker hygiene” and the neglect of one's body in favor of longer hours and days of concentrated technical work with great detail, highlighting painful experiences of engineers who considered themselves “ugly” and “socially inept,” which, according to them, would make them fit “naturally” for a career in engineering. The topic of necessary isolation and focus for cultivation of skills interestingly enough is one of the

experiences in queer communities. When discussing the issue of masculine performativity and competitiveness, he attributes it to the socialization of geeks of being targets of bullying in US schools, which tends to alienate them from larger social groups and respond with the formation of smaller groups of technically and scientifically-inclined peers. By attending to a more homogeneous group with similar interests in particular games, books, and technical and scientific topics, computer and science “nerds” and “geeks” come to identify themselves as technically-capable persons through masculine forms of argumentative competitiveness.

The literature on gender, technology, and science is of key importance in unveiling fundamental aspects of hacker personhood. In articulating “love” with “Open Source hardware” as a means for a fulfilling life for the individual, Mitch re-articulates the symbolic context of the technosciences as a practice of (traditionally masculine) control over (historically “female”) nature. As Fox Keller's (1985) research on gender and science suggests, the historical conditions for the constitution of modern subjects of science rested upon the symbolic opposition of thoughts, feelings, and subjective impressions (as attributes of a female experiential realm) to that of impersonal, objective, logically sound, and rational practice of men of science and computing. Based on this ideological distinction, a rift between orders of experience was created imposing a division between gender identifications which led to the exclusion and

recurrent themes of discussion among hackers themselves and one that I identify in the four trajectories we saw in this chapter. Some attribute it to depression, such as Mitch, others attribute it to societal and familial pressure to succeed in school, such as NalaGinrut. They all attribute it, however, to the deep interest in learning by themselves—sometimes with perceived negative effects in life as discussed by Oliva: his obsessive focus on Free Software development made him neglect other aspects of his formation, which he regrets for not concentrating in the study of other subjects, such as philosophy and history.

marginalization of gender minorities in science. Central to Fox-Keller's argument is the observation that the "capacity for objectivity develops together with the articulation of self and gender" (Fox Keller 1985:71). The political effect of (masculine) performances of technical mastery that were denounced in the recent literature on gender and Free Software is an entry-point to the study of enskillment. This literature does not, however, address the fundamental conditions of cultivation which can be studied through the technicians "work" upon themselves over relatively long stretches of time.

As we saw for the four trajectories in this chapter, cultivation of computing expertise starts very early in childhood and involves specific means of incorporation: strong support in the family for education, local or remote contact with more experienced users and peers, access to documentation, computer machines, software, electronics parts and tools. As central as the issue of masculine performance as a condition for participation in technical groups, the question of the intersubjective foundations of hacker personhood were accessed through the analysis of encounters and disencounters, engagement and disengagements involving technologies and technologists in transnational software and hardware development. In the process of reviewing interview transcripts with the research co-participants, I would often get messages such as this one from NalaGinrut: "You will not believe, I am reading Niibe's network code in the Linux kernel right now!" After fieldwork, events such as this were hardly surprising. I found that encounters were very commonly held over the media of software, hardware design, conference presentations, workshops, and documentation, in which names of Free Software or Open hardware authors signaled existing and potential ties with other projects, technologies, and technologists. This dispersion of technical artifacts and technologists created a common infrastructure for exchange as well as a sense of familiarity and belonging. Shared pathways, for instance, put Oliva and Gniibe on the same global task, partaking the work of activists promoting a new version of the GPL in its third edition, helping to organize events to debate the new license in Brazil and Japan. Oliva and Mitch shared the stage of the International Free Software Forum in Brazil to deliver keynote presentations on different subjects but along a shared ethical plateau (Fischer 2003). NalaGinrut and Mitch participated in events at the local Shenzhen makerspace, Chaihuo, in which the latter was given by a member of the former's local group, Shenzhen DIY, a replica of TV-B-Gone made in China as a symbolic token of recognition, a returning gift.

Despite long distances and the concentration of technical activities in the Euro-American axis, personal and technical pathways are often crossed at transnational instances of Free Software and Open Source hardware development. The general reciprocity sustaining encounters and remote collaboration is founded in the practice of gift-giving among strangers and is oriented by an ethical imperative. It transcends face-to-face interaction, despite the importance of regular meet-ups for cohesion and coordination of work among Free Software developers and Open hardware engineers. The impersonal characteristic of the process guarantees the extensibility of Free Software and Open hardware as a gift but not its sustainability, as local conditions for reaching the point of being able to contribute are not trivial to achieve as they rely on recognition of technical skill and trust.

The discussion of one's identification with hacking in one's life was meant to address coexistent, conflictual, and invisible forms of technical self-cultivation, personal identification and belonging, which are religious, political, and familial in shaping experiences across local and transnational scales. Not only different positions are taken in the order of historical narratives through which hackers as spoken through as queer, Neo-Calvinist, anarchist, Confucianist, Mohist, but along personal narrated trajectories in which cultivated dispositions are made body and mind, and thus the very existential ground for perceptive and differential forms of engagement with the world of alternative computing. In the next chapter I will turn to the ethnography of spaces and places of hacking with the goal of exploring the sociotechnical foundations of an identifiable contemporary practice: the formation of convivial places for material and symbolic exchanges in a global network of community centers.

CHAPTER 4

Imagined Spaces and Convivial Places of Hacking

> "This place, this non-home home is more than that though. It's a place to chill, a place to party, a place to work: a place to worship the technology that makes up it's members hearts and dreams. The members, the initiates, the visitors, these are people who live and breathe computers: who want and need them for all they do, who draw from digital devices the strength to do whatever they damned well want. In that sense, then, this is a place of worship" – tfish, source: http://www.l0pth.org/history

A hackerspace—we were told by a member during an ordinary gathering at Tokyo Hacker Space—relies on three variables: *its space, its people, and its projects.* From its people, hackerspaces become places for dissemination of information and socialization with public exercises of expert knowledge. Through the means of its members, a hackerspace expands beyond the limits of a city, a region, and a country into dispersed networks of technologists who travel around the globe to attend conferences and give workshops. From its members' projects, a hackerspace travels widely as a symbol through tangible and intangible media, articulated in instances of remote and face-to-face exchange. Based on its physical space and its equipment, hackerspaces afford certain projects while constraining others, facilitating encounters, lasting experiences of communion and playful banter, serving as much as a magnet as a centrifugal force for curious and non-initiated newcomers. From the combination of these three dimensions, hackerspaces support both imagined spaces and convivial[53] places.

It is part of the ethnographic experience of arriving at global cities to work among technologists an impression well depicted by Georg Simmel (1971) with the sociological figure of the stranger: wandering in the anonymity of crowded streets among busy and fast-paced transient professionals, not quite outside the group and yet marginal, estranged, and distant. The sentiment of invisibility and disconnect which is afforded by the immersion in the city's fast-paced crowd is suddenly interrupted as one enters into a hackerspace. There one may find excitement and puzzlement with shared technical and political interests. One could discuss what does and what does not work for a certain experiment with a particular set of tools; one is likely to find skilled and curious partners for collaboration on projects with various degrees of complexity—from environmental monitoring to basic soldering workshops, computer security to programming lessons. Hackerspaces offer a place in which the experience of strangeness can be amplified or obliterated. One might still be distant after the ritual rounds of introduction at regular meetings as questions about what does one "hack" on

53 I use the term here as a reference to a highly influential book for pioneer hacker activists of the San Francisco Bay area, Ivan Illich's "Tools for Conviviality" from 1973. In this chapter, I discuss the extent to which the politics of hackerspaces as a heterotopic space for liberation through reclaimed technology and redistributed technical knowledge is collectively embraced and yet disputed and challenged in the actual, everyday experiences of participants. In Illich's definition, conviviality is the "opposite of industrial productivity. [It means] autonomous and creative intercourse among persons, and the intercourse of persons with their environments; and this in contrast with the conditioned response of persons to the demands made upon them by others, or by a man-made environment" (Illich 1972: 24). For an analysis of two precursors of the contemporary hacker and maker culture in the Bay Area, the counter-cultural and the cyberculture movements, see Turner (2006) on the topic of digital tools and systems for liberation and conviviality; Levy (1984) for a historical account of the first generations and Cameron and Barbrook (1996) for a critical presentation of what has been called after them the "Californian Ideology."

or “make” are often asked as conversation starters.

Focusing on personal trajectories, forms of exchange and governance, and technical projects at community spaces, I describe in what follows the experience of different collectives of the hackerspace network in San Francisco (Noisebridge), Shenzhen (Chaihuo), Hong Kong (DimSumLabs), and Tokyo (Tokyo Hackerspace). In order to study the interconnections and distinctive features of each of these spaces, I will approach each case through Foucault's notion of “heterotopic spaces” (Foucault 1984), defining hackerspaces, for analytical purposes, as spaces of difference. It is particularly useful for our discussion Foucault's definition of space as “set of relations which delineates sites which are irreducible to one another” pointing to the specificity of socioeconomic and political forces intersecting local, regional, and transnational dimensions in emergent technical localities. Hackerspaces can be framed as convivial places for standing as “singular spaces to be found in some given social spaces whose functions are different or the opposite of others” (Foucault, *ibid.*). In other words, spaces meant for “hacking” and “making” with fluctuating and disputing definitions of hacking, and the hacker personae nonetheless, created against or in parallel with institutionalized places of experience for technical training and labor in the context of IT companies and educational centers. Hackerspaces and makerspaces hold in practice and discursive practice the promise for creating alternative modes of engagement to engender new productive arrangements, guided by ideals of horizontality and solidarity among co-workers and collaborators internationally. These ideals are mostly shared horizons and points of arrival not departure for the creation of imagined spaces as convivial places as we will see in this chapter.

In terms of its general presentation, this chapter is organized along three axes and centered around the constitution of community spaces as follows: 1) the production of new places of sociability (*hackerspaces as convivial places*); 2) their emergent socioeconomic and technical arrangements (*projects as convivial technologies*); and 3) the circulation and cultivation of technologists who animate the imagined spaces and convivial places (*persons as hackers and/or makers*). Hackerspaces demand framing interactions, which tend to be scripted in particular ways to encourage exchange as well as active self-training and informal learning. The emphasis on the question of who gets to actively participate opens up the space for the analysis of social distances as well as of possibilities for cultivation through experiences of membership. Participation, therefore, will be explored with the discussion of the key participants' trajectories in their respective collectives, drawing from our discussions on personhood, morality, globalization, and relationality from the previous chapters. For the discussion on spatial arrangements and global interconnections, I will describe the circulation of technologists and their projects with a focus on shared practices which serve to create social, economic, technical, and imaginary ties between distinctive locales for computing and electronics.

4.1. Noisebridge Hackerspace

Noisebridge opened its doors in the Mission district of San Francisco in 2008 after almost a year of planning in regular face-to-face meetings of local computer hackers, electronic engineers, and tinkerers. In one of the early meetings, one of the founders described Noisebridge's purpose as a "hacker embassy:" "this nicely sums up one aspect of what we hope Noisebridge can be—a public face for hackers to the greater community, and also a focal point for the Bay Area hacker community to interact with other hacker communities around the world[54]."

One of the key events for gathering momentum and bootstrapping Noisebridge was the summer tour of North-American hackers to European hackerspaces in 2007. After the summer tour and the experience of communion with Euro-American technologists at Chaos Communication Camp, a group of friends returned to San Francisco and started to work on the preparation of what would become the first public space to carry the title in the Bay Area. The group grew fast as the original proponents mobilized their own networks to find people to help organize the space. As soon as Noisebridge outgrew its capacity in numbers and projects to accommodate everyone and everything at the original space in a small room in one of the back alleys around the 16th and Mission of the Bay Area Rapid Transit (BART) subway stop, they moved to a much larger rental space and became widely open to the public. As one of the founders casts publicly his version of the early days:

> "We decided to become a 501(c)(3) tax exempt educational member non-profit California

54 Source: Noisebridge Discuss Mailing list, https://www.noisebridge.net/pipermail/noisebridge-discuss/2008-January/000088.html, accessed 12/03/2012.

> corporation [...] We were granted the tax exempt status shortly after moving into our first space at 83C Weise on 1-September-2008. We outgrew 83C within 3 months. After extensive searching by dedicated Noisebridgers, we signed a 3-year lease at our current space at 2169 Mission on 1-August-2009. A build-out team formed itself, and, as is the case with everything at Noisebridge, with no leaders, and our one (and only one) rule (Be excellent to each other), people self-organized to create a plan for how to lay out the room, created plans for build-out, and within 30 days, fixed up the empty (and grungy) space (that used to be filled with people sewing garments) into a beautiful space that we could, and did, move into before our move date of 1-September-2009. Our numbers have continued to grow steadily, with a big jump after the Maker Faire in May-2011. Hundreds of people (most of whom are not members) go through Noisebridge each month[55]."

The encounter of North-American and European hackers in the summer of 2007 was the impetus for the composition of a very influential document, "Hackerspaces Design Patterns[56]" put together by two experienced Chaos Computer Club members after several rounds of discussion among members of various European hackerspaces about organizational patterns and anti-patterns. The document was meant to help guide the creation of new spaces. The European tour inspired North-American hackers to create community-driven spaces, which were readily launched by late 2007 in New York and Washington DC and, one year later, in San Francisco. In this formative period, an international network of hackerspaces—initially limited to the Euro-American context but soon to be expanded to various countries in the global North and South—took shape based on previous existent networks connecting European and North-American hackers. For the United States, it represented a third wave of independent computing and electronics associations, posterior to the creation of electronics hobbyist clubs of

55 Source: https://noisebridge.net/index.php?title=Oral_histories, accessed 01/12/2014.

56 The discussion of patterns developed in computer science under the rubric of "design patterns" to solve common engineering issues, and also influentially in architecture with the publication of a key document in participatory design, "A Pattern Language", published in 1977 by a group of architects which described organizational patterns for urban dwelling with a sociotechnical approach. This chapter draws from these publications to describe the experience of participation and construction of hackerspaces.

the 1960's and 1970's, the exclusive computer clubs in the 1990's, and the experience of temporary autonomous spaces—so-called “hacklabs”—providing access and training for activists in the context of the anti-capitalist globalization movement in the late 1990's and early 2000's (Juris 2008; Maxigas 2012).

Noisebridge is known for its diversity and rather peculiar demographics, a place one can find individuals from various socioeconomic strata and with distinct degrees of cultural and technical capital, which are not to be found in other makerspaces in the Bay Area. Noisebridge encompasses activities in various areas of expertise, involving artists, musicians, system administrators, software developers, electronic and mechanic engineers, electronics hobbyists, computer security professionals and researchers, teachers, activists, lawyers, and newcomers to programming and electronics. Since its inception, the space has served as a launch pad for companies in the nascent business of Open Source hardware and 3D printing, as well as for collaboration with several Free and Open Source projects. Public activities are held at the space comprising networks of technicians and activists, spanning through a wide range of topics such as algorithms, operating systems, game development, 3D printing, electronics, time-bank collectives, activists for social justice, digital inclusion, and Internet privacy issues, NGO activists, students pursuing science, technology, and art degrees, information security, among various others areas of expertise and interest. One can find a wide spectrum of socioeconomic positions as well among active members and non-members: from elite university educated young adults, start-up founders and employees, and established senior engineers working for companies in the Silicon Valley to homeless youth and unemployed squatters living on charity and welfare programs of different age groups.

The space accommodates a very diverse group without disguising the fact that it is, still, in its majority, predominantly Euro-American in its constituency. Interestingly enough, the Hispanic populations of the Mission neighborhood, as well as other minority groups from the city, are to be found only sporadically at Noisebridge. It is rather common for marked differences of socioeconomic background and technical expertise to be the source of tension in the context of meetings and debates on and offline. Along gender, socioeconomic, ethnic, and cultural capital distinctions, various groups share the hackerspace but do not come together as often to participate in the same circle of conversation, except for open workshop and classes which are open for all. Impromptu discussions require a level of knowledge and expertise to join on topics such as cryptography, algorithms, and electronics. Social networks overlap and, at times, collapse at the space—groups from squats, shared houses in the city and across the Bay Area, political organizations, groups sharing a certain occupation in tech firms, such as system administrators, come together in political events and, at times, are at odds with each others' political stances. In open workshops and classes, newcomers are anonymous in amidst groups of members and non-members, whereas most of those who come for a class rarely stay to participate in the meetings and in the everyday life of the space, leaving promptly as instruction ends. There is yet another group with those who stay and become integral to the political and technical life of the space. I was one of those willing to learn, to teach, and the help the space as it intrigued me as much as it did to others how important would it be to make Noisebridge thrive as an experiment in technical politics.

The radical openness of the space—seven days a week, twenty four hours a day without closing as long as it is occupied by someone—was often celebrated when communicating about the greatness of the space beyond the boundaries of its collective but also increasingly disputed among members, non-members, and outsiders through various channels, such as the face-to- meetings and online discussions. In pragmatic terms, openness means that whoever wished to come visit, attend or hold a class, meeting, or workshop, or just meet people and socialize was welcome. Because of this policy and the wide distribution of gate codes and physical keys, Noisebridge served as a public more than a private space. Conflicts often arose from the perception of "over-use" or "abuse" of Noisebridge's facilities and tools. Its openness, nonetheless, was generative of spontaneous collaborations, exchange of know-how among strangers who come to meet at Noisebridge and work on or debate topics of interest.

The space was very dynamic in its turn-over of attendants as well as in its spatial arrangements. In a matter of weeks, furniture was moved around, new donated equipment was received and stacked on whichever surface was available around the "hacker alley"—a place for storage of donated equipment which is available for anyone to use and "hack" on. The chaotic feel of the space was very attractive to those with experience in computer and electronics labs in which piles of computers, tools, peripherals, and storage media may be found dispersed in a landscape of technical artifacts, diagnostic tools, posters, and imagery with political messages.

Noisebridge's fostered entropy was also the source of anxiety among those with a more ordinary and disciplined experience with technology and those who have the necessity of a cleaner, quieter, and organized environment. The vast area of the space—a 5,200 square foot space with two bathrooms, a dark room, 3D printing area, dirty shop, library, two classrooms, plus other common areas—occupies the whole floor of a commercial building above a garment factory populated by workers of Cantonese origin, a Hispanic grocery story, and in front of a Latino evangelical church. Noisebridge's area accommodated comfortably large workshops and classes. It also allowed for a certain degree of personal distance and parallel activities, affording a certain degree of anonymity. Non-*habitués* could circulate unnoticed in the space, while other people, immersed in their activities with headphones on and in front of their computers, could easily avoid being disturbed with parallel conversations, averting eye contact. At quite often times, Noisebridge felt like an extension of the public space of the Mission without its original inhabitants, where one was able to find a huge distribution of characters from young hipsters and computer professionals to homeless and vagrant young with their dogs and loaded travel backpacks.

Standing as a heterotopic space for intersecting art, politics, and technology, Noisebridge was built around alternative forms of sociality. Its landscape was composed by a wealth of electronics and computing equipment, used machines and peripherals ready-at-hand for those with skills to use and re-purpose them. Its place in the context of other places for computing—such as educational institutions and IT firms—is suggestive to experiment in technical learning. Its library was impressively well-stocked on topics of computer programing, electronics, and hacking. It included various exemplars on software development, electronics, and network hacking as well as feminism, intellectual property, and science fiction. The walls of the space were covered with messages, slogans, stickers, and posters with allusions to political issues. Unlike the plasticity and vapidity of Facebook headquarters' decoration around its commercial and corporate PR twist of the notion of "hacking" and necessity of moving forward and "shipping code" as fast as possible, Noisebridge members spouse various versions of what it means to "hack" and to be a "hacker" which can be read on the walls, zines, or pamphlets dispersed throughout the space. It is a lively topic of regular conversation as well. The landscape was suggestive of its political orientation toward conviviality by the way of shared slogans, high availability of tools, and openness to participation in workshops, classes, and everyday use. Symbols articulated around Noisebridge narrate the contemporary political context with stencils of Chelsea Manning, critical cartoons against the usage of the US DARPA funding for sponsoring hackerspace projects and events; posters exposing cardinal values for Noisebridge—*do-ocracy* and *excellence*—are to be found right by the entrance door and as a saturated, pre-constructed object of everyday discourse.

Around the space, differences are to be found in the way activities are territorialized. Right by the entrance and in front of the wall retaining the "member shelves" was the "hackatorium" with a set of long tables where people sit by to talk, have meetings, and write code. Conversations are, in general, about technical topics and, sometimes, political issues, and easily turn into battles of wit in which individuals perform the knowledge of a particular technology or spouse political positions. Next to the library and in front of a former dark room for photographic work, where one can find stools and high tables, was a place where people normally concentrate on their work using head-phones, which was not necessarily software coding, usually occupied by more anonymous or marginal Noisebridge attendants. The same applies to the backroom, when it was empty and the kitchen, which was usually occupied by those who are non-members. The server closet holding the network infrastructure was an informally forbidden area for do-ocratic experimentation given its control and oversight by a tight-knit group of Noisebridge system administrators and early members, most of them were no longer regulars.

Noisebridge fulfilled, at once, the role of an enigma, a place technologists either enjoyed and supported or avoided in San Francisco. Its neighborhood, the Mission district, was increasingly a place of contrasts: expansive boutiques, fancy cafes, and gourmet restaurants were placed at the heart of the neighborhood just a block away from churches conducting services in Spanish, migrant community support organizations, pawnshops, and second hand-stores, remittance service shops, massage parlors, flea hotels, catholic missions, small Latino-run businesses, with street vendors selling popsicles and copied DVDs. It was also the location for gathering of local political groups, such as the Food Not Bombs collective. The neighborhood historically hosted South and Central American migrant families who have been gradually pushed outside the city as rent increases are driven by another influx of tech entrepreneurs and young tech workers. Remodeled and modern looking facades of some of the business locations on Valencia st. tells the story of a fast-paced change in a neighborhood that was once a marginal and stigmatized region. The effects of gentrification are rendered visible as the neighborhood takes part in the new prosperity bubble of middle class IT and creative industry workers, two of the fast growing economic sectors of the US economy alongside the war industry (Edwards 1994).

Noisebridge's space was not solely imagined, conducive of face-to-face encounters and collaborative engagements, but had an infrastructural function. The space not only hosted one of the fastest nodes of the Tor network for Internet privacy with exit policies and generous amounts of bandwidth, which was sufficient reason for occasional FBI visits and for high prestige among hacker collectives, but also served as a meeting place for gathering security specialists and developers of security technologies, as well as people who worked and advocated for privacy and increased information security. The space was, first and foremost, a place of encounters, classes, workshops, and occasional meetings.

Entering the Space

Throughout seven months of regular, daily attendance at Noisebridge, I came to learn what the space meant to its regular attendants and about the (partial) results of a collective experience in horizontal governance which has been attempted and rebuilt by its members and non-members. For the most part, Noisebridge stood for a place of cultivation and socialization, but also for distress and disillusion given its heavy demands for sustained participation in the community-driven governance procedures.

First time I came to the space I was offered a tour by a man in his mid-to-late forties, the same person who I would be invited to join other members in asking him to leave the space for his allegedly disruptive behavior and accusations of sexism, i.e., for "cat-calling" women in the streets, exactly twelve months after my first visit. He was identified by other members as part of a group of former Occupy activists and squatters who would spend time at Noisebridge on a daily basis. After going around the facilities and finishing the tour, I entered the elevator with him and another person; he, then, joked while gesturing as if he possessed a camera on his hands and was ready to snap a picture: “I am a Fed and I am taking a picture of you!” to what I responded with a half-smile and no words as I tried to understand what prompted his action. I came to realize later that privacy was a very strong value at Noisebridge, whereas video and photo cameras were not welcome in most cases, except for events with remote participation or journalist articles and live video streaming for the regular show-and-tell “5 Minutes of Fame” in which people from the community step-up to present or talk about the projects they are working on.

In my first attempt at joining an activity, I came to interact with a computer network enthusiast who organized weekly events for Unix and GNU/Linux system administrators. He seemed highly suspicious of the new faces, including mine, and introduced himself with the same handle he used for his online communications. In the first meeting I participated, he had with him a Pineapple router, a network device running a modified Open Source firmware for testing and exploiting computer networks. He seemed knowledgeable of network security at first and maintained face as a security-minded person, always using his turns to talk about the importance of personal privacy. He used also every opportunity to sustain a position of a learner of network hacking for educational purposes, stressing at every opportunity that he was not interested in intercepting wireless communications at Noisebridge. He reminded me and the other newcomers that the network of the space was very hostile and that one should not trust it. The same suggestion could be found in the Noisebridge wiki under “visitor advice”: “the network at Noisebridge, like any public network, should be regarded as potentially hostile. This means that you should assume that any unencrypted communications over the network could be (and most likely are) monitored by others[57]". In subsequent interactions, my attention was drawn to the importance of face maintenance and performance of technical knowledge around the space. In our next two meetings, I came to realize that I spent much more time teaching him the little I knew about computer networks, than learning from him or others. His hacker persona became unsustainable over time as his lack of basic network administration skills became evident. The workshop had always a very low attendance, despite the constant presence of *bona fide* system administrators physically at Noisebridge, participating in Noisebridge's online channels (being the mailing-list "Rack" and "Discuss" and the IRC channel #noisebridge the most active).

I eventually stopped attending the system administration weekly meetings and started to learn about electronics by joining a popular group activity—"Circuit Hacking Mondays" which was by far one of the most popular workshops at Noisebridge, hosted by a Noisebridge founder and various volunteers.

For the initial four weeks, I had no connections and no friends at the space whatsoever, just a few acquaintances who helped to bootstrap Noisebridge when it was located in a small room nearby the intersection of 16^{th} st. and Mission st. and who have ever since gave up attending the space because of its recurrent and seemingly insolvent problems regarding the open door policy. In my interactions with Noisebridge regulars, I remember being asked before getting to know people, half-jokingly, if I was a Fed when it was more likely for me to be a Mission district local, which were quite rare at

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57 Noisebridge Wiki, source: https://www.noisebridge.net/wiki/Visitor_advice#Hostile_network (accessed on 07/14/2013.

Noisebridge despite its location at the heart of a working class Latino neighborhood. A common topic of discussion in the space, alongside discussions of technical matters, was the wrongdoings of the government and its repressive apparatuses, so one could most likely overhear discussions about politics, FBI raids, and NSA spying—which followed the cases of Wikileaks, Chelsea Manning, Aaron Swartz, and well anticipated the leaked documents by Edward Snowden and the public outcry regarding the massive surveillance apparatus deployed by the US and other nation states.

I engaged in the activities of the "Circuit Hacking Monday" helping with what I could by arranging soldering irons in place, making little metal stands for them with hangers, and responding to questions on basic issues regarding soldering and placement of electronic components to the novice. I could not help as much as I wanted, since I was learning in the process myself from seasoned electronics engineers, so I would basically relay information on how to get certain things done just as I was taught. There was no shortage of people to help and to be helped at the space, which I came to realize how relevant it was for the interactions to be framed in a way that I could call the "pedagogical mode". In other words, when meeting people, parties of the interaction would either take up the position of the conveyer of knowledge and the recipient, and instruments and suggestions on how to get certain technical tasks done would be delivered. Over time, I realized this was a constant in respect to the nature of interaction at other hackerspaces as well.

Based on my experience with the electronics workshops, I came to learn about basic Open hardware projects and to experience assembling electronic kits with other enthusiasts, both novice and skilled engineers who heard about the fame of Noisebridge and decided to come visit. In one of these regular workshops for soldering and exchanging knowledge on electronics and Open hardware, while I was waiting at the door for a person at Noisebridge to open the gate, I was approached by one of the founding members who organized regular electronics workshops on Mondays. "Do you have a key?" he asked smiling to what I responded I did not. "Do you want one?" to what I promptly replied: "For sure!" He reached for a key in his pocket and handed it to me, "there you go," with a large expression of satisfaction. This gesture felt as a recognition of a connection and a vow of trust. It was not special for its exclusivity as I came to learn later, given that this gesture was repeated innumerable times, including in a performance in a TED talk on the international expansion of hackerspaces given by Mitch Altman in which he dumped dozens of keys on the stage in order to make his point about the radical openness of Noisebridge (and the importance of openness of hackerspaces across the international network). It was a special gesture in what it meant for those interested in Noisebridge in particular: it was an invitation for sustained participation in the life of the space, a tie which implied shared responsibility for it sustenance.

I was also offered other means to participate at Noisebridge, not only by possessing the physical key, but also through the electronic means of an electronic key code. In an ordinary evening, one of the well-known and respected hardware hackers—himself an inventor and enthusiast of technology and its political possibilities—was wiring a new inter-phone system for Noisebridge with a camera feed coming from the entrance of the building to the space upstairs. I was interested in the system and the activity in itself, so I followed it closely but silently, helping whenever asked. He needed a CAT-5 Ethernet cable, so he handed me a box of tools to prepare it, which I gladly did with skills I acquired during high-school in my own experiments wiring networks at computer labs, working *pro bono* in order to learn about computing (which I briefly mentioned in regards to my own trajectory in Chapter 1). He had to leave promptly to catch the last subway train and asked me to finish wiring the system, and so I did, crossing a cable across the building and along with a very precarious bundle of wires. The next day, he did not mention the wiring, but approached me to ask if I wanted a key code, a code that could be punched into the pay-phone at the entrance of Noisebridge to open the gate which I gladly accepted.

I came to realize how important being active in the space and doing tasks that were perceived as valuable for self-training or rendered innovative by experimenting with technology are as means for cultivation of relationships. One of my lasting impressions of Noisebridge was the prevalence of a mode of interaction, the "pedagogical mode" I suggested above, based on teaching and learning: more experienced tinkerers when asked a technical question would immediately launch into a very elaborate answer with full detail, and beginners would feel comfortable to ask questions and engage in response, or feel overwhelmed with detail and just nod assertively to be left to themselves. I have found myself asking questions regarding electronics and solving some issues for some of the regulars at Noisebridge who were teaching themselves GNU/Linux—a system I had sufficient familiarity to explain its main characteristics with certain degree of detail. People would often come to Noisebridge to look for help with malfunctioning computers and electronics, including the Mission residents. Some people would use the facilities and tools to fix their electronic devices by themselves, whereas others would come to ask questions and would eventually stay and end up helping others. “What are you working on?” turned out to be one of the most frequently asked questions; at the same time, a conversation starter around the space and a prompt for assessing someone's activities and skills. It also become a joke around more regular and homeless attendants at Noisebridge: the question itself had an inquisitive character as it would render obvious that one was not working on something technical or “worthwhile” at the space. This question, which turned out to be key as a conversation starter at hackerspaces, was also the first instance for the possibility of creating a social tie: it is an opportunity to share problems and solutions and to find potential collaborators. It is also a unique opportunity to demonstrate one's worth in face of other peers at the space.

Imperatives of Excellence and “Do-ocracy”

Noisebridge is known for having one basic rule from which all behavior and interaction is supposed to rely upon: the imperative of being “excellent to each other[58]”. In the daily life of the space, I came to experience the limits of its openness, the interpretative elasticity of the demand for excellence, its potentialities through the joy of entering interactions under the premise of excellence, and the disappointment with disputed versions of what it meant. Excellence is instantiated by another general orientation, the do-ocratic imperative, which stems from the hacker value of learning

58 One of the inspirations for the rule of excellence was the movie “Bill and Ted's Excellent Adventure” which tells the story of two Californian adolescents who are chosen to save the future of the Earth through time traveling under the premise of experiencing world's history and passing a history exam. The popular phrase at Noisebridge, “be excellent to each other dudes,” is borrowed from the movie and elevated, ironically, to an organizational principle.

and understanding through self-motivated and independent practical engagement—as discussed in terms of the “hands-on approach” in the classic study of pioneer US-based hackers by Steven Levy (1984). “Do-ocracy” consists in strongly emphasizing horizontality in decision-making with an *ad-hoc* orientation: as problems appear, rules are created and, after long period of deliberation, consented upon, instead of being created and enforced in *a priori.* Another way to put this in a hacker fashion is to suggest that, as locking mechanisms or restrictions are put into place, an unparalleled curiosity will drive the need to understand how they work and why they were implemented in the first place, leading, ultimately, to their challenge.

Noisebridge is imagined as a non-hierarchical group of inventors, developers, makers, and artists interacting as collaborators which is not meant to be governed by a set of preemptive rules. I came to understand the do-ocratic order by engaging in practical activities as well as pondering over a series of conflicts I witnessed over time surrounding the principle of self-entitled creation and recreation of the space. Do-ocracy is supposed to be bounded by an understanding and valuation of excellence, which is informally regulated by peers. Various Noisebridge founders had previous experience with autonomist organizations, early online communities in the 1980's and 1990's and hacker collectives which contributed to the orientation toward the application of horizontal mechanisms of governance. Do-ocracy is a derivative form of the “sudo leadership pattern[59]”: if something has to be done, there is no need to ask

59 For the purposes of system administration, “sudo” is a command on GNU/Linux and BSD systems for the execution of administrator commands under a regular user account. It is used colloquially as a metaphor for the practice of self-entitlement which is meant to bypass the need of special roles and privileges—i.e. as a normal person or “user” one is able to perform as if one was the “administrator.”

permission, one is supposed to go on, grant him or herself permission, and do it without the need of administrative powers, unless it breaks the basic rule of being excellent to him or herself and others. The Noisebridge wiki page on "diversity" glosses over it with the suggestion that "doing excellent stuff at Noisebridge does not require permission or an official consensus decision. If you're uncertain about the excellence of something you want to do, you should ask someone else what they think[60]."

I participated and witnessed countless instances of amicable interaction and technical exchange, but also several events of felt violation of the rule of excellence. In one particular occasion in a calm evening, a young person who was new to the space was called on for being disrespectful to other members when trying to work on his experimental project. He was asked not to turn on an engine he was working on at the space—a small, but extremely loud Tesla coil-powered motor. Because his intentions were curbed, he responded with angry verbal aggression toward those who complained. The matter was then taken to the next Tuesday meeting for discussion, as it is common practice to address conflict. During the meeting, he was inquisitively questioned about his behavior and his intentions. One member reminded him in a very serious tone that this *type of behavior* [was] *not accepted* at Noisebridge. The young man seemed angry and would not look people in the eye, keeping his head down while another member reprehended him for *asking people to shut up*. A committee for problem-resolution was formed right after the meeting to mediate the conflict involving the young inventor and the people he offended a couple of nights before. He stopped coming to the space after the incident.

60 Source: https://noisebridge.net/wiki/Diversity, accessed 11/17/2013.

Another telling instance of do-ocractic practice involved tearing down a dry wall at the space to replace it with a glass window. In an ordinary evening, one of the members with the help of a couple of non-members decided to do something against the recurrent theft of tools from the dirty-shop, which had a door right next to the exit door. The problem at hand addressed homeless and vagrant kids entering the space and going straight to the dirty shop just to be found perusing over cabinets for tools. In order to make it harder for them to leave the space unnoticed, the door was removed and a glass window was placed in it, so now people could see who was in the dirty shop. Tearing down the wall did not require asking for permission nor validation from members. The infrastructural change was immediately implemented and then communicated at a meeting. It was finally praised but initially it faced resistance and skepticism from members who were wondering why there was a hole in the wall of the dirty shop and an unusual mess at the entrance of the space. The same member who volunteered for tearing down the wall could be found regularly helping with other infrastructural matters around the space, as well as helping to clean and organize the space. I joined him, for instance, in one opportunity to clean the glass doors of the space and remove all the residue of paint and dirt on it.

There is a protocol for conflict resolution which involves isolating the contending issue from the meeting when it escalates or proves to be unsolvable through open discussion. The contentious matter is taken to a session of remediation in which a person (who is not involved directly in the feud) engages in reconciliation with the involved parts of the conflict. Innumerable conflicts involving homelessness, sexual harassment, and theft have been driving members and non-members away from

Noisebridge over time, attesting to the limits of the collective reliance on discernment for observation of the imperative of excellence. Another highly controversial issue was the radical open door policy. In general, “excellence” worked as an operator of relationships, that is, it was meant to project and express the relation between people and among people and technical objects as projects that involve, for instance, hacking for collective good (as the creation of book scanners to make books available digitally) or hacking for political causes (as in the hosting of an important node of the Tor network for the purposes of individual privacy and protection against surveillance). Right before entering Noisebridge, one could read by the doorsteps: “you are responsible for the vibes you bring here, be excellent.” The imperative guides relationships between knowledge of technical things and people with desired or embodied skills. It was a common occurrence to find people talking to each other and exchanging ideas about different ways of going about something technical as well as having a shared sense of humor with jokes that are understood as a marker of shared meanings and perceptions of the state of technical affairs. Conflicts usually surfaced whenever different groups with different perceptions of the purposes of the space and from different collectives were confronted: perceived differences were marked in the bodies—they are differences of socioeconomic background, levels of formal education, ethnic group, gender, and personal cultivation in social spaces in and out of the Internet.

Protocols and Practices of Horizontal Governance

During the first year, a close-knit group of founders and supporters held face-to-face and online discussions about the organization of the collective while applying for legal status as a California Non-Profit Organization, a tax-exempt educational non-profit under the Internal Revenue Code 501(c)(3) of the US tax statutory law. Individuals with experience with other hackerspaces and professional associations chimed in, offering suggestions about the role of the board of directors, as well as over their prerogatives and those of the members. As one member suggested, "in general, the board isn't called on to do much, but they are called on to not do quite a lot—there is a lot of legal power in the board which, as an organization, we rely on the board not to exercise[61]." There is a tacit agreement that the board would not be more than illustrative, not having therefore any oversight on members projects and would only be appointed due to a legal requirement, not an organizational need. The running joke is that the board members could be easily substituted by a few lines of a Unix shell script. During the early meetings, there was no perceived need of creating a set of rules, but a strong sense, pushed more strongly by one of the founding members, the importance of having a consensus-based decision-making process. Legally, the board have responsibility over Noisebridge but their members are not differentiated from other members in terms of voice and responsibility in practical terms. As a mechanism to protect the board members, insurance is paid for each position (President, Secretary, Treasurer, Executive Director respectively) with resources that are obtained through membership dues and

61 Source: http://noisebridge.net/pipermail/noisebridge-discuss/2011-December/027181.html, accessed 10/24/2013.

donations coming in regularly from large companies and IT professionals from the Bay Area for tax exemption. Positions of authority are commonly made fun of by members: "it was my understanding that the meeting got to a point where everyone agreed that the next person to walk through the door should be the President [...] I walked through the door next[62]." An influential member known for his extraordinary prose and political cultivation composed a verse which thoughtfully captures a cardinal orientation in Noisebridge's governance:

> "For we're excellent to each other here
> We rarely ever block
> We value tools over pre-emptive rules
> And spurn the key and the lock[63]."

Following the "Tuesday pattern" from the Hackerspace Design Patterns, Noisebridge held regular Tuesday meetings which were open to anyone interested. Meetings were important spaces for face-to-face debate, where tensions and issues surfaced but also for identification of members, non-members, aspiring members, and individuals with particular interests and skills. They represented the space and time for presentations of self and performance of identities, when newcomers had the chance to cause an impression and find collaborators to address problems that are considered interesting to be pursued at the space. Presenters usually preface their self-introduction with short affirmative sentences, such as "I hack electronics" or "I hack society" (when they generally do not have a strong technical background), whereas the most seasoned or well-connected members joked about their own area of activity and interest, simply

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62 Source: https://www.noisebridge.net/pipermail/noisebridge-discuss/2010-March/012861.html, accessed 03/20/2012.

63 Source: https://www.noisebridge.net/wiki/Noisebridge_Vision, accessed 03/15/2013

refraining from talking more about themselves by just saying their first names or nicknames.

The weekly meeting rite included a brief description of what Noisebridge is with an opening for whoever felt like describing it to the newcomers. “Does anyone want to say what Noisebridge is?” was a regular opening question. The moderator and note-taker for the meeting were chosen on the spot right before it officially started and were usually taken up by members or non-members who were more familiar with the meeting protocol. Another recurrent question often asked for pedagogical purposes was: “can someone describe the consensus process?”

The governance of the space was sustained as horizontal as the group managed to achieve with occasional conflicts regarding underlying differences of class background, recognized and displayed technical aptitude, and experience with autonomist collectives and consensus-based decision-making. Noisebridge members tended to avoid differentiating between members and non-members when it came to the governance of the space, but the distinction was often brought back into focus in moments of crisis over consensus items—which were archived on the Wiki and discussed in and outside meetings until a consensual position was agreed upon without any member blocking it. Decisions could be blocked in extreme cases via a proxy present at a meeting to speaking on behalf of an absent member. Members could “stand aside” when no consensus could be reached or when they could align themselves with other consenting members. Formally, members were distinguished from non-members in two ways: they had monthly membership dues which could be skipped and they could block consensus. Membership, however, was not trivial to obtain. It was not, as it is usually prefaced at meetings “the same as membership in a gym or a chess club.” Certain members expressed concern that people without “a proper understanding of consensus” could hamper the functioning of the space, so there was usually a vigilant protection of the collective from accepting a person who might make the process of achieving consensus more difficult. The process of membership took into account contributions to the community as well and, quite often, assessments of one's technical abilities or perceived potential capacity. Considerations regarding previous experiences with horizontal politics, public display of technical competence, and personal connections were key in accepting an applicant to become a member.

Whereas for certain hackerspaces the role of “facility manager” was created formally or informally to keep facilities and tools organized and cleaned, for Noisebridge there were practically no pre-established roles except for the officer positions required by law, which were only fulfilled as a legal not practical requirement. The assumption was that the collective as a whole is supposed to self-manage the space. All the work around the space, from cleaning to general maintenance, was done by volunteers themselves. The kitchen and the library were often maintained by women volunteers. One of them was to be found regularly cleaning the kitchen, who was not connected to the community through technical and artistic projects but by her interest in helping the space. Formal managerial positions, such as that of President, Secretary, and Treasurer, were mocked as legal formalities given the status of the organization as a Non-Profit charity. Officer positions were voted after members were picked as candidates. The whole voting process was taken lightly and the positions were not perceived as ways of entitlement and voice above other members and non-members' voices, but they tend to be occupied by members with a certain degree of prestige, which stems from their contribution to the space or their technical and activist credentials. In a lively occasion of voting, ballots were made into paper balls and tossed around as they would in a classroom paper ball all-out war. Members consulted with others on the spot regarding the voting rules; informally, candidates were picked on the spot and votes were cast in a joking manner.

Membership was obtained through a process of application and consensus among participants of a meeting in which an applicant presented him or herself. One possibility was safeguarded for members which was the possibility of vetting an application or collective decision via a proxy. It was necessary for the applicant to collect the signature of 3 members in good standing and write about what brought him or her to Noisebridge in his or her application, an important narrative part of the application that usually glossed over saturated symbols such as “hacking”, “community”, and “collaboration,” identifying Noisebridge as a place to find a community to acquire skills. Applications were archived in a binder that was available for everyone to see and kept by the entrance of the space. The binder was read each meeting for new applications to be considered among the present attendants. If the applicant was not present at the meeting, his or her application would not be considered and kept for the next meeting or for the period of three weeks before it was discarded and had to be re-initiated. If an application contained three signatures and if the applicant was present, his or her application was read and he or she was invited to leave Noisebridge so the present members and attendants can discuss any issues they might have had with the applicant. Upon his or her return, the applicant was supposed to bring gifts for the participants of the meeting. This orientation was usually communicated in a jocose tone. Applicants usually showed signs of nervousness during the process as it involved a collective deliberation among the present members and non-members regarding acceptance or denial. It was a ritual in its own right with the regular phases to demarcate the passage of status: separation, liminality, and, finally, aggregation (Van Gennep 1960). First, the applicant was invited to leave the space and advised to procure for gifts before he or she returned. The temporary separation of the applicant generated feelings of anxiety, apprehension, and nervousness. This period would come to an end generally whenever a consensual position regarding the application was reached. Any opposition to the application had to be voiced and justified. Arguments in favor of the applicant were also expressed and versed about technical abilities, capacity to get along with others, projects one was conducting at the space and interested in advancing, as well as general affinity with different groups within the space. After a series of questions to probe if the applicant was trustworthy and committed, such as: "in what circumstances would you block consensus?" or "what is your understanding of the consensus process?" The period of liminality was a period of evaluation of how one responded to questioning. Arguments against the acceptance of one's application returned to the table in the form of a series of questions. The whole session served as a ritual for incorporation of a new member and as a pedagogical moment for non-members through which notions of what consensus and excellence meant were assessed and corrected with versions vocal members espoused. Applicants were also asked about controversial topics such as removing the kitchen, under the premise that it would supposedly stop attracting *people who are not at Noisebridge to* *hack*, or having locking hours in order to prevent people from sleeping at the space overnight. During the Q and A session, the applicant would usually try to respond to the inquiry by mobilizing pre-constructed elements from discourses he or she was exposed to around Noisebridge and its orientation toward excellence and the collaborative nature of its social experiment. A particular applicant might not be very familiar with consensus-based decision making process, but he or she starts to learn by attending meetings before the evaluation of his or her own application takes place, often by listening to other voices of more experienced members with different forms of assessment of responses: *that person is a little bit confused about how things work around here.*

One applicant, when asked about his understanding of consensus during the evaluation of his application, stated it was *a mechanism for the individual to go against collective decisions.* This and other tangential responses were usually followed by a corrective rebuttal: *this is not quite how consensus works.* After leaving the liminal period and being reintegrated, I found this particular applicant outside the space, looking relieved and having a conversation with other non-members. Speaking of his acceptance to be become a member, he confided: *If I could hack Google like that to become a member, they would hire me, just because I hacked my way in.* He managed to save his membership application by talking to the group about his ideas on computing and neurobiology. For a group of non-experts, his discussions of the computer/brain interface seemed curiously well-informed. No one, which is unusual when people talk about technoscientific topics of which there was expertise in the circle of attendants, challenged his goals or observations. It was all followed by an interim of silence. On my way out of the space, I congratulated him saying *it must be great to be accepted after all.* He nodded affirmatively with a huge smile on his glowing red cheeks. He seemed relieved after being pressured by the collective in a crowded meeting.

Another key mechanism to control participation in the space is "asking for people to leave," which has not only become much more frequent in the past two years —and mostly after the event of Occupy San Francisco—but also came to be formalized as a procedure which is often carried out with tension. If a person is considered disruptive, is perceived as an abuser of other people or the space (for over-usage such as sleeping, cooking, or spending *too much time at the space*), they might be asked to leave. When any person is asked to leave, he or she is supposed to return for a Tuesday meeting to discuss his or her behavior and, depending on the seriousness of the matter, he or she can be banned permanently, which then becomes a "consensus item" coming into immediate effect and published on the mailing-lists and on the wiki. Critical events involving sexual harassment and violence have resulted in permanent ban of non-members.

The most active discussion list, Noisebridge-discuss, was used for general remote communication among members and non-members. At times it converged and indexed the activities of the space, but most of the time it had its own dynamics of interaction which were not the ones which took place at the space and, by far, not the ones that were oriented by the imperative of excellence. In comparison to other hackerspaces in which the mailing-list was part of the everyday life of the collective, for Noisebridge there was a stark discontinuity. The list, as much as the IRC at certain extent, was mostly populated by people who were interested in Noisebridge but who were not regular attendants nor members. The list was sometimes referred as “Noisebridge-disgust” because of the intensity of debates which easily escalated into flame-wars. It was a place for people to expose political positions and the space for feminist activists (both members and non-members) to come out about recurrent events of harassment and violence, not only verbal but actual violence against gender minorities in the space. It was also the instance for more trivial discussions about what to do with certain pieces of furniture or to coordinate equipment donation, report on the status of the space and new projects, announce fund-raising activities as well as to discuss problematic events involving conflict between members, disputes regarding the feasibility of particular projects, etc. The mailing-list was generally the place were announcements of disruptive events occurred and it was also the target of Internet jokes about the status of Noisebridge as a place for “homeless and Arduinos” (as it is identified and mocked by other maker and hackerspaces in the United States for instance) or identified as “hippie hackerspace” among certain hackerspaces in East Asia. Heated discussions have revolved in the past around sexual harassment targeting women at the space, people using the space to sleep and cook, spending most of their waking hours at the space, drug usage, and disruptive behavior, theft, and disrespectful behavior toward others.

I came to interact at the space with a young GNU/Linux developer quite often just to discovered a few months later that he was been accused of being a sexual harasser. His criminal record was put up online and shared on the Geek Feminism wiki, a popular community online resource, which had among its contributors feminist programmers and activists from the Noisebridge community, such as the "anarchafeminist hackerhive" which held regular meetings at the space until they split to create a new feminist hackerspace in the same neighborhood where Noisebridge is located. The young developer came to the space an ordinary evening and yelled my name. I gave him a high-five while I was on my computer, reading the Noisebridge wiki and teaching myself how to operate the laser-cutter for the first time. He said he liked the stickers on my computer, Tokyo Hackerspace (THS) and Free Software Foundation Latin America (FSF-LA), then, he looked at my t-shirt and I happened to be wearing a Debian conference t-shirt. I suddenly became aware of the fact that I was in full uniform or, anthropologically speaking, surrounded by diacritic elements that would attract the attention of certain technologists while repelling others. He inquired me about the conference t-shirt I was wearing and I mentioned that I volunteered doing video work, given previous experiences I had with Free Software-based video-streaming. He was working on the public computer attached to the laser-cutter of Noisebridge and doing technical work—writing code and building development tools to extend support of GNU/Linux to a particular ARM-based computer. We had a quick exchange about single-board and low-power GNU/Linux computers and he quipped about the bad aspects of popular projects in this area for their lack of "freedom." As our conversation progressed, he would yell at the computer at every failed compilation attempt. When I approached his computer to ask what was going on, he responded paraphrasing Thomas Edison: "I am not failing, I am just discovering a thousand ways things should not be done." He could be found in high spirit around the space quite often, always smiling and interacting with people, having lively conversations about computer programming. I came to learn after he disappeared from the space that he was homeless and was being hosted by a non-member *habitué* from San Francisco—the same person who would later circulate the information of his behavior as a sexual harasser. After the discussion of his case in a meeting, he was officially banned: forbidden to enter the space and to send messages to the mailing-list; a prohibition he did not observe as he still sent a couple of brief messages to the list after been outed.

This case evoked the ambiguity surrounding the principle of excellence when practiced and evaluated. While hacking on software, the developer was perceived as most excellent by the community of software programmers in the space until the information about his behavior became public. It is common at Noisebridge for the notion of excellence to be rearticulated through different understandings of hacking and recontextualized given a particular unfolding of conflictual events. As many places on and offline, Noisebridge was the place of recurrent discussion regarding what it meant to hack and to be a hacker which was usually taken to determine how far the concept of excellence could be extended. The attempt at extending the concept of hacking by non-technical *habitués* at Noisebridge became the source of jokes by other members, for instance, in the discussions of "food hacking" whereas people disputed the merits of hacking in the context of alternative methods of food preparation or in the context of sleeping at Noisebridge under the guise of "sleep hacking."

Entering the space once I noticed a whiteboard next to the gate posing the question: "What is Hacking?" Around the question, one could read disputing concepts of what hacking is or should be. It was one out of many instantiations of the debate. In previous meetings, the question surfaced when attendants discussed how to address problems of theft and abuse of the space by regulars. One of the Noisebridge's founders, Mitch Altman, had been quite vocal in respect to his understanding of hacking. In one presentation for an "unconference" in San Francisco, elaborating freely on the notion of hacking, he defended that hacking is "taking anything in the world, used as a resource, and there are a lot of resources available to all of us, and doing cool things with it, learning from it, and seeing what happens, what works, what does not, and sharing it. But, above all, doing it because we love. We can hack anything. Of course, people think of computers and tech, but we can also hack ourselves, our lives, our resources." This definition encompassed a wide range of practices that are defined around Noisebridge as not computer or electronics-related hacking. It also pointed to the demand that was embedded in the notion of hacking as an ethical injunction for learning and self-improvement: by engaging in experimental practices with various resources in the world (a resourceful world, one must add, of San Francisco Bay Area), one is meant to situate oneself in a position to improve his or her life. This is not tangential, however, to the question of governance and horizontality: hacking, broadly defined, was fostered at Noisebridge as one of the main guiding forces for maintaining the space in organizational, political, and material terms. The plural and encompassing definition of hacking was heavily disputed, however, but it served at the same time to allow for encounters across difference that were not accommodated by other hackerspaces in the region.

Occupy San Francisco and Hackupy

One year after the onset of the Occupy movement in San Francisco by late 2011, a heated discussion revolved around the “Occupy group” at an ordinary Tuesday meeting. A critical voice suggested the group attracted a lot of *people they did not want at Noisebridge*. There were complaints about *the space not having hackers anymore*, suggesting its *decaying state* when *it used to be great*. The Occupy movement itself was not the topic of contention, but some of its participants and their behavior. Anthropologists who carried out research and activism during Occupy events such as David Graeber and Jeffrey Juris have suggested ways in which the movement served to mobilize groups simultaneously on and off-line, creating physical spaces of contestation, sociality, and solidarity through occupations and autogestioned camps. Juris' (2012) distinction between the network logic of social movements, remounting to the New Social Movements of the late sixties and the “aggregative logic” of the newest social movements serves us as an analytic foil to describe the application of technologies in aiding mobilization as well as coordinating direct action. In the context of early mobilizations of September 2011, Noisebridge was an ally in providing technologies to facilitate the virtual and actual gathering of activists, bridging technologists and political actions as well as technologists as activists until more pronounced differences in perspective, socioeconomic condition, and political project surfaced.

I spent my first night working at Noisebridge after a couple months of regular attendance, working alongside one of the non-members who was closely linked and identified at NB with the Occupy movement. The same group one could find throughout the day and evening at the space, some sitting quietly at one of the public computers and others sleeping on the couch by the library. The same people whose stories I came to learn later by the fatidic day they were about to be banned due to accusations of “non-excellent behavior.” I ended up work with a person who was avid to learn the GNU/Linux operating system and live video streaming, two technical topics I had cultivated some experience in the past. We found an old rack server at the “hacker alley”—a wall of the space with shelves in which all the discarded e-waste and electronic parts for hacking are to be found—and decided to build a streaming server for testing. My partner in the project was eager to peruse over piles and piles of electronic junk for the missing parts, RAM modules, usable hard-disks. We spent a great deal of the night talking about use-cases for our project: we could provide a live video feed on the Internet and let other people participate in meetings and activities taking place at Noisebridge or we could provide activists with the same service during demonstrations using Internet connectivity offered for mobile devices. I was drawn to the technical project for the possibility of exchange, its potential political usage, and the novelty of a Free Software implementation of new codecs and server technologies that I wanted to test out. I explained all the details of what I was doing to my co-participant while building the experimental, alpha-version software we needed for the server. We did set-up our working area around a more secluded corner surrounded by disassembled personal computers and hidden from the gaze of curious passers-by against a wall of old electronics testing equipment. We had everything we needed at arms length: an analog video camera, a PCI video capture card, a fairly robust server that we had to reassemble given its missing components, and plenty of network bandwidth for testing. My interlocutor—himself a regular at Noisebridge and a squatter in San Francisco at the time—casually shared stories of his youth and of younger, non-member inhabitants of

Noisebridge: their struggle with drugs, their deep engagement with the Occupy movement, and the fact that it was *harder for them to get jobs, because they did not have a place to sleep or shower*. He talked about his early experiences with a Commodore 64 and the tricks him and his friends had to perform in order to break copy protection of games. In one out of several contentious meetings where people would complain about the state of the space, the fact that the facilities were dirty and nobody seemed to care, a member went off blaming some of the non-members for their economic condition and homelessness: *they spent a year at Noisebridge,* scolding no one in particular while directing his critique to all, *where they could have learned something to get a job, but they didn't*. Upon my return the next day to continue working on the server, I found the hard-disk was missing. My partner in the project told me he had to procure for a RAM module which had also disappeared, so we both gave up the project. Noisebridge's tools and equipment were perceived by some as if they were assets of a public library. To expropriate what was not private property in the first place felt disturbingly wrong, except in face of the need that was fairly obvious all around the neighborhood and for some of Noisebridge regular attendants: the dire need for housing, food, and a liveable source of income.

When the Occupy movement took San Francisco's downtown with street marches, sit-ins, and public space occupations, Noisebridge came in to help in various capacities. The space was used to hold meetings for Occupy activities meant to bridge activists with and those without technical background, the so-called "hackupy meetings." Some of the founders of Noisebridge set-up a tent at the Occupy San Francisco camp in solidarity and served in the capacity of technical support by providing pedal-power sources, audio streaming services, holding hackathons at the space for building web pages for the movement, among other actions. "Hackupy" was one of the short-lived initiatives at Noisebridge to bridge hackerspaces with the movement, similarly to the role fulfilled by hacklabs a decade earlier in the context of the alterglobalization movements with the global expansion of Independent Media Centers. As one member described the initiative: *my hopes are that more hacker spaces will jump in on this and list out their hacker space as open to those in need of help* [...] *At Noisebridge we've had people hacking away on Occupy tech more or less every night. I've gone through (or will eventually today) list off most weekday nights as Hackupy nights.*

The intersection of Noisebridge with the Occupy movement was eventually perceived as the major source of disruption for the close-knit social relations within the space. As the space grew in popularity, the influx of strangers also grew considerably. Before the onset of Occupy, there were numerous intersectional bridges of members' personal trajectories with social movements, autonomist groups, and strong interest in autonomous forms of political organization. Activities were dedicated to gender minorities and there were activities around "hacking mobility" for members with disabilities and special needs. The solidarity and active participation in the Occupy movement was felt as a natural progression for most members, given their political commitment identified as one of the reasons why they were drawn to participate in creating and supporting Noisebridge in the first place. What did not work as the experience of exchange with Occupy activists unfolded was the felt difference in the context of the everyday life of the movement's actions between more established middle-class lifestyles, represented mostly by some of the members with high-paying tech jobs and contracts *vis-à-vis* the activist groups, which combined groups of squatters and homeless activists. The posterior occupation of Noisebridge itself altered the perception of the space in respect to its openness, frustrating founding members who felt abused in their position of supporters of activists. By extending a helping hand, Noisebridge members felt the issues that surfaced in the needs of Occupy activists from low-income groups carried a much heavier burden. In the process of disoccupation of downtown San Francisco, Noisebridge started to receive a larger contingent of the activists, identified by some members as freeloaders or *oogles*, which are, in street slang, youth from a middle-class background who are said to have become homeless by choice not necessity. One of the founding members lamented the state of the space as of 2012: *it's becoming increasingly clear to me that Noisebridge has jumped the shark somewhat. The people I find myself most running into there are not into technology, hacking, or, really, Noisebridge. I have found them to be mostly belligerent, uninterested in rational conversations, and seemingly trying to push various political agendas. I am getting tired of seeing the Hackerspace that I worked so hard to help build, fall apart, both socially and physically*[64]. Another founding member with technical background said he joined because *he liked the idea of a club for specialists to study computing*. Groups in Europe, he observed, are closed for non-members and hard to enter and become a member. He then reformulated his previous observation by adding he does not value exclusivity, he only thinks the openness of Noisebridge made it lose its focus and purpose. *It is not a place for people who are experts to work on projects, but*

64 Source: https://www.noisebridge.net/pipermail/noisebridge-discuss/2012-February/028455.html, accessed 03/15/2013.

a general space for people with loose affiliation with the idea of hacking, computing, activism, etc. He also suggested, because of openness and lack of orientation *the community could not defend itself,* which was clear in the recurrent cases of theft and assault against women, but also in the difficulty the collective had in preventing people from sleeping at Noisebridge and not returning to the space after being banned. The article "The Tyranny of Structurelessness" by Jo Freeman (1972) was very influential to him in its suggestion of how tyrannical structures get in place when there is an assumption of structurelessness or in the absence of explicit rules, informal structures of power tend to rule social relations and mechanisms of collective governance.

A couple of years after the event former Occupy activists kept returning to Noisebridge, only to be invited to leave the space again or be banned for their over-usage and allegedly disruptive behavior at the space, which was increasingly felt to be unacceptable since the outbreak of Occupy. As I was told by one of the members who not only engaged deeply with the group based on her political convictions and actions as an activist but also felt that it was *what Noisebridge was all about* felt it was too much, driving people away from Noisebridge, burning them out and frustrating their expectations for the space. *There was some point with Occupy, this is hard to say because I feel I am betraying my ideals, but I got so frustrated that people were living* [at NB]. *I got so frustrated that people get out of jail and come hang out at Noisebridge. I was "oh great!" I agree with rehabilitating people. It is not that I would not hire people because they were in jail* [...] *but there is a way to say "hey, you are so much drama, you are so dysfunctional that you can't be here because you are driving away people who can function." The point where we had to have the emergency phone for the night, because the* *people there at night were too afraid to call the police, so they had to call someone middle-class like us to be the front-man, because they were all on parole, have immigration status. Oh, this is not good! We cannot have middle-class person you call to solve problems, but we did for about a year during Occupy.*

Supporting Noisebridge from a Distance

The group of original founders with few exceptions is not to be found at Noisebridge, but some of them still keep their membership status and help maintain the network infrastructure. One of the founders summarized his trajectory as *growing up in Mid-country, raised by republican parents, who took seriously the compassion dimension of Catholicism.* He had memories of doing interesting things with computers. Grew up modestly but never had any economic hardship. His parents were very strict and he never developed any interest in the computer experiments that were classified as digital trespassing since the passing of the Computer Fraud and Abuse Act (CFAA) of 1986. Following the laws because they were rational, he confided, had been his take on the question of criminalization of hacking. *Not all laws are good*, he would add, *but there are ways to break laws while keeping on par with the spirit of laws.*

His career in information security started when he discovered cryptography by learning about PGP and the Crypto Wars from Wired magazine in the early 1990's. At that time, he was also exposed to a great dose of *Ayn Rand-libertarianism coming from white males from the Bay and the Valley.* His English literature teacher introduced him to Ayn Rand and he dove into it only to rethink his position later on under the light of his adult life experiences. He had early transformative experiences which involved connecting a small ISP to the Internet and exploiting security flaws in his homework assignment in college. He reversed-engineered a piece of software that was distributed by his professor in order to show how it allowed for privilege-escalation based on a bug he found. His professor was not pleased with his findings to say the least. Through the reprimand he received for his inventiveness, he learned how stifling computing education could be to his actual training. He could not find professors and researchers at Michigan Tech to help him with cryptography and security research, but he proceeded with his experiments independently. He wrote a script to log into the machines of his college computer laboratory when they were idle and use their computing power to help in a challenge to break a particular cypher, which his university contributed 10% of the total cycles used to eventually meet the challenge.

After college he moved to the Bay Area to work on BitKeeper, a source code version control system that was used by Linux Kernel developers for a short period and adopted by a few IT companies. Due to disagreements with the top engineer and executive of the company, he decided to quit. Among his political experiences, he cites participating in the debate team of his high-school, but it was, in his words, *connected to a very traditional, American mainstream* of commercial newspapers as sources for debate among Republican and Democrat candidates. He did not identify himself with a particular political tradition, being closer to North-American libertarianism in the past, but having changed his views. He still believed in *individual freedom* and the importance of working towards it, which is something that fundamentally moves him to work in information security. He is one of the maintainers of the Noisetor project, contributing for the management of fast exit nodes for the network. He was introduced to Tor by another Noisebridge founder and activist for Internet privacy. They decided to work together on a fund-raising project to pay for the bandwidth costs of having powerful nodes and collaborate with a European consortium to support the Tor network on a global scale.

He was very active in the founding and early years of Noisebridge, but progressively moved away from the space. The promise of Noisebridge was fueled by the excitement he experienced at the Chaos Computer Camp in 2007 and the European tour which gave origin to a wave of new hackerspaces around the United States and the globe. He says he was so involved and committed to Noisebridge that, at some point, he got burned out and left. Excellence, do-ocracy, and consensus were basic symbols that were present since Noisebridge's inception. They were adopted, in part, because some of the founders were adamant in supporting ideas of radical openness and horizontality. Due to their charisma, the acceptance of these ideas were not further problematized, but accepted in good faith according to him. It could work as an experiment, but in his evaluation, it unfortunately did not. He confided he was very disappointed with the state of the space and rarely comes to visit, helping only from afar.

Actual and Imagined Spaces

Noisebridge was more of a promise than an actual instantiation of the principles of horizontal politics and respect for the other, even though it was possible to identify efforts to guide interactions and relationships through the values of excellence and do-ocracy. These values were as much of a shared horizon as material and experiential realizations of an alternative political present, for they constituted an actual space for cultivation of dispositions toward collective decision-making and technical experimentation. This cultivation, however, was not without friction and unexpected effects. The desired for and disputed horizontality was one of the key sources of long debates, as well as a central concern for several members. Meetings extend through long hours and some decisions seemed, at times, almost impossible to implement, such as the proposal of having closing hours and procedures for controlling access to the space when members were present.

Noisebridge was imagined as a symbol of autonomist tech development, but it was also the object of skepticism and scorn due to its very foundational values by other hackerspaces within the US-based network. An imagined space against regular institutions of education and work in information technology and an experiential place where constitutive ties of capitalist IT labor regimes and practices were supposed to be actively questioned, if not loosen or severed altogether.

Noisebridge's fostered symbols of excellence in interpersonal relations and technical projects, openness, and horizontal governance were articulated differently and disputed as divergent groups of computer specialists, entrepreneurial actors, experienced political activists, unemployed and curious tech-inclined contingents come to share the space, participating in narratives of inclusion and collective exploration of art, politics, and technology. Openness is often overshadowed when commercial intent was foregrounded. In one of the innumerable discussions I had about low ARM-based single-board computers from Chinese manufacturers which I was testing myself, a start-up founder and member of Noisebridge told me he had acquired his boards *not for play, but for product development* and that he *couldn't show* [them] *to me until the release of their new start-up product.* Another telling instance which highlight this point of intersection between gifts and commodities happened at Circuit Hacking Monday, which is led by experienced electronics engineers accompanied by one of the key founders to teach people how to solder and troubleshoot issues. The structure of the event is made by intertwining gifts and commodities at various instances. First, the workshop organizers set-up the table with soldering irons, wet sponges to clean the irons, and tools. Then, they launch into the explanation of what Open Source electronics kits they have to sell. There are a variety of kits which are very simple for beginners, such as gadgets with blinking LEDs, electronic games, and mischievous tools such as the TV-B-Gone (explained in the previous chapter). All the kits use Free and Open Source technologies and platforms and are meant for educational purposes. The instructors announce the prices for each kits and ask which ones people are interested in purchasing. They emphasize the fact that the lessons are always free, but they have to charge for the kits, because that is how they make a living like any other independent Open hardware engineer. After sits are taken by the soldering stations and people are ready with their kits, the electronics instructor goes on to explain how to make a solder joint in less than a five-minute demonstration. The explanation is very detailed and it proceeds as the instructor performs himself a test solder joint with mastery. As people start to put together their own kits, they use laptops and cellphones to check for online information on how to identify and place components onto circuit boards. They follow online documentation written by the creators of the Open hardware kits being sold. The documentation usually has a tutorial component as well with an explanatory section about the techniques involved in creating that particular device or gadget. The soldering workshop is one of the most famous, regularly given, and well attended events at Noisebridge alongside computer programming classes. The same workshop format has been used and replicated in various hackerspaces in United States, Japan, China, Germany, Chile, Egypt, Brazil, and various other countries by Mitch Altman whose trajectory we discussed in the previous chapter.

At an ordinary Circuit Hacking workshop, a young women in her mid-twenties once approached the workshop organizer to ask him for one of his kits; she did not know how to solder and she affirmed she was there to learn. The instructor answered she was at the right place with a welcoming smile. They exchanged the kit for twenty US dollars. In about five minutes of dedicated hands-on demonstration—which the instructor patiently dedicated for her for the second time after his demonstration for the whole group—she was ready to start soldering. She opened up her laptop which had curious blue keys contrasting with other keys. When asked about those colored keys by the workshop organizer, she said it was her *invention* and she *could not talk about it.* The organizer kept himself smirkingly silent. A bigger silence ensued and it became awkward for those witnessing the scene, including me as I sat next to her practicing solder of a surface-mount component. Despite the general orientation for openness and sharing, monetary and voluntary transactions on the register of the gift get intertwined and confused at the workshop space. The purchase of a kit was not mandatory as any member or non-member of Noisebridge was welcome to bring their own project to the table and to work on it, like I did, asking questions or helping others with questions.

Often times engineers with small electronics businesses came to the workshop to meet other engineers and distribute business cards or to help people with questions about electronics. At times, they offered their own products and kits. The space and time of the workshop, which extended itself from three to four hours on average, occupying the whole evening, was organized in such a way to guarantee that interactions happened mostly under an open register, but other hegemonic values intervene—such as those surrounding the idea of the inventor and his or her property, shutting down further possibilities of exchange with a cloud of obscurity: “No, I can't talk about my project; no, I can't show you my project” which tends to be a common practice in the domain of IT under the injunction of Non-Disclose Agreements (NDA). In general terms, ties are created among workshop organizers and participants creating a debt on the register of the gift: the transmission of information on how to accomplish certain tasks in electronics at the hands-on workshop. It also establishes equivalence as kits are exchanged for cash, serving as a prelude for another gift relationship which can possibly unfold: as Open hardware projects are distributed widely with their schematics, design files, and bill of materials, it is possible to reproduce them without much effort, but for the market price. Having been given the possibility, social and economic ties can be made or re-activated. But ties can also be severed as new derivative creations are not contributed back, breaking the cycle of prestations in the economy of public and open workshops for Open hardware. When a participant refuses to share information about a certain project or when a workshop attendant refuses to speak about her creation while she learns from someone else's creation, ties are severed and potential cycles of prestation which could follow an initial prestation are foreclosed.

Grounded in the context of practical exchanges (on the register of the gift or commodities), the imaginative power surrounding Noisebridge is being exerted until recently through narratives of Open hardware hacking as a model for new projects at new community spaces. Its place as an imagined space where all the best projects and the most brilliant hackers gather has been attacked more recently as outsiders have come to characterize Noisebridge as the place for *homeless and Arduinos*. The space, offering as it does a window into a wide spectrum of socioeconomic life and technopolitical orientation in the San Francisco Bay Area, is unique in its possibilities and difficulties as it is going to become clearer as I discuss next the experiences of other hackerspaces.

4.2. Chaihuo Makerspace

Chaihuo was the first makerspace of Southern mainland China, located in the burgeoning city center of Shenzhen. It differentiates itself from other hackerspaces, in the first place, by calling itself purposefully a makerspace. The second differentiating factor is that Chaihuo was founded and has been supported by Seeed Studio, one of the biggest companies in the business of Open Source hardware. Sponsorship of a company, according to the Hackerspace Design Patterns, is considered in the Euro-American context to be an "anti-pattern" with the rationale that it is more sustainable for a community space to guarantee its independence through the means of its members and through its own activities, such as fund-raising campaigns, selling member's projects, or reselling products directly to customers on behalf of Open Source distributors. Chaihuo operates on a daily basis as a co-working space with evening and weekend gatherings for presentations and occasional small workshops. The founder of Seeed Studio and one of the founders of the space, Eric Pan, suggested the definition of "makerspace" was adopted because of prejudice against hackers in China. The loan work "hacker" [黑客 *heike*] is usually articulated in the Chinese news and in the everyday parlance similarly to mainstream news elsewhere with malicious activities of computer experts.

Chaihuo opened its doors in 2011 with sponsorship from Seeed Studio not only to bridge the local manufacturing companies with the Open Source community abroad following Seeed's business orientation, but also to provide space for development of local projects based on the company's products. It started in a more isolated location of Nanshan district and, then, moved to the upscale OCT Loft (Overseas Chinese Town), a leisure compound comprising design, arts, and fashion ateliers and shops. The OCT loft is a place where well-to-do, foreigners and cosmopolitan inhabitants come visit for music concerts, art exhibitions, and gourmet food over the weekends. There one can find a Starbucks coffee shop, fancy bookstores, barbershops, and small boutiques. Chaihuo's decoration was done with Ikea furniture, displaying an angled, modern style with colorful walls and ambient lightning—far from ideal for an electronics workshop, but warm and comfortable for occasional meetings. In order to be accepted to move to OCT, Pan says they had to convince the OCT administrators that Chaihuo belong to the local art scene. The decoration had to follow strict guidelines and activities within the space had to be restricted. The space itself does not have the chaotic feel of a hackerspace, it presents itself with the cleanliness of a managed space of a Techshop or a Fablab with paid staff. During fieldwork in China, I heard recurrent complains from local technologists describing Chaihuo as a *place for talking but not for hacking*. A local engineer, when speaking of Chaihuo's history, suggested *it was designed to be a boutique store-front for Seeed Studio*. The entrance of the space displays a few community Shenzhen Do-It-Yourself (SZDIY) member's projects, some electronic kit products, and a popular and expensive US-made 3D printer, which I have found always under heavy usage by co-workers running their start-up companies from space. During business hours, Chaihuo was managed by the partner of one of Seeed Studio's top officers with the help of prestigious community members who pay a monthly fee to have keyed 24-hour access. There were various levels of membership. People were welcome spend a few hours at the space, but it was not meant to be used regularly without membership. Donations were requested during regular weekly meetings and workshops that are open to the public. The entry level membership does not provide key access, restricting access to the space to business hours or the presence of a keyed member. The higher level of membership is targeted for start-up companies, which used the space on a regular basis to conduct their research and development activities.

During a typical week day, I would share the main table of the space with co-workers of small Shenzhen start-ups working on wearable devices and other Bluetooth gadgets, built to launch highly desired crowd-funding campaigns to be carried out over the Internet, catering for an audience and a market both inside and outside China. Most of the design work for the products were developed at Chaihuo, including the work of prototyping. It was common to arrive at the space and find a young, recent engineering graduate working on his project, a portable Bluetooth stereo system, preparing circuit boards on the spot with the small, temperature-controlled reflow oven. After printing the plastic casing for his device on the 3D printer, I would find him hunched over his circuit boards with a tooth-pick at hand, putting soldering paste on small contact surfaces of each board, patiently placing surface-mount components with tweezers one-by-one, task otherwise performed by automated CNC machines, and putting the boards on the IC heater reflow oven, one of the few operational tools other than soldering irons and multimeters for electronics work at the space. It was also common to meet foreigner engineers and technology entrepreneurs looking for business or technology partners at the space. Some of the foreign projects involved gadgets, like dog entertainment remote-controlled gadgets, meant for crowd-funding campaigns on the Internet for customers abroad.

Starting from Chaihuo, I went on various trips to the electronics market, but also around town to procure for parts in lesser known electronics distribution hubs, such as the Bao'an Center and laser-cutting services with local technologists. Given its location at OCT Loft, Chaihuo is not allowed to laser-cut plastic or wood in its premises. So, I would regularly go out with Chaihuo *habitués* to, in their parlance, *hunt for parts*. In one particular occasion, we took the modern Shenzhen metro to the more residential area of Nanshan in search an affordable shop to run design files on a laser-cutter. On our way, we stopped at a small shop to have cold tea in an arborized street with swirling branches hanging above the sidewalks, refreshing the otherwise heavy feel of the humid summer heat. At a certain point on our stroll, my companion interjected by pointing a symbol on the ground, carved onto the cement: *look, a diode!* Placing his foot at the top termination of the letter F in the combination KF to form the symbol of a diode in circuit diagrams. I looked at it and only saw the symbol after trying to dissociate it mentally from the acoustic image of the letters K and F. The other person accompanying us, himself an economics major, hobbyist computer programer, and regular at Chaihuo, observed in a scornful tone, *it looks like a K to me!* We proceeded in our search without any luck, given the high price of the small shop we found, returning to Chaihuo after failing to cut our design files. This mundane event made a strong impression on me. It reminded me of a shift in my own perception after attending workshops on "lock-picking" at hackerspaces in the San Francisco Bay Area. I could not help but pay attention to locks and wonder what mechanism they hid and, mostly, if I could eventually open them. I surprised myself thinking, "why am I obsessing about locks?"

One can find a vibrant electronics tinkering scene at Huaquiangbei, a gigantic electronics market in Shenzhen. In crammed booths one can find representatives of various factories from the outskirts of the city with samples of electronic components of various kinds, electronics tool, LED shops, cellphone service booths, and computer repair and retail shops where young men and women can be found soldering circuit boards, fixing phones and laptops, and assembling desktop computers. The atmosphere is frantic and time flies in its maze of tight and crowded spaces of what the locals of the DIY group call *the jungle,* a place where one has to *go hunt* for specific components. My partner in the excursions *to the jungle* is known within and outside Shenzhen's community as a hacker who made himself known for being passionate about electronics, computing, foreign languages and science with a special interest in physics. He has two young daughters named after renowned computer scientists and mathematicians: Grace (Hopper) and Ada (Lovelace). When asked if they are going to be engineers like himself, he expressed doubt as they might end up choosing a different occupation. He was employed in the past to work with industrial automation, and was currently working for an international hardware incubator in Shenzhen, founded by Euro-American foreigners with experience in Open hardware and access to venture capital, serving as one of the main hubs to bridge Western start-up companies and young engineers with foreign investors, local factories, and distributors in mainland China. His position is highly praised as he serves the expat contingents as the go-to person for advancing projects locally. He is entitled with the task of sourcing parts and help foreign engineers get their projects done. When speaking about his training, he would proudly say he was an auto-didact. His first contact with computers happened when he was 17 as he did not have access to digital technologies or electronics in his village. Among other Chinese engineers at Chaihuo, they would make fun of his English accent for speaking with marked tones which resemble his regional dialect. He is an avid reader and a very applied student of his favorite subjects. We would find him often on his computer reading Wikipedia articles or technical books on electronics. I was casually told the story of his very first access to higher education. He once wrote to a physics professor from Shenzhen University regarding a question in a physics book he was reading on his spare time. To his surprise, the professor wrote back and invited him to attend classes at the university without having to officially enroll, as long as he kept a low profile while doing so. This was his first and only experience with university-level education. The lack of formal education, however, did not prevent him from learning electronics and computing to advance his own projects: a picture phone, which he designed entirely by himself from scratch, building the circuit and manufacturing circuit boards to transform a regular dial of a digital phone into a "picture phone" which calls the person identified by the picture on a button. He says he made this device for his grandmother who could not remember phone numbers and wanted to reach out for family members. Another of his projects, which was originally made out of a controversy with his wife over their air-conditioner was a very simple device to tell the house temperature in Morse code by blinking a small LED. He moved to Shenzhen in his early twenties in search for a position in the electronics industry. He is also versed in Linux and one of the founders of both Shenzhen LUG (Linux Users' Group) and Shenzhen DIY (Do-it-Yourself) groups. When introducing me to other Shenzhen DIY members, he prefaced our conversations with this own take on my project: *this is Felipe, he is a hacker, building hardware for the Raspberry Pi, he is also* *writing about hacker culture, and he is from UCLA*. The same introduction he would give to the Shenzhen LUG mailing-list. To which I would readily protest I was not a hacker myself despite my interest in working and studying the technologies I write and care about, I was just curious, a shared attribute I have found to be imputed to the hacker *persona*. He would reply with irony: *OK, so you are not a hacker. Stallman was the last hacker alive!*—in a clear reference to the early days of Free Software in which Stallman gave video and written interviews in which he proclaimed the death of MIT hacker culture with the rise of commercial software companies, claiming he was the last exemplar alive from a dying culture of virtuous technologists.

Itinerant foreign engineers would often attend Chaihuo. Some of the most prestigious hackers would also come present their work and give workshops. After participating in the "Hackers in Residence" program at Tsinghua University in Beijing, Mitch Altman and a group of Euro-American hackers came to Shenzhen for "China Hacker Tours," which I joined for two consecutive years. In one particular occasion, after visiting local factories and shopping at Huaqiangbei, Mitch came with the group to Chaihuo in order to meet and greet with the local community. After a brief presentation on the benefits of Open Source hardware for recreating education and for-profit enterprises, the floor was opened for questions from the audience. One of the more peripheral regulars of the Shenzhen DIY group (SZDIY) inquired about the actual possibilities of making a living with Open Source, since that was the major theme of Mitch's presentation, the opportunities for hackers and makers *to live the lives they wanted to live by doing things they love.* I learned later from more seasoned members of the SZDIY group that the question was received with embarrassment. It suggested, I was told, *they did not know anything about hacking* as the question assumed a popular and misguided outsider view that Free and Open Source technologies are antithetical to commercial, for-profit enterprises. On the register of a proper hacker-to-hacker exchange, a plastic container concealing a gift was passed on through the crowd reaching Mitch in the front of the room. Inside the plastic box was a locally manufactured clone of the TV-B-Gone project. Mitch expressed content with the spread of his project, responding without words but a smile. This act had a powerful symbolic valence: it was the return of a prestation first given by Mitch to the community with his project. For some of the Open hardware enthusiasts, it was actually the very first project they came across in one of the workshops Mitch gave in Shenzhen and various other hackerspaces around the world. The person behind the gift was the influential auto-didact hacker of the SZDIY group. It was a "proper" gift for not being a mere clone as it respected the request for attribution and sharing under the same license of the original project (Creative Commons 2.5 BY-SA). I will return to the question of the definition of proper and improper copies later in this chapter. For now, let's turn to the various instances of Open hardware activity in the city: from home-based offices to hardware designers and small companies offering brokerage services for large manufacturing plants.

Home-based Open Hardware Business

At the Noisebridge's monthly event "5 Minutes of Fame" a North-American engineer living and working in mainland China took the stage to show pictures of one of his Shenzhen electronics factory tours. At every opportunity, he would offer remarks about Chinese engineering practices, quality assurance mechanisms, and the nonobservance of intellectual property which were shown in the pictures he projected of Chinese electronic gadgets stamped with copyrighted images of famous Japanese video-game characters and trademarked logos. His comments were directed to an audience of Bay Area technologists who already had their fair share of prejudice regarding technical production in mainland China, an audience otherwise eager to devise alternatives to the intellectual property regime and engage with Chinese companies to fulfill their own manufacturing needs.

Weeks after his presentation, we met again at the Maker Faire in San Mateo, San Francisco Bay Area where I helped to staff the Noisebridge's booth. For the occasion, we had an unfinished prototype of a priest robot, "robo confessional" which we wanted to place inside a confessional to let it speak to and record Maker Faire attendees' views on the question of military funding for hacker and maker spaces. The project was never finished, as most Noisebridge members were hesitant to attend Maker Faire, even if to install a confessional conceived to "hack" the event. The engineer had a booth for his company operated in Shenzhen with the help of his partner at Maker Faire. He was visiting the Bay Area to show his products for the Arduino platform and to promote services of brokerage between Euro-American engineers and Chinese manufacturers. Originally from the Northeast, he was trained in mechanical engineering and had been previously held several jobs in technology companies, including OpenMoko, the first company to work on an Open Source mobile phone. He moved to Shenzhen after working in Taiwan, Hong Kong, and San Francisco during the dot-com boom. When young, he was sent to a school in Boston where he met a tight-knit group of MIT students and technologists. His interest in learning and practicing magic got himself connected with the JuggleMIT group which was known in the community for having gatherings at the mathematician Claude Shannon's house. He operated his business, a web-shop selling electronic components, kits, and tools from his apartment located in the outskirts of Shenzhen. After explaining my project to him and my interest in extending my research to China, he invited me to stay with him, his partner, and their housemate. His partner was a Chinese engineering major from a small farming community near Shanghai. She had dropped out of graduate school, after being dissuaded to pursue a post-graduate degree in engineering. After her disillusion with academia, she moved to Shenzhen to work for an electronics company doing exclusively quality control, fixing circuit boards which had returned from distributors and consumers. According to her description, her parents are functionally illiterate farmers, *they can read Chinese characters but they are not educated*, so she had a strong incentive to study as hard as she could and purse a university diploma. During her university studies, she formed a close-knit group of friends from an all-women dormitory, but also experienced painful events of mistreatment. One of her professors once said she *should not be* [at the university] *because she did not have* guanxi [connections, relationships]. One key feature that would render her persona rather incomplete in the eyes of the Chinese academic engineering community. She insisted in getting a degree in engineering anyway and moved on to graduate school. During her graduate studies in fluid mechanics, she had to perform repetitive tasks for his academic adviser: gathering data, organizing, and preparing his articles for publication.

Whenever she sent him an email with project ideas for her master's thesis, he would shut her down, insisting she had to study topics he was interested himself. She also have memories of being forced to manipulate data and mask deviance and error in data-sets. At some point, she confides, she got tired of lying and gave up graduate school, right after an event in which she was scolded by her advisor. In Shenzhen, she quickly felt disappointed with her first job for an electronics company as most of the tasks only involved inspecting solder joints and poor contacts. When speaking about her upbringing, she would use pre-constructed expressions regarding "the Chinese" she overheard in discussions of her partner with foreigner engineers, although she would often acknowledge how unsustainable stereotypes were if one was to look for the seemingly shared traits on the scale of a person's life. She had very unpleasant experiences with an itinerant North-American who she once hosted, a person who, feeling overwhelmed with the cultural differences he was experiencing in Shenzhen, would bitterly complain about everything he identified as distinctively "Chinese," making remarks about the Chinese nationals and comparing them with animals, such as pigs and dogs. She was appalled with his behavior and asked his partner to never host foreigners they do not know well ever again. This was right before I arrived in Shenzhen to be hosted by them. A complete stranger, but a foreigner well vaccinated against vicious forms of symbolic violence and "othering" with objectification of cultural differences. She would speak very highly of her partner electronic skills and foreign connections. She could not picture me in an electronic labs with a human sciences training. For their enterprise run from their apartment, she is responsible for contacting local factories and distributors to procure for electronic parts. They dreamt of having a prosperous business and imagined US-based Open hardware businesses to be the model they wanted to pursue. Their online shop followed the model of similar businesses in Open hardware: they provided electronics parts, tools, and kits which came with descriptive wiki pages on how to put the kit together. He also develop all sorts of circuit boards for prototyping with various functionalities, including relays, potentiometers, switches, LEDs, connectors and terminals of various kinds.

The other roommate in the apartment converted into an Open hardware business was a *bona fide* hacker himself, an expatriate North-American, son of US diplomats who grew up with the privilege that stem from being surrounded by political elites, local and foreign. Throughout the period of fieldwork in Southern China, he was one of my companions, joining me for various tech events and workshops in Shenzhen and Hong Kong. He had been traveling regularly throughout his life. His childhood was spent in the Congo, where he was introduced to a toy meant to stimulate his mathematical reasoning before he was alphabetized. Experiences he identify with hacking started in high school in the mid-70's. He recollects being part of a group identified as the "freaks" in opposition to the "jocks." Early on in his independent studies of computing, he discovered a way to penetrate the HP2000 operating system, a common institutional mainframe equipment at the time. He was granted access to the machine during after hours and weekends because of his friend's mother managerial access to the school facilities. He would go to school over the weekend with friends to access MIT computers via ARPANET, read manuals and the "Jargon File[65]", where he

65 The "jargon file" (jargon.txt) or the "hacker dictionary" was the object of various controversial revisions (see Steele and Raymond 1996). I am quoting here the original version, which is the one my interviewee had his first contact with the definition of "hacking," distributed currently in HTML

came across the definition of hacking for the first time:

> **HACKER**: [originally, someone who makes furniture with an axe] n. 1. A person who enjoys learning the details of programming systems and how to stretch their capabilities, as opposed to most users who prefer to learn only the minimum necessary. 2. One who programs enthusiastically, or who enjoys programming rather than just theorizing about programming. 3. A person capable of appreciating hack value (q.v.). 4. A person who is good at programming quickly. Not everything a hacker produces is a hack. 5. An expert at a particular program, or one who frequently does work using it or on it; example: "A SAIL hacker". (Definitions 1 to 5 are correlated, and people who fit them congregate.) 6. A malicious or inquisitive meddler who tries to discover information by poking around. Hence "password hacker", "network hacker".
> […]

On weekend days, they would occupy the computer room at the empty school. Without losing their precious computer time with sleep, they would explore the system as long as they could physically support. Two symptoms he felt for spending too much time on the computer console included: the top of his head would hurt and his eyes would not focus, it was a sign, he explained, he was *getting dehydrated*. His vision would get blurry and he would start to feel dizzy, *blood sugar was low,* he would assess, realizing, then, he had not eaten the whole day. His experience with the HP2000 was not considered "hacking" as the term was not yet common. His friends would identify themselves as "computer bums" instead of "hackers." They had long hair and were more attuned with the counterculture movement identifying themselves against "jocks[66]".

In an informal meeting at Chaihuo, one of the founders of SZDIY reached for a Mandarin edition of Levy's "Hackers" to whom I promptly said my housemate knew

format by Paul Dourish at UC Irvine: http://www.dourish.com/goodies/jargon.html (accessed 12/10/2013).

66 In her exploration of the dynamics between culture and social class in a North-American high-school, Ortner (2003) discusses categories in students' experiences which oppose "nerds" (tamed, low capital) and "jocks" (wild, high capital) in respect to perceived personal qualities, disguising class structure and belonging. Ortner also calls attention to the emergence of categories, such as "freaks" and "burnouts," which were meant to identity students who were connected to the counterculture movement. This is an important intersection from where hacking and phreaking draw key influences, helping to form the imagery in the 1970's and 80's of the hacker as an "untamed nerd."

some of the characters in his book. He was not only acquainted with some of the characters, but roommate's with Stallman in the 1980's and known to the MIT computer scene as he used to sleep at the office of a much regarded pioneer, Richard Greenblatt, when it happened to be vacant overnight. Young Chinese enthusiasts flocked around my roommate as he exposed his thoughts on what hacking meant to him. He would write Lisp code for fun on his bus trips around Shenzhen and could not be easily impressed with simple projects which were prevalent at the local makerspace. It was very hard to get him to work for any project, since it had to involve a serious intellectual challenge coupled with good compensation. According to him, the hacking scene around MIT he experienced flourished particularly in the late sixties because, in his words, of the three factors in confluence, *peak of oil, peak of money, and peak of freedom.* People around him were carefully paying attention as he spoke of his memories of the mythical place of hacking, while displaying a useful library he wrote for the Arduino platform to automate programming 7-segment displays. His presence and narrative fueled the imagination of the SZDIY members centered around a remote history of what hacking was in comparison with what it had become in the present where we shared the main workbench at Chaihuo.

Open Source Hardware Supply-Chain

In the March 2013 issue of the Chinese version of Forbes magazine featuring "30 Chinese entrepreneurs under 30" years-old[67], we find Eric Pan, CEO of Seeed Studio,

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67 Source: http://www.forbeschina.com/review/201303/0024076.shtml (accessed 10/13/2013).

pictured on the front cover wearing a slick suit. The article dedicated to his company tells the story of Eric's education at Chongqing University in electronic engineering, his outdoor hobbies, his quick passage through an internship at Intel, and his first contact with a cloned Arduino board. His entrepreneurial views are depicted as the innovative force bringing his company to the heights of the Open Source business to become one of the biggest in the world on par with US-based companies. We are also told Eric's entrepreneurial spirit is one of main forces for what was popularized by a former Wired magazine editor turned start-up executive Chris Anderson (2012) as the "New Industrial Revolution" with democratized, micro-scale productive forces, such as 3D printers, laser cutters, and other computer numerical control (CNC) machinery backed by Internet-based sharing communities. Eric described the role of this company in this seemingly new context as the one of a facilitator to "[speed] up the process from idea to prototype for hardware entrepreneurs" (Forbes 2012).

Seeed Studio is located in an industrial complex in the outskirts of Shenzhen. In my first visit, Eric was very casual as he had been in my other visits and tours of the company, suggesting he rarely wears a suit except in occasions such as the one for taking the picture for Forbes. He told me about his experiences outside China, his trip to the publisher of Make Magazine in Sebastopol, California, his meetings at hackerspaces and makerspaces in the Bay Area, such as Noisebridge and Hacker Dojo. Outside the window, we could see the green mountains surrounding the Nanshan district. The north-bound area of Nanshan is somewhat remote, predominantly industrial, and working class. Seeed's headquarter occupies two floors of an industrial building, one with the factory facilities and the top floor with management, advertisement, development, and engineering teams. Eric expresses satisfaction when explaining that the skies are always blue and the whole city is a huge “Techshop,” making an allusion to the shared, well-equipped membership-based workshops in United States for small-scale fabrication. *Right next door I could do enclosures with injected plastic, everything is easily available*, but distributed through large stretches of the city. He explains his projects of opening something like a Techshop at Seeed. His partner, inspired by a recent visit to the Californian Techshops and makerspaces, had just opened a shared workshop named “Techspace” near Shenzhen University, where, for the inauguration, they had the first hackathon of the city organized by the members of the local community of Free Software and Open hardware enthusiasts, the SZDIY collective. Eric mentioned with excitement his impressions of the people he met in the Bay Area: *they are so wired, so interested, everyone wants to change the world*. Drawing from models he experienced abroad, Seeed was set-up to provide services for engineers in various areas: from design to fulfillment, from sourcing to manufacturing and outsourcing (when demands exceed Seeed's capacity of producing in the order of a thousand circuit boards per batch). Eric is eager to invest in what he calls an *ecosystem* around his company. Chaihuo as a co-working space, Techshops for fabrication, business partners, and the online community around Seeed are perceived as integrated components of a system.

Seeed's entrance gate resembles the entrance of any other Chinese industrial enterprise, except for the products on display: ones that were once prototypes requested to be manufactured in China by foreign designers and engineers from the Open hardware community. One such project is an Open Source gardening timer and controller called “Open Sprinkler,” a recent addition to their inventory. The Open Source project and product was a partnership with Chris Anderson, which called attention in its packaging to the absence of the omnipresent “Made in China” in its plastic wrapping and substituted for the curious “Innovate with China” origin reference printed on a sticker. At first sight, it suggests Euro-American hardware designers and engineers can innovate with China, that is, having it as a partner on more or less equal footing, or having China as a mere provider of cheap parts and labor force for innovation that happens elsewhere, which is a recurrent observation made by expatriate engineers working in Shenzhen.

Entering Seeed's office one passes through a meeting room while facing a large open area of the building floor. In its aesthetics, it resembles the spatial organization and the colorful looks of Silicon Valley's Internet companies such as Facebook and Google: there are no cubicles and everyone works side-by-side. There is no clear division between teams as divisions are allocated by the management and only visible to the employees themselves based on tasks to be performed with teams. Affixed to one of the walls, one can see Seeed's timeline with pictures from the early days of its foundation in 2008: from a webshop operated from an apartment bedroom in Shenzhen by Eric and his co-founder to a company that employs more than one hundred young employees in various sectors from manufacturing, clerical work, design, research and development.

I am escorted around the premises by the chief of public relations at Seeed and told the company is run as a *big family*. A small publication is put together by her team with employees' birthday dates, movie recommendations, and discussions of group activities and affixed to the walls around the company. They organize regular group activities and celebrations involving various sectors of the company. The engineering team meets weekly for soccer matches, without the female engineers, at a near-by rental soccer field, to which I came to join regularly. I was invited under the premise that, because of my nationality, I would "naturally" be a good soccer player. I could not, however, keep up with their expectations as I spent much more time on the computer then playing soccer throughout my childhood and adolescence.

The second floor of Seeed's factory was occupied by the Agile Manufacturing Center (AMC), housing small groups of designers—receiving design files from designers abroad or working on Seeed's own projects—engineers work on new designs, testing already existing ones, and factory workers running pick-and-place machines, inspecting boards and performing small fixes, soldering, and boxing small batches of components. Seeed's PR describes the company as an *open factory*, one that can be used by designers abroad to run their products if the products prove to be popular online. On the factory floor, women and men can be found performing various tasks: from electronics design of circuit boards to quality control. During my visit, one of Seeed's female engineers showed me the printed circuit board manufacturing process walking me through each step. When I mentioned how many times I heard people praising Seeed Studio abroad from its services and how the perception of Chinese manufacturing as pirated and low-quality, Eric rebutted: *we try to do things differently here.*

A month after my first visit I returned to Seeed with a group of Euro-American tourists on a "Hacker Tour of China" organized by Mitch Altman and dedicated for manufacturing in China. The same openness I experienced when first visited the company was extended to the foreign visitors at this time. One of Seeed Studio employees told me the company had more than a hundred employees and they kept contracting more. The average employee age is early to late twenties. They are recent university graduates and the company has male and female employees in various activities, both at technical and non-technical capacities. I suggested to a Seeed employee the recurrent issue among IT professionals—with more incidence among women and minorities—of feeling "burned out" due to exploitative work conditions. The response I got was affirmative: *it was similar in China*, [with the difference that for Seeed Studio] *it was not work, it was life, if you keep people happy*, he told me, *they will work harder for you.*

Seeed is well connected with companies and independent Open Source developers from abroad, specially the United States. Connections are activated, fostered, and multiplied as Seeed engineers, technicians, and marketing directors travel abroad to attend meetings, summits, and conferences throughout the year. Mitch Altman, one of the key international hackerspace network animator, describes the process of adopting of the Open Source in China as one of trial and error. *In China*, he says, *there has been several examples where people do things without understanding what Open Source means, but when it is pointed out to them, they fix it. So, I have been pretty good in getting the concept to people all over China.* Seeed has been one of the keen participants in the global collaboration around Open Source hardware with a very specific position and a mission: that of a convener for Open Source creators with the goal of changing the image of China as a copy-cat abroad by creating local conditions for technological development. Mitch describes his experiences with Seeed in terms of a successful collaboration and careful observation of licensing agreements on their part: *when* [Seeed] *wanted to make TV-B-Gone kits, they asked me first. They did not have to. There is no agreement about it, but it is a nice thing to do. So, we had to ask* [the other company] *too, because they are the ones making TV-B-Gones because I have an agreement with them, so let's bring them in. We discussed what would make everybody happy. And, if they want to call it TV-B-Gone kits, they can give me some amount, a quarter or whatever, and sell it. Instead of making them cheaper, exactly the same and sell them and compete against* [the other company] *in US, they would make the Chinese version, for all models of TV in China, including the China-only brands. And it worked, everybody was happy with that.* This arrangement puts in evidence what exceeds Open Source licensing, that is, what is not specified in the licensing terms *per se* but operates fundamentally as a moral injunction creating and sustaining ties around a particular project. This moral injunction creates ties among developers and businesses within an imagined community of Open Source practitioners. It is not the "constitutive outside" described by Hayden (2010) in respect to the capitalistic drive for innovation in the Euro-American context but a tacit condition of possibility for transnational collaboration, whose outside is comprised differently by practices deemed "wrong": Open Source copies which do not respect trademarks and are meant to flood markets with low-cost clones to compete with originals (which brings forth the orientation toward improvement of the original as an ideal condition for partial reproduction under the guise of "innovation"); and the commercial agreements which are created in parallel with public forms of licensing for manufacturing of Open Source-based products.

Seeed Studio's Open Source hardware supply instantiates these conditions of possibility under very particular conditions, which can by described by reconstructing the steps of design, production, and distribution of a hardware project, such as the USB Gnu Privacy Guard token, a device meant for information security and privacy created by Gniibe, whose trajectory we saw in the previous chapter. While volunteering for the Gnu Privacy Guard (GnuPG) project, Gniibe also started to experiment with the implementation of a random number generator for a low-cost platform in order to create a USB cryptographic token, similar in functionality to a smart card. In his first attempt, he used a microcontroller from the AVR family, the same family of microcontrollers used for the Arduino platform. The performance was too slow for performing cryptographic functions, so he tried a very small 32-bit ARM computer manufactured by ST Electronics and distributed in a kit for the novice: STM Discovery Kit. He re-purposed the kit hacking the board in half literally and using just a portion with the STM32 chip for his security device. After verifying the success of his first prototype, he started to search for a printed-circuit board manufacturer and quickly found Seeed Studio online. He submitted a "wish" using Seeed's website for his project: "Minimum STM32F103 USB Board (FST-01)." The function of user-contributed "wishes" at Seeed allows for projects to be evaluated in respect to the interest of Internet users for a particular potential product. It is also an entry point for project ideas to be tested for commercial viability. Gniibe's project was not the usual Open Source hardware project for various reasons: he used a microcontroller that was not so common for hobbyist projects. He also designed the layout of the circuit for his device using a Free Software PCB layout program, KiCAD, which was not the most popular piece of software for electronic design. And, finally, he implemented an encryption algorithm and a random number generator for the usage of the USB token with GnuPG, which is highly used by Free Software developers and security professionals, but also fairly esoteric for most computer users outside the context of information security. In order to test his prototype, Gniibe got in touch with Seeed Studio through their “Fusion service” for express orders of a small quantity of printed circuit boards (PCB). One of the women engineers at Seeed took up his order and they went over the requirements. Gniibe used Seeed's wiki to distribute documentation in English about his project, which he copied verbatim from his personal website, where most of the documentation was initially written in Japanese. The wiki page was edited to provide links for public repositories where he published all the versions of the firmware for his device, including schematics, and design files. It also listed the “bill of materials” (BOM) with the name of online distributors for more specific electronic parts, such as the microcontroller unit STM32F103. After receiving his PCBs from Seeed, he started a new iteration of his design assembling his own boards using an improvised hot-plate to solder tiny electronic components. He verified its overall functionality and went on to order a larger batch (+100) from Seeed Studio's “Propagate” service, which became a distributor of his Free Software and Open hardware project. “Propagate” is described by Seeed as a service involving “agile manufacturing for small batch PCB, kitting and assembly[68]”. It requires, before manufacturing, estimating return on investment (ROI), preparing an estimate for the client, and receiving from him or her a list of materials to be used in the project plus a “test plan” for quality assurance, and, finally, distribution

68 Source: http://www.seeedstudio.com/wiki/index.php?title=Propagate_Manual, accessed on 09/23/2013.

with documentation in English on the wiki with a link to the product to be bought at "Bazaar", Seeed's e-shopping platform. Following the process, Gniibe's project was submitted on July, 2012 and requested manufacturing on August, 2012. By the end of September, the production was done and the product "FST-01, tiny USB 32-bit computer" was ready for distribution. Abstracting from Gniibe's project as an example and accounting for its cyclic characteristic, the general supply chain of Seeed can be described as follows:

Fig.1 Seeed Studio Supply Chain

What is particularly important about this example is the imbrication of the public and the private as Open Source projects travel from their context of design, published as gifts to end up as a commodities—from the sphere of activity around private electronics labs to hackerspaces and back. In order to sustain Open hardware projects, relations must be created on the registers of the gift and the market, following a general pattern which starts from a previous Open Source platform or project and completes a cycle of research, development, sourcing, manufacturing, distribution, and, re-entering the cycle, recreating and making derivative versions.

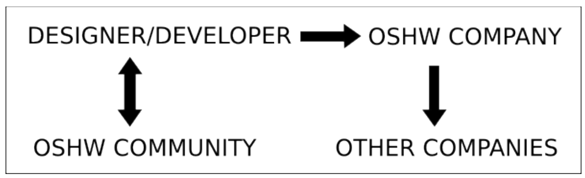

Fig. 2. Basic relationships sustaining Open Source Hardware companies' supply chain

The feasibility of projects through production, circulation, and usage is guaranteed by the possibility of shifting between registers of gift and commodity relations. Free Software is a gift whose ties can and usually are extended to market relationships involving software development and technical consulting under service contracts. Only in some commercial applications or appliances, Free Software becomes embedded in a commodity (or in violations of GPL compliance when Free Software is embedded in commodities, such as network routers, which involve the most common cases of infringement): in contractual relationships with software companies which package, document, and provide support for Free Software in the corporate sector. Open Source hardware, conversely, is born as a gift carrying the likely potential for becoming a commodity. Its constitutive intangible parts (firmware, documentation, design files, etc.) are released publicly in digital form and distributed widely. Its tangible parts are held back to be exchanged and evaluated on the register of the market and within industrial settings. In order to sustain the commoditized aspect of Open Source hardware, instances of gift-giving are created with the distribution of intangibles as well as in face-to-face workshops given at hacker and makerspaces, where the novice come to learn about electronics, receiving instruction through the means of the purchase of an Open hardware kit or, which is also quite common, the Internet and informal exchange over topics of shared interest. Hacker and makerspaces create conditions for the conversion of gifts in commodities and vice-versa. If the space is not widely open to the public (such as Noisebridge), it usually has “open house” events and dedicated nights, which is the case for DimSumLabs, Chaihuo, and Tokyo Hackerspace, among several other places where people can come to share information about their projects and topics of interest, exchanging information and animating the flow of gifts as well as of commodities through, respectively, pedagogical encounters with or without monetary transactions.

Following Gregory (1982) and Tsing (2013) on the relationship between gifts and commodities, a fruitful question for us here is how gifts become commodities and how, conversely, commodities shift to the register of the gift while maintaining their capacity for reverse transformation. Seeed Studio's supply chain offers us an example of this double movement with their model of production, distribution, and formation of alliances. What Tsing (2013) named “supply chain capitalism” is a useful concept to illuminate Open hardware businesses as their practices involve aligning contractors, subcontractors, volunteers, developers, designers, and partnerships with non-profit enterprises. In contrast with supply chain enterprises of transnational scope, the nature of Open hardware supply chain involves distributed and independent research and development, shared education resources online and offline, and collaborative spaces for testing, documenting, and improving designs at hackerspaces. Tsing also attention to a common blind-spot in political economy research in which gender, ethnic, national, and socioeconomic differences are effaced in mystified depictions of overarching supply chain configurations. In this regard, Seeed Studio's case is relevant because it highlights cultural aspects of its formation as a mainland Chinese company *vis-à-vis* its intimate coupling with Euro-American development and business practices. During my fieldwork, I found a common theme in conversations with mainland Chinese and expatriate engineers of how difficult it was "for the Chinese to innovate" and the extent to which Seeed stood merely as a service company to take care of the burden hardware engineers did not want to carry in respect to manufacturing, order fulfillment, and distribution. Seeed is perceived, given its geographical location, as perfectly suitable to act as a broker for foreign clients to tap into the industrial capabilities of Southern China. It is, however, also commonly perceived as being deprived of the capacity to *create*, common held opinion which has been increasingly challenged as Seeed fortify its ties with foreign designers and insists on demanding from its employees to start experimenting and working on projects of their own. Being an active participant in the production and circulation of Open Source commodities, Seeed had also increasingly sought to elevate some of its high-paid workers to the ranks of the cosmopolitan class of Open hardware designers, while inevitably serving as an efficient and affordable industrial source for converting gifts into commodities.

Shenzhen's "Creative Class"

Seeed's supply chain benefits not only from local companies, but also from local engineers and, to a great extent, from the contribution of an emergent "creative class" formed by expatriate Euro-American engineers who had recently established themselves and their businesses in Shenzhen. One of them was made famous in the Open hardware community with his USB logic analyzer and other projects hosted in his popular web forum. He came to Shenzhen after creating stronger ties with Seeed to distribute his project, getting its legal sponsorship to continue his work on Open Source electronics as a resident in China, and taking advantage of being next to Huaqiangbei to advance new projects and business ideas.

His trajectory presents regularities we find in the trajectory of other engineers (such as the ones we discussed on chapter 3). He was a prodigy kid, brought up by liberal parents in the Midwest of United States and *being involved with technical things as long as* [he] *can remember.* On 6th grade, he had to pick a book to read, so his mother sent him to school with a copy of Abbie Hoffman's "Steal this Book." His upbringing was, as he puts it, *anti-establishment at its core.* At the age of 16, he was granted early access to the University of Iowa due of his high scores on admission tests. *I got in lots of trouble when I was in school, because I was very smart, they told me, but I was very bored. I would tangle with the administration. I would read rulebooks, and I would use their rules against them and fight with them over their rules, and they would try to punish me on various things, and it would piss me off so I'd hit books, I'd read laws, I would be in their face.* He enjoyed math and science very much, so his father pressured him to pursue an engineering degree, which he did and ended up disliking. He could not relate to the way engineering was taught. It involved too many metaphors from sports and an atmosphere which made him uneasy. His informal training in computing and engineering came at a young age. His grandfather was a civil engineer and an early adopter of personal computers. He inherited personal computers from his grandfather, such as the Apple][, when they were neither affordable nor popular in the United States. He was also given a Radioshack electronics kit from which he got introduction to electronics and tinkering. Engineering felt as the wrong topic of study and the wrong profession for him in college, so he transferred to Iowa State University and got a degree in architecture. His deep interest in how cities function led him to pursue a masters degree in urban planning at University of Hawaii, which eventually got him back into programming and electronics, as he engaged in a project to implement a wireless sensor network to collect data on urban life patterns. The sensors he had at hand, produced and distributed by a prestigious US university did not work well and presented several problems, so he started to work on his own circuit boards. He later moved to Netherlands and pursued a second master's degree in human geography and got involved with other city planning projects. *I left Hawaii because it looked like George Bush was going to be elected again. So many people were like, "I'm going to move to Canada if this happens." I actually laid out a plan. I said I am going to move to the Netherlands because it's the most liberal place that I can find.* In Amsterdam, he began writing articles on his prototypes for Instructables and, later, under a contract for the influential Internet news website for the Open hardware community, Hack a Day. He did a series of posts on his project, the Bus Pirate, for Hack a Day and caught the attention of Seeed Studio, who wrote to him with a request: “we’ve had a lot of requests to build the Bus Pirate. Would you be interested in this?” to which he responded: *Yeah, sure. You can make it, but I don’t think anyone really wants it.* [Eric] *was like,* “Well, you can just build twenty. You don’t have to make a thousand of them. You can just build twenty, and we’ll see what happens.” [...] *At the time I was such a poor student. It was $420 the original investment for twenty, or something. I was like,* “That’s a lot of money. I can’t swing that.” *So we did it; this was before Kickstarter. We got a group pre-order on Hack a Day as a fundraiser, so we order all of them as a group, we processed the order, it’s like a week or two I think.* [Seeed] *built them and shipped them out* [...] *Surprisingly enough, in a week we sold like a thousand of them or something on pre-order.*

The beauty of his work in China, I was told, consists in having flexible working hours and lots of freedom, *whereas a local Chinese engineer would put in 12 to 16-hour work days.* In comparison to other foreign engineers, he identifies himself and is identified locally as a designer, a creative type: *I’m kind of artsy and I’ve got a creative side.* [In respect to Shenzhen] *I find it a very traditional engineering culture. It’s much like what I saw in Iowa that made me not want to be an engineer.* His position is usually put in perspective with Chinese engineers and developers who are considered to be lacking in the creative aspect. He currently disputes this position after his initial exposition to the local electronics market: *the Chinese are designing more and more of their things locally. Those 50-dollar tablets, the 50-dollar cell phones, all that stuff, that’s all completely designed here for the third world market. There’s a lot of creativity there.* His partnership with Seeed involves providing projects ideas, the creative input, whereas the company carries out production and distribution. He lives next to the

Huaqiangbei electronics market and makes local connections with market workers by playing dice, drinking, and eating street food when they are off their shifts by the time the market closes.

He came to understand intellectual property licensing through its negative, restrictive aspect. While doing a documentary for a graduate school project, he found himself having to find public domain content for his production (sounds, images, music, effects), which were difficult to find. He, then, turned to the idea of putting his DIY work in public domain and, later, under a Creative Commons-attribution license. *I was, like, "People need to know that they can use this, that I don't care. It's not going to diminish my material if you use it"* [...] *So, I started putting everything in the public domain. Take it, steal it, I don't care. I just don't want to make it shitty for someone else who wants to use something that I did. That's when I really got into open source is from doing it myself.*

"Copy-Cat Culture" and "Bad" Clones

Shanzhai or "copy-cat culture" as it is discussed in the West is constitutive of the technical landscape of contemporary China. It became a topic of discussion among Open hardware engineers when Bunnie Huang first described it in his influential blog in 2009: "*The contemporary shanzhai are rebellious, individualistic, underground, and self-empowered innovators. They are rebellious in the sense that the shanzhai are celebrated for their copycat products; they are the producers of the notorious knock-offs of the iPhone and so forth. They are individualistic in the sense that they have a visceral dislike for the large* *companies; many of the shanzhai themselves used to be employees of large companies (both US and Asian) who departed because they were frustrated at the inefficiency of their former employers. They are underground in the sense that once a shanzhai 'goes legit' and starts doing business through traditional retail channels, they are no longer considered to be in the fraternity of the shanzai. They are self-empowered in the sense that they are universally tiny operations, bootstrapped on minimal capital, and they run with the attitude of 'if you can do it, then I can as well'*" (Huang 2009; see also Li and Lindtner 2012 for a discussion on innovation and design). In the mainstream Western media, discussions about Shanzhai tend to focus on the assertion of impossibility of protecting and enforcing intellectual property rights with the long-lasting theme and Western prejudice regarding the absence of a "rule of law" in mainland China. On the opposite side of the spectrum, legal scholars argue over the identification of Confucionist roots and the Chinese political history as defining elements of the impossibility for intellectual property protection in the country (Alford 1995; Ocko 1996; Yu 2012). In this debate, what is particularly important is to highlight yet another interpretative and analytic possibility: one which assumes the organization of the Open hardware supply chain as the space of encounter and circulation of mainland Chinese and foreign technical objects and persons creating new ethical and legal sensibilities.

What I have witnessed through the examination of personal and technical trajectories in mainland China is an emergent set of practices of production and distribution which rely on license compliance in a world of exchange otherwise oriented toward interpersonal, familial, and economic practices. What Hayden (2010) has aptly called the "constitutive outsides" of the emergent digital commons under the pressing political and economic drive for innovation is particularly useful for framing the issue of the proper ways of copying source code or cloning hardware projects. According to the author, there is an unresolved, constitutive tension within the activist practice which is centered on the importance of fostering a digital commons, with initiatives such as Creative Commons, which has to do with its emphasis on creativity and innovation. This is a topic I will return for the conclusion of the chapter on the discourse of openness and the role of proximity and distance in creating transnational ties to shape practices of hardware and software development in China. Suffices to say here for now is that the "constitutive outsides" of the digital commons are very revealing of a particular dynamic of production in the transnational context of the Open hardware supply chain.

Based on his experience of brokerage among local and foreign partners, Eric Pan discusses Shanzhai in terms of an elementary stage of the learning process: *it is like learning to write, the first thing you do is to copy from the textbook. One would write the* [letter] *"A" for a hundred times or more. I think in China we are in the copy stage. We imitate and, going further, we will stop imitating. "I can do better than you", so I can start exploring things, I can start making things out of my own thinking. So, China needs more time. Copying when everyone else is copying is going to have an impact on business models. I think it is similar to fashion. In fashion you do not have copyright, you have the control of the brand and you have to act fast.* [People build upon each others' work a lot] *and that does not hinder creativity.* On the same topic, the expatriate engineer and designer, whose trajectory we briefly discussed in the previous section, speaks from the perspective of a creator about his initial reluctance in going public: *I had a little bit of* *fear somebody would steal something and make all this money and I would have to support it for them or whatever, but people do that anyway. It doesn't stop anybody. It just makes it harder for people who are trying to help you to help you* [...] *we have people who* [copy] *Bus Pirates and sell them all over China, sell them on Taobao, sell them on Ebay. I'm not going to start up a Taobao account, I'm not going to set up an Ebay account just to make a couple bucks a month. It's not worth it for me. Those people pay to have those accounts. They keep them up. They keep those products up. They sell them. They put our name and link our website, and they do that for free. I don't have to pay them to do that* [...] *I don't have to ship products. They do that for free. It's only been a good thing*. Despite their difference in perspective and position, copying in itself does not constitute a problem since it is the very basic condition for circulation (and, consequently, increased production) of technologies. The problem, however, resides in the conditions and proper ways of copying. The "constitutive outside" of the Open Source hardware exchange, that is, all the practices of cloning that do not observe moral and legal parameters, is of particular interest as it highlights technical, moral, and political skills and sensibilities as prerequisites for active participation.

We were once sitting as we usually would during the day to chat about Free and Open Source in my host's living room converted into an electronics lab and stock for his online shop in the periphery of Shenzhen. Piles of blue bins holding a great variety of electronic parts and components could be found next to a mid-sized laser-cutter with its ventilation tube coming out of the apartment window and, next to it, a soldering station with bundles of wires of various colors. My host was not in good terms with his neighbors due to complains for him to stop cutting plastic because of the fumes the machine expelled into the main court of the apartment complex. His finished and unfinished prototypes were everywhere at sight, small robots, various electronics components and parts, electronics kits in plastic bags, proto-boards with half assembled circuits. My host pointed at his computer monitor showing me a Taobao's website, a Chinese portal for web-shops in which most of the domestic electronic transactions for small to mid-size quantities gets done. On display there was the webshop of a local Open Source hardware enthusiast displaying the logo of the Open Hardware Initiative, a logo with gears inspired by the trademarked Open Source logo of the US-based Open Source Initiative. The website showed the picture of an Arduino clone. My hosts laughed at it and said *people were not doing it right by just copying* an Arduino board, which is Open Source hardware by definition with a minor restriction: copying is allowed if the Arduino brand is removed. He quickly jumped to a justification: *but* [the owner of the webshop] *is selling to the Chinese. He just had a baby.* My host, then, launched into a story of how good this engineer was in particular, and, at the same time, how disconnected he also was from Western debates on Open Source licensing.

In a couple of weeks after having our conversations about Open Source projects in China and trying to situate myself in respect to the local activities, the groups, and the companies, I came to visit different companies and conduct interviews with Chinese founders, software developers, and engineers in Shenzhen. I visited and recorded interviews with engineers and company owners working on Free Software development and designing single-board computers to compete with Euro-American projects. One of my interviewees introduced himself as Wei and invited me to come to his office and electronics lab in the region of Bao'an, where I often switched trains to go home after spending the day at Chaihuo makerspace, and where I often witnessed poor city dwellers and commuters being checked for identification by the police at the point of intersection between the main Metro line (*luobao*) and the purple (*huanzhong*) metro line taking to the more peripheral areas. Shenzhen is a city of “privilege” in very specific ways, namely, that it is a place with more job opportunities in factories and in the service industry, it is also a place for connections with more cosmopolitan activities due to its proximity to Hong Kong and to the constant influx of foreigners. More importantly, it is a place one needs government approval to stay, which is enforced in peripheral areas, where police officers inquiry immigrants for valid permits, *Hukou* (household registration system), to stay in the Special Economic Zone (Bach 2010).

Wei's office was located in one of the industrial enclaves in amidst the city, where one can find various workshops for wood and metal work, as well as several companies providing all kinds of services. These enclaves are surrounded by residential apartments, a big shopping mall, and small businesses. At his company, Wei tells me casually that he ventured into his own business because of the pressure he suffered from his wife's family. He recently got married and was pressured by the family of his wife to engage in a profitable business. He was one of the Seeed Studio's first engineers and experienced its growth from a few employees up to a hundred in the process of creating ties with foreign companies, engineers, and designers abroad. Seeed is highly regarded as the place where he came to understand Open Source hardware: *when I got to play with Arduinos I realized it was completely different, it was so convenient. The most amazing thing is that Arduino is build by people on the Internet and it is meant for artists. The most important thing is Open Source. Seeed used the concept of Open Source* *excellently, they created Seeeduino* [an Arduino clone] *by collecting ideas, they asked the community:* "Is there any improvement we can make to the Arduino board?" *So, Seeeduino was based on ideas from the community. It was accepted by the community. Seeeduino was the first to become famous. Because of this example, I came to learn about Open Source hardware. Its power is very strong. It is different from the traditional way of designing things.* Seeeduino contrasts with "bad clones" that can be found everywhere in China and in online shops: it fulfills the necessary condition of "improvement" of an existing Open Source hardware project, returning the contribution to the public in order to be considered a legitimate derivative product.

Small companies in China such as Wei's have to move as fast to deliver products, and this very sense of pressing urgency is one of the main reasons given for widespread practices of improper cloning. Interestingly enough, economies of technical services and gift giving such as the ones involving Free and Open Source technologies represent to Chinese newcomers, at once, a transformative experience and an instance for ethical evaluation of copying practices. *Under what circumstances to copy? How to copy? What is meant to be copied and what is not?* The experience of entering the global economy of Open hardware meant for Wei and other Chinese entrepreneurs such as Eric the process of slowly coming to grasp how to participate, learning what could be replicated, what they could improve, what they could provide in terms of service, carving a space as brokers and facilitators for local and foreign projects. Under what circumstances they had to ask permission for running a project on industrial scale for profit on their website? Learning how to interact and position themselves in the context of Open Source production went a long way as expressed by Wei in respect to his experiences as one of the first Seeed employees: *for me, what I can do is to try to make things open and follow the licenses, at least, in the international market. But, here in China it is difficult, to be honest. I keep the hope for the change here in China. As the economy develops, the idea of licensing will change. In terms of a personal experience, people are always trying to make something acceptable and respected by the community, not just a copy. Even copying without attributing the original... things in China are a little bit different. You know, some people are trying to get the money as fast as possible, and the fastest way is copying. I do not think it is sustainable over time, since things are changing. China is more and more open. But there is a long way to go. Why I am so hopeful? People always wanted to be respected. Once they get better, they will try to make something valuable, as valuable as the new things designed in America.*

Copying without regards for licensing restrictions or moral injunctions for attribution and sharing were the norm as mainland Chinese companies were more secluded from watchful foreign eyes. The context of production, distribution, and usage is perceived to be changing, however, and the change comes about with stronger force as Seeed and other companies create stronger ties with companies and engineers abroad. During our meeting in his office, Wei showed me his website where the Arduino clones he made had the Arduino logo blurred. He then told me that it is a new regulation by the webshop infrastructure owner, the Internet Chinese giant Alibaba, to enforce trademark laws by forbidding webshops to display and sell products which infringe trademarks. A couple of months after we first met I returned to his website, which now show similar Arduino clones, extension boards, and accessories, but now with its own brand name and logo silk-screened to his products.

Wei was inspired by the magical arguments put forward by Chris Anderson his highly influential book "Makers," depicting the Open hardware initiatives, involving fast prototyping, 3D printers, Open hardware and Free Software platforms such as Arduino to be leading the world to a "new industrial revolution." Wei says he is hopeful for the change in China. He wants to be part of the "revolution" with other Open Source companies, such as Seeed in China, Adafruit and Sparkfun in the United States: *it is a good thing to be open, be honest, and make things. To make hardware as well as software projects. The market is getting bigger and bigger. Customized products are becoming more and more important, this is why there are so many small companies to meet small requirements. I got to know this information from Chris Anderson that the third industrial revolution is really happening here with Open Source hardware, 3D printers, Arduinos, and the community.*

Entering relationships in the context of Open Source is not a trivial matter as it involves a different orientation regarding ownership, property, and "propriety" of one's technical and commercial conduct, as well as a set of particular ties surrounding the person who shares and the technical object that is shared. In China, the question of economic hardship is privileged as the prime motivator for attempts to use Open Source hardware as a means for short-term economic return. It breaks the linkage with the West and the "right way" of doing Open Source by engaging in practices that are common in China, but condemned by engineers, designers, and companies abroad. Seeking economic benefit and competitive advantage in detriment of the "spirit of Open Source" is hardly unique to Chinese entrepreneurs. I have been told by various Open Hardware producers about disloyal practices of competition that never surfaced in the media, but are well known among producers in the Euro-American context. The conflict over gifts and commodities serves as an important index of the sensibilities at stake. One of the key practitioners and cosmopolitan spokesperson of Open hardware suggests in this regard that *there has been times when people were not so happy with* [a company] *copying their projects and selling in their website.* [I have heard about the case of scrapping the competitors website to monitor prices] *and getting busted, and then doing it again. It is just violating the spirit of the whole thing, because the spirit of Open Source is sharing and if we all do that there will be enough for* [all of us](marked emphasis) *for making a living doing what we are doing. We do not have to make zillions of dollars.* [This other company] *is doing, as far as I can tell, totally within the spirit and doing it right all along the way on every step and continuing to do it, they are doing really well. That is not their primary goal to maximize profit, but they are making plenty of it.*

The passage from cloning trademarked Open Source-licensed hardware to blurring or masking trademarked logos on public, Internet display to, finally, the adoption of their own logo and redistribution of improvements to the original contributed design describes a longer trajectory of large-scale transformations which has been in course since China joined the World Intellectual Property Organization (WIPO) in 1980 and the World Trade Organization (WTO) in 2001. In the past decade, a major shift in economic policy toward market liberalization brought the PRC closer to the United States as a trade partner. Chinese patent applications skyrocketed in China in the past ten years. Major Internet companies, such as Alibaba and Tencent, were pressured to comply to the WTO TRIPS agreement, creating mechanisms to enforce intellectual property rights by receiving claims and taking down violating postings.

Interestingly most infringements on the platform are related to trademarks, followed by copyright due to distribution of DVDs and software. The Chinese copyright law is considered insufficient for the purposes of the WTO/TRIPS agreement, so amendments have been discussed and implemented. One document to this effect is the "Regulation on Computers Software Protection" [计算机软件保护条例[69]] from 2001 which contains provisions for software copyright. By the 2013, the Creative Commons set of flexible copyright licenses in its version 3.0 was fully translated and adopted to the PRC jurisdiction, rendering many Open Source hardware design files legally supported. To this date, however, no official Mandarin translation of the GNU GPL and other Free Software licenses were in circulation, however private discussions were being held among local and foreign activists to start translation projects.

69 Source: http://en.pkulaw.cn/display.aspx?cgid=194529&lib=law, accessed 12/15/2013.

4.3. Dim Sum Labs

Dim Sum Labs (DSL) was founded by a group of Hong Kong-based electronics and computing professionals and entrepreneurs. It was originally called "HK Space" and registered as "HK Make" in 2011, a legal limited corporation "dedicated to the advancement of science and the arts" according to their constitution. As a non-profit company, they were required by law to have a board of directors and a secretary. I learned from observation that DSL was operated through an informal notion of "open governance." There was no established procedure for defining who gets to join the board, and its positions have been historically occupied by senior members of the collective. There were no functional attributions or prerogatives for the directors. Similarly to Noisebridge, directors served as legal placeholders for liability purposes. There was an informal, core group composed by technically skilled and experienced members formed by foreigners and locals of Chinese descent. Since its inception, the core group has been responsible for managing conflict as well as administrative tasks, including rental contract, insurance, membership, events, and partnerships.

The experience of founders abroad was the basic ferment for the initiative of bootstrapping a community space for meeting and tinkering with electronics. They first organized in a meet-up format, finding participants via a public announcement on the Internet, and gathering at the local co-working space, BootHK. Early meeting documents from the period of foundation describe the efforts of gathering resources, creating the network infrastructure and procuring for the most common building blocks of hackerspaces, such as workbenches, chairs, tables, soldering stations, electronic testing equipment, whiteboard, CNC machinery, printers, computers, and various other tools. The solution they found was to hold small workshops in order to attract the attention of technology enthusiasts and entrepreneurs. There was no other space for hardware workshops other than BootHK at the time in the city. Robotics turned out to be a very attractive topic for enrolling interested parties, as well as for engaging in discussions surrounding the perceived need of fostering a "start-up culture" in Hong Kong. As one of the founding members explained, it was assumed for any enterprise in Hong Kong to fulfill three basic roles—the so-called "three H"—in order to succeed: *the Hacker, the Hipster, and the Hustler*. Each of these positions were supposed to manage, respectively, the information technology, the design, and the business aspects of a start-up company.

Among its founders, DSL counted with early supporters who had extensive experience working abroad as entrepreneurs, computer professionals, and engineers, attending prestigious universities, research centers, hacker and makerspaces in Japan, Singapore, United States, Germany, and the United Kingdom. The decision to create a physical and more permanent community space was a difficult one as it implied a financial burden most founders did not want to incur. One of the founders started a co-working space, which he would rent out for start-up companies. According to one of the early members, the vision was that *a pure hackerspace is not payable, so* [...] *you do both, a co-working space and a hackerspace. The co-working side pays for the hacking side.* Some of the early members were eager to help fund a more open space for technical experimentation and, to their surprise, one investor approached the group and donated enough money to secure the rental of a room in a commercial building, centrally located in Sheung Wan, Hong Kong island. After providing the contribution for the initial deposit, the investor was never to be seen again at the space.

One key aspect of DSL was that it had more contacts and actual ties with hackerspaces in Europe, Japan, and the United States than with makerspaces in mainland China. This is due to several factors, which include the economic and cultural capital of DSL members and the troubled political relations and socioeconomic distance between Hong Kong and Mainland China dwellers. In their discussion of Hong Kong's emergence as a global city, Forrest et al. (2004) examine how socioeconomic class is spatialized and manifested through urban occupation in the city. As China repositioned itself in the global economic order serving as a central industrial power, Beijing, Shanghai, Shenzhen, and Hong Kong raised to the ranks of global city centers connecting Chinese industrial and global financial elites. Another distinctive aspect has to do with Hong Kong's new political and administrative context with its transformation into one of China's Special Administrative Regions (SAR), tightly connected with Shenzhen through the movement of people and commodities as well as financial and industrial elites across the border. In this context, poor immigrants from Mainland China are discriminated against and accused by Hong Kong residents for causing recent cuts in social security benefits (Forrest et al. 2004, op. cit.), affecting public housing, schooling, and health care. In innumerable conversations at DSL about this troubled relationship between Hong Kong and Mainland China, I learned that one of the most common pejorative terms in use to stigmatize Mainland Chinese immigrants was that of “locusts,” which happened to be used iconically in several instances of protest around the island. The vast socioeconomic inequality in the city expresses long-lasting traits of its colonial legacy: places which are now occupied by expatriates and Chinese elites were occupied in the past by British colonial officials and well-positioned Chinese industrialists.

In comparison to Noisebridge, DSL is also centrally located, but occupies a much smaller office space. DSL is situated in an upscale region of Hong Kong, surrounded by antique stores and specialty shops in one of the oldest neighborhoods in the city, which is also one of the places where most young and well-off expatriates live. It has been maintained with membership fees of thirty paying members approximately, and had ten to twelve members who attended the space regularly. Among its members, one would find IT technicians, start-up entrepreneurs, designers, and professionals with interest in computing, including university professors from design schools and lawyers. Regular events in the space were targeted toward the exploration of topics of "innovation" and more general tinkering. Signature events of hacker and makerspaces were there to be found with regularity, such as 3D printing and CNC machinery, analog electronics, hydroponics, lock-picking, cryptography workshops, informal meetings for "show and tell" and technical troubleshooting, presentations by itinerant hackers and engineers (showing their projects or coming to meet and greet). One of the distinctive events that I have found at DSL was the meeting group for data analysis with financial sector IT workers, a workgroup on R, a programming language and framework for statistical analysis. Other activities followed a more regular schedule and dynamic of Open hardware experimentation in other hackerspaces with common tools, frameworks, and replicated prototypes.

Despite its geographical closeness to makerspaces, hardware start-ups, and incubators based in Shenzhen, DSL sought inspiration elsewhere in more established and internationally renowned hackerspaces, such as Noisebridge and Tokyo Hacker Space. One of the founding members, himself trained in finance and engineering at elite schools in London and Tokyo, describes his trajectory in respect to DSL in terms of a return to his early interests: *I remember reading at the THS website that they were trying to electrify an acoustic music instrument* [and] *to me the idea was very inspiring. How do we bring technology with other walks of life*? His initial intent, as he recalled it, was not to find profitable endeavors, which has been otherwise a key part of his professional training, but to reconnect with his early university studies in mechatronics at Tokyo University: *in this sense, I am a bit multidisciplinary. I was not interested in pure programing, I was more interested in this mix of physical things and technology. In respect to the co-working space, I was not planning to make money out of* [it], *but I was certainly interested in making something that maybe one day will make money. I was not doing it for the sake of making money; it was more "let's try make something." That is how I got started*. Curiously, his first workshop at the hackerspace was on coffee roasting. His question was: How can you "hack coffee" to achieve particular results? As he recalled it, the workshop had very little attendance, but shared early on a common topic of interest in hackerspaces around food experiments and beer brewing under the controversial rubric of "food hacking."

Loosely following the "design patterns" for hackerspaces, DSL held Tuesday gatherings alongside an event called "Hackjam." Tuesdays were not dedicated to formal meetings (called "admin meetings") as they were held sporadically to address emergencies with management and maintenance issues. Hackjam was an open house, public "show-and-tell" for technologists and artists to demonstrate and discuss their projects, as well as for socialization of local technologists or itinerant hackers, artists, and entrepreneurs. Joining the event for the first time, I was immediately addressed as the space did not allowed for ignoring one's physical presence as Noisebridge largely did, finding myself among a group of expatriates and a few locals. In my first interaction, I was approached by a technologist whose personal trajectory I came to learn later in our recurrent conversations about his experiences as an employee of a formerly influential Silicon Valley-based IT company and his frustration with the intense workflow and absence of social life in the context of the so-called Dot-com bubble of the 1990's. At the occasion, I was accompanied by my partner, herself an anthropologist working with adolescent girls in Nepal. There were only three women among twelve men in the space, a rather unusual ratio given the rare presence of women. One participant was a physics teacher from Hong Kong, who had special interest in robotics and electronics. She brought to the space a small replica of Theo Jansen's "Strandbeest," a wind-powered, PVC-made sculpture, which she adapted herself to control with an Arduino board and a remote control. My partner happened to be in Hong Kong in transit to her field site and was curious about the "hackerspace" concept. I observed interactions while following a parallel presentation of an experimental music synthesizer created by one of the members. As I approached another small group, I was promptly inquired about my work, which I described using a similar explanation I would offer for first encounters to summarize the work of years: "I study Free and Open Source communities, projects, and career trajectories with a focus on spaces for technical cultivation and project development such as DSL. I am interested in how technical skills are formed outside universities and IT companies." Followed by the usual silence accompanied by an expression of puzzlement, one of the attendants broke the silence to verbalize a common concern in self-presentation: *Are you a hacker?* to what I promptly answered I did not consider myself one. Far from it, I had too much too study in order to get there. I was already prepared to answer the question, since I was asked the same question too many times from academics and non-academics, in and out of the field. I was, then, encouraged by him with an energetic tone: *I will make you into one!* The conversation continued with explanations on how to start programing that were particularly directed toward my partner, who shared with the group she did not know how write software. This exchange was particularly important for foregrounding a tacit demand for performing technical ability which was meant not only to assure respect from other technologists, but also to attract attention from the unusual participants. In virtue of the small space of the DSL's office, there was very little room to accommodate everyone, so just of few of us were sitting, while people divided themselves between small groups and around the demonstration of particular projects. One member in particular was helping a person who brought a toy guitar to modify it and build an actual music instrument in the midst of a chaotic atmosphere with loud, technical jargon-ridden cross-talk. This event would repeat on a weekly basis with variable intensity in terms of the quality of its social interactions and technical exchange.

The everyday space of interactions was not without tensions and heated debates on how DSL should be conducted and what its members should seek after as part of the collective. DSL was marked by overlapping differences in member's skills and perceptions of hacking and making, tinkering, and its economic value which also stood for fundamental differences in objectives and desires. There was little interaction throughout the week, except for a couple of evenings. Most activity and debate would occur online. In one heated thread of discussion about the state of DSL in a popular social networking website, an argument about the dilution of the "hacker spirit" was ignited by one of the active members:

> *Possible problem: I worry DSL is turning into just another co-working space and moving away from a hacker culture. I worry the hacker culture will be diluted and be stamped out by other ideas other than the hacker culture. Please comment and let me know if I'm being too sensitive and or incorrect.*
>
> *Possible solution: take new members in batches. They sign their name up to join the hackerspace. Then once a month we hold a talk for introductory members. In these talks we go over the history of the hacker culture, what it means to be a hacker and what the purpose of the hackerspace fulfills. We also lay down the high level framework rules of the space. After this folks may decide if this is their cup of tea[70].*

This discussion, involving most of the active members of DSL at the time, progressed with references to a very influential talk given my Mitch Altman on the "hackerspace movement" in which he described the functioning of Noisebridge as an anarchic and radically open space supported by the notion of "excellence" in regards to interpersonal relationships. The question of DSL becoming a co-working space or not was posed in a moment in which activities involving start-ups and circulation of start-up workers increased in the space. At odds with this orientation, this period of transition led a few members to increasingly emphasize the need of connecting the space with global initiatives around Free Software and Open hardware development, projects that were first and foremost perceived as technical embodiments of "hacker

70 Source: https://www.facebook.com/groups/dimsumlabs.members/permalink/626114724142215/ (accessed on 03/01/2014).

values." DSL hosted the city government-sponsored InventHK event, "StartmeupHK," with a series of activities, including their first collective trip to Shenzhen to visit Chaihuo makerspace and the SZDIY community. The overall tone of the controversy regarding DSL being a "co-workspace or a hackerspace" revolved around divergent understandings of hacking and the difficulty for members to agree upon the creation of a set of rules for the space, placing discussants in a double-bind. From one side, there was a perceived value around concepts such as the "right to hack" and "right to community"—expressions in wide circulation at hackerspaces among hacker activist groups. Yet, from another side, there was a perceived need of informing newcomers about the general orientation of the space, but members could not reach a consensus on the content of the message to be delivered to newcomers. Creating mechanisms for selecting those who get to participate, based on their interests, felt for some of them the right thing to do in order to improve the space and its projects. For other, it felt like a controlling mechanism which would be detrimental to the financial sustainability of the space, since DSL was mainly supported through membership fees. One member suggested the need for coexistence between the two major visions for DSL, *a successful hackerspace needs*, he argued, *not only the Steve Wozniaks but also the Steve Jobs*, referring to a popular perception of the need in IT companies for inventive engineers but also sales, design, and business-minded leaders, which echos the "three-H" of the start-up culture mentioned before. As DSL itself was founded by entrepreneurs who situated themselves mostly in between the maker *ethos*, carrying the discourse on hacking as unconstrained tinkering, and the economic and competitive advantages that are attributed to agile start-up enterprises, the conflict was not settled but eventually silenced. What resulted from the debate was a wiki page which was meant to document the DSL principles *vis-à-vis* its allegiance to the goals of the wider network of hackerspaces.

One of the more experienced members, himself a former employee of a big multinational IT company who happened to participate in the foundational meetings of Noisebridge, composed a document for the DSL wiki entitled "Rules & Guidance for New Members" in which he described the place as a "pretty anarchic place [...] there are few if any real rules to follow." Among the rules they find inspiration, the document describes: "be excellent to each other; every time you visit, leave the space a little better than when you arrived[71]" with links to Mitch's keynote presentation on the "hackerspace movement," Levy's book "Hackers," and "Anderson's Makers: the new industrial revolution." As yet another founding member described the general orientation of DSL, riffing off the cardinal values of "do-ocracy" and "excellence" at Noisebridge: *I guess what we try to do is to operate on the basis of respect for the space and for everybody else. If you want to do something, do it! If nobody shouts at you, then it is fine.*

The open governance of DSL was conflated with the unspoken but observable fact of its structurelessness. Two particular events showed the evidence of major sources of tension: the presence of "disruptive" individuals and the fabrication of "disruptive" projects. Given the open door policy of certain hackerspaces, they tend to attract people of all walks of life, creating the problem of having individuals whose

71 Source: http://wiki.dimsumlabs.com/index.php/Rules_%26_guidance_for_new_members (accessed 03/15/2014).

dispositions are not adjusted to the way the original members imagine and value DSL's constituencies. One example of undesirable presence was that of a certain middle-aged man who discovered the space online and decided to attend. He was trained in economics and versed in finance, but had no experience with computing, electronics, or any contact with hacking or Free and Open Source technologies whatsoever. He was drawn to the space by the marketing potential of "maker culture" to unleash profitable enterprises. At every opportunity of debate with DSL members, he would argue for the benefits of strong intellectual property protection. He would also bash mainland China and its inhabitants for being lawless, while exalting the virtues of Hong Kong for its "established rule of law." It did not take long for him to become an undesirable person at DSL, partially because of his opinionated remarks which were offered constantly without request but mostly for his "idle participation" in the space. He did not have a project or problem to contribute, he was to be found idle or interrogating other people at the space quite often. One member described his activities as such: *repeatedly interrupts people when they are trying to work, even if they tell him to leave them alone; likes to try to order people to do things (like cleaning the toilet or floor); in his defense, he usually cleans the toilet himself; touches peoples projects (also while they are working on it); ignores community decisions and community advice; likes to piss people off by repeatedly making political and sexist statements that he knows they strongly object to.* As a temporary measure, his membership was revoked, but a controversy ensued over the right course of action to deal with the situation. There was no established procedure for banning someone as there were no clear guidelines to accept or reject one's membership. Some members were not bothered by his presence and were actually glad for his volunteering in cleaning the space. What was the most interesting aspect of the controversy was the emergence of the necessity of creating “community guidelines” and protocols for banning individuals and protecting the collective. The provisional solution taken was to follow Noisebridge's guidance in conducing a session of mediation, that is, to find someone who was not directly implicated in the conflict to talk the *disruptive* person into adjusting his or her behavior in accordance with the community practices and values.

Another conflict was not of interpersonal nature but of abuse of the physical space. There were just a few tools at DSL for fabrication, other than electronics bench equipment, including CNC machines. At one occasion, a retired expatriate man with a business in Hong Kong discovered and approached DSL and its promise as a place for Do-It-Yourself tinkering. He brought, then, to the space his project of a wooden pipe organ. It took him several months to finish it, but he finally managed to build it for display at the Mini Maker Faire at the Hong Kong Polytechnic University in 2013. The concept of the project was well adjusted to the goals and aspirations of the DSL collective, but the project became an issue due to its large size. During the process of cutting wood for the organ, the small space of DSL got covered in saw dust, including floors and computer equipment. It became obvious quite fast the disruptive nature of the project, so members started to complain and take action by moving parts of the organ to adjacent parts of the space. The problem was only solved after the organ was exhibited at the Maker Faire and, finally, disassembled and stored. As for the guidelines for accepting or rejecting memberships, there were no protocols or informal practices to address disruptions of this nature.

There are important implications in these examples which have to do with the value of direct participation in social experiments at hackerspaces. *The signal-to-noise ratio*, as one member suggested to me, *has been really low at DSL,* but it has not prevented him from benefiting from its creation. Through DSL, he met his partners with whom he started a successful start-up company, integrating household appliances with mobile devices and web services. Helping to bootstrap DSL and embark on the experiment with loose forms of governance allowed him to learn about non-hierarchical stances on questions of command and control. *I definitely think* [it was a] *very beneficial experience. I guess my background tends to be much less collaborative.* Before joining DSL, he gathered experience in the military, working as a consultant for the police force of Singapore and, later, corporate experience working in a private equity firm. Growing up in Hong Kong, his family had allowed him to choose between only three choices of elite professional career: doctor, lawyer, or engineer. *As a consultant, my job was to write a report and give to the client. There was a certain degree of frustration. What tangible results am I delivering?* [...] *The hackerspaces showed me or put me in this more collaborative mindset, realizing that it also has reflected in my business now. I feel that I cannot do everything, even though I wish I could do everything, but how my teammates, my partners, they would do things not the way I would, but all I can do is to trust them* [...] *If I haven't started this hackerspace, I wouldn't have met my partners to begin with.*

Entrepreneurs and Makers

Bill was one of the original founders of DSL and one of the most active members. He participated in a group of volunteers who collaborated in helping the space with its financial, legal, and organizational duties. Out of his numerous activities, he was known for giving regular Arduino classes and teaching electronics at the space. He was born in Hong Kong and spent eight of his childhood years in Japan with his family, where he attended an international school with English instruction. He started to learn computer programming in the late 1970's. His first machine was a Sinclair ZX80, which he bought with his savings. *Back then*, he said, *for electronics, it was actually easier in Hong Kong. In the street you would find "electronics and radio shops" where you could buy simple components, because back then Hong Kong still had a manufacturing base for toys, radios, and electronics. I went to high school in Wan Chai and, I remember, I was 13 or 14, I would take my lunch money and go buy a transistor radio kit. Since I was young, I was always taking things apart to see how they worked.* He had recollections of growing up with his father, a businessman with no interest or knowledge of electronics, often handing him electronic equipments to fix. After completing high-school one year earlier his father sent him to a boarding school in United States. Living in the United States in the 1980's furnished him with the wealth of publications on hobbyist computing and electronics, bulky catalogs to acquire electronic parts, and personal computers.

The transition for the US was a turning point for him in terms of political consciousness. *I grew up as colonial citizen of the British empire. Under colonial rule there* *was not a peep about any political* [topics]. *We were not taught anything about anything. When I went to the United States, suddenly I found myself having to learn about history of the United States, which is more of a political history of the United States.* [In my history] *books they discussed elections, they talked about filibustering, etc. It was martian language to me. Growing up in Hong Kong we were not even taught the word "election." Imagine being 16 and not knowing what election means. I was a "politics virgin" when I went to the United States.* In his experience, he struggled to pass history courses during his high school and college years.

He got his B.A. at Swarthmore College, a liberal arts college with an engineering program. Despite the diversity of subjects he had access to, he concentrated in computer engineering, learning to write microcode for microprocessors. After college, he accepted a job in New York at Wall Street as a computer programer working with FORTRAN. He soon felt he was out of place in the city and decided to start searching for a post-graduate program. He found a new interest in environmental engineering and was offered a position at Drexel University in Philadelphia. His lab work involved analyzing sewage water, which turned him off completely from his new career goal. He then proceeded to a Ph.D. in systems engineering with a focus on applied math. *After finishing the Ph.D., I realized academia as a profession was not for me* [...] *I was watching all my professors and they were very back-stabby and always fighting over grants and stuff like that. It was really ugly. If they are going to fight for this, I thought, I might as well fight in the industry for more!*

After completing his Ph.D., he decided to move to Silicon Valley, staying there for over ten years. *I was a technical guy, where else should I be!* The so-called "dot-com bubble" was expanding fast in the late 1990's and it was about to burst with an inflation of Internet start-up businesses. He came to attend Burning Man a couple of times. *Because I went to a liberal arts college, I was always a little bit alternative, a little bit fringe, I was always experimenting a little bit on the edge* [...] *it was great that I went to a liberal arts college, because it kind of widen me. If I have gone to a technical institute, I would have turned out differently, I would have been more narrowly focused. Even in my music taste, I was a little bit on the edge.* It was very exciting for him to be based in Mountain View and therefore very close to major IT companies. He worked at different capacities for local start-ups, from operations to project management, software architecture to programming. *Silicon Valley was great, but after N number of years, I started to forget about my hardware and tinkering roots. I felt very uncomfortable. At some point, my college roommate* [...] *who was living nearby... and I decided to rent a garage together. We had our own garage in Mountain View and we were just tinkering with crap. Nothing really came out of that. We were playing with* [arcades]; *we were also doing projects with PIC microcontrollers.*

After more than twenty years of residence in the United States, he made the decision of returning to Hong Kong. He felt he needed to spend time with his family. As they aged, he felt the need to stay closer, instead of seeing them sporadically once a year. He took more than a year pondering over the decision of returning. *I am really glad I made such a decision* [...] *I am was not settled in the US after ten years in California, my parents were getting old. This is the Chinese part of me, right? The* *traditional thing. My family is in Hong Kong.* Around the time he was planning his return, he started to hear about hardware hacking and the creation of various community spaces such as Noisebridge in San Francisco, Techshop in Menlo Park, and Hacker Dojo in Mountain View. *So, I got back to Hong Kong, I was sitting around… I was looking around, there was no hackerspace in Hong Kong. Someone should start one. Eventually, I went to "Meetup.com" and proposed for us to start a hackerspace. The first guy to show up for the meeting was* [an engineer and entrepreneur who started a 3D printer company in Hong Kong]. He suggested they should first start a co-working space, which Bill agreed it made sense, because, he reasoned, they might be able to attract people who could afford to pay rent. First, Bill helped the engineer and entrepreneur to start "Boot", a co-working space in Wan Chai. Every Tuesday night, Bill would organize "HackJam," later joined by another entrepreneur and engineer who was also interested in creating a hackerspace, and who had previously learned about hackerspaces after visiting Tokyo Hackerspace and following their activities online. [HackJam] *was not getting much traction. I think it started to get attention when I changed the name from HackJam to BotJam or something. I said we are going to build robots.* After experiencing a small growth in attendance and public interest, they formed a group of more permanent members, including computer programmers, engineers, mechanical and electronic engineers who would help to pay for the initial costs of renting an office space for DSL.

When asked about his memories related to hacking, Bill offered his own take on the term referring to his childhood and college experiences with uncontrolled chemistry experiments, lock-picking, rewiring pay phone lines to use a modem in his dorm, and perform all sorts of re-purposive tinkering with hardware, such as building his own light pen to be used with a TV set. *I do not identify myself with the "software cracking" kind of hacking. I know some people do, but it is not something that gets me excited.* [It is more about] *making stuff for me. I use the verb "hack" more in the sense of using something in a way that is probably not intended to be used, to re-purpose. I think I did that throughout my life.*

When questioned about the distance between Hong Kong and Mainland China, and the proximity between Hong Kong and some hackerspaces in United States, he offered an interpretation of the border as forbidden territory, by approaching it, one could could get shot. *Back then mainland China was a black hole. In 1978 or 79, the border was opened for commerce with Hong Kong by Deng Xiaoping and a flood of requests from distant relatives arrived for televisions, and other things.* The distance between DSL and hackerspaces in Shenzhen only started to decrease quite recently after the visit of SZDIY members with the proposal of holding a joint "hacking event" in Shenzhen. The proposal did not get much traction as crossing the border involved the difficulties of acquiring an "entry permit" for most mainland China residents.

Bill's organic involvement with the local "maker movement" was carried out alongside his position as an adjunct professor of entrepreneurship at Hong Kong Polytechnic University. He has served in the past as a mentor in and outside academia, helping to bootstrap technology start-ups. On a side, he also conducted an online business which he started on his own. He is one of the most active members of DSL, always to be found at the HackJam meetings or offering workshops on Arduino, lock-picking, and more experimental projects with MCUs involving music and various forms of interactivity. He has found, despite his negative past experiences as a Ph.D. student, renewed interest in teaching through the usage of Open Source platforms, such as Arduino, and aspiration from hardware hacking projects. *Going back to the days when I thought I was not going to be in academia if I to make a living through teaching and had to fight for grant money and all of that, I realized that I really love the teaching part. I do not love research, I love teaching.* [...] *I am not sure if it is the spirit... most of the start-up people I know are not hackers, most of the hackers are somewhat entrepreneurs, but not always though* [...] *I guess the overlap is that in Hong Kong the media sees everything as a big lump, the innovation/creative industry. In Hong Kong, they see this as non-bank, non-real estate thing that is on the other edge, they do not know what it is, but they are afraid of it, because a disruption can happen.*

Similarly to Bill's trajectory, Robert Boyle was another key member whose cultivation in science and technology presents us with striking parallels in relation to other personal histories of hackerspace constituents. Boyle's trajectory is similar in many aspects to the trajectories we saw in the previous chapter. *My dad tells this great story that I was able to type A, B, C on a computer before I could actually speak.* His father, himself an IT manager who worked with mainframe computers, bought a personal computer right before Boyle was born. He learned how to use it and brought Boyle on it, who started to play with electronics when in primary school. Boyle also started to tear his toys apart for the sake of exploring how they worked, *make same random connections in the toy, get it to make a sound. When I was 10 or 11 my parents* *bought me an electronics kit and I started to learn properly by then.* He considers himself an autodidact. He had access growing up to a couple of computer books that were expensive to acquire. From this source, he taught himself C and digital electronics. He also had early experiences with the British BBS scene and practiced phone phreaking. Telephone charges at the time were prohibitive, so he managed to find ways to get access to the trunk network and by-pass the carrier charges for long-distance calls. *I was never a hacker* [...] *It was a necessity* [...] *When I first went on to Compuserv, I would be interested in AI, I was reading books on AI* [...] *I started implementing programs, and the first thing I did when I got online was to go to the AI space on Compuserv to upload my program.* He later got access to the Internet and started to learn about Free Software, software licensing, and test various GNU/Linux operating system distributions.

He studied electronic engineering for a Master's degree and worked in IT for about six months as an ASIC (application-specific integrated circuit) designer, deciding later to go to law school. He was never interested in social sciences or humanities and made an extra effort to finish school as soon as he could. The professional engineering practice eventually proved to be a burden for him, instead of a pleasure he knew well. The experience of working for the Government Communications Headquarters (GCHQ) in the UK gave him an idea of what a lifetime career as an engineer would be like. He felt overwhelmed and made the promise of never touching anything related to engineering again. *After I was qualified as an Engineer, I got pissed off with engineering. The degree and the job just sucked all the fun out of it and made it just all about circuit analysis and boring things instead of actually making things.* He realized to become a lawyer could be a very prosperous option, specially when it comes to a specialization on intellectual property. So, he decided to pursue a degree in law and a career as an intellectual property lawyer. During the early 2000's, he started to follow with interest numerous lawsuits involving IT companies, and the emergence of the figure of the "patent troll[72]". He found in intellectual property law a possibility to bridge his knowledge and interest in new technologies with the prospects of his new career. *When I started off, I was very focus on patent law and we would do big firm litigation. Everyone had a science background, since I moved to Hong Kong, no one does, so every technical question they have, they come to ask me.*

Around 2010, Boyle started to get involved with the DSL founders, right before the space was rented and before the name Dim Sum Labs was chosen. He learned about the Arduino project online and decided to cross the border to Shenzhen to buy one—a Seeeduino, the Seeed Studio's Arduino-compatible board. Early discussions for bootstrapping DSL revolved around questions of organization, governance, and legal status, or as he puts it, *to structure* themselves as a group. *Having a space meant that we started to be liable for things. So,* [another member] *was very paranoid that a person would walk into the space, get injured, and sue him. Should we make it that every person who comes has to sign a waiver?* The path of over-bureaucratization of the space seemed rather ridiculous to him. Early administration meetings were held after the Tuesday HackJam gatherings, but they stopped having regular administrative meetings for over a year, which started to be held sporadically to deal with pressing and upcoming issues,

72 "Patent troll" is a colloquial expression for a non-practicing entity (NPE) whose activity consists in threatening to bring inventors and small companies to court for allegedly infringing NPE's patents. "Patent trolls" usually target several small businesses with requests for payment in order to avoid starting a legal dispute. For a critique of the social costs of patent litigation moved by non-practicing entities, see Bessen et al. 2011 and Bessen and Meurer 2008. For an argument against the US patent system from the perspective of large IT companies, see Lemkey and Melamed 2013.

such as controversial decisions about the space, or to mediate disruptive behavior or arguments involving members and non-members. A formal procedure for making decisions was eventually formalized, but decisions being made at the meetings faced resistance and were hardly taken into effect. There is an informal procedure, which seems to be the most comfortable pattern they eventually came up with. F*or any decisions, you first post* [on the social networking site] *to the members' group, then members can say they are pro or against.* [For instance] *should we remove the broken Reprap* [3D printer]*? Someone posted to the group: "I am going to remove the printer, does anyone object?" But, actually the same seven or eight people actually go to the group's page ever. There are a lot of people who have no say.*

When asked how he positioned himself in respect to Intellectual Property issues given a widespread sentiment of its inadequacy and questionable nature at hackerspaces, he would express an opposition of principle to it accompanied by sense of his ability to promote change from within the regime. *Idealistically*, he pondered, *I am very anti-patent. Let's not forget why I got into the field in the first place, because I wanted to be inside the system to change the system. There is no use being like* [Free Software activists], *standing on the sidelines, and mouthing off. That is useless. For example, the government* [of Hong Kong] *is now consulting on copyright reform. Of course, the US is saying we should extend the terms of protection, strong enforcement, etc.* [For] *my client, who is a major copyright owner, I had to write their response to the consultation. I was able to write a very logical argument about why copyright needs to be reformed in the good way. I am doing the lobbying for them. I get to say to them "your viewpoint needs to be this." Sad fact is: start-ups need patents, if they do not have patents,* *it is hard for them to get investment. At the end of the day, I am in the system, I am part of the system. Am I part of the problem? I do not think so.*

Boyle has been instrumental for the start-up companies founded around DSL. He would consult for the members' companies on matters of patent filing and potential litigation. Quite often, he would also intervene and help at administrative meetings offering legal advice. In respect to the protection of projects of his own making, those of which one could found dispersed at the space such as a digital harp and a voice amplifier, he claimed no ownership and found no need whatsoever for restrictive licensing. When it comes to his business ideas, however, he draws a clear line separating his work from public copying. *I am doing a few start-ups, one of which I had a very cleaver idea for it. Because now I want to make money off of this, and because no one has done it before, but once people realize they will copy it easily, I decided to file a patent on it.* In his own terms, he is now *trying to make a career out of hacking*.

Celebrating Big Gift Givers

In a tour to visit Chinese companies and communities, one of the founders of the Arduino project, Massimo Banzi, came to visit DSL. Banzi was trained in electronic engineering and describes himself as yet another engineer who came to the profession due to his childhood predispositions to take things apart. In his lecture at the City University of Hong Kong for design students, I found various DSL members in the audience and we planned to join Banzi for lunch and a subsequent trip to DSL after his talk. Banzi offered an overview of the Arduino project, advocating that the "way you hack," the way you teach is that is important about his Open Source hardware project. Its key accomplishment, he suggested, consisted in changing the order of how things are done in electronics: first you blink an LED, then you learn about resistance, voltage, current, and Ohm's law. The work of Eric Von Hippel (2005) on "Open Source economics" and democratization of innovation has been very influential to him. The Arduino project started very small, having only $700 US dollars of initial investment. The founders of the project were working in a design school that was about to be shutdown, so they decided to license the project as Free Software and Open Source hardware as a strategy to prevent it from being closed off with the school and inventoried as school property. At the time, one of their doctoral students, Hernando Barragan, started an interesting project called Wiring, which facilitated the usage of microcontrollers by design students, so it was incorporated into the Arduino project. The basic impulse for creating the project came out of the need to have easy and practical tools to teach students to create interactive projects with electronics. They named the project after a pub in Ivrea, Italy, where the founders would gather regularly for drinks. The brand Arduino was later registered in Boston, and the project took off after the wide distribution of Arduino boards by several clone projects, which included several unauthorized distributors from China, as we saw in the previous section, as well as established distributors such as RadioShack in the United States (with its thousands of shops distributed across the United States). The initial relationship of the Arduino project with Atmel—the semi-conductors company producing the AVR-family of chips Arduino boards use—was notorious for ignoring the project and not return emails. Atmel is said to be now responding promptly and having staff dedicated to Open Source projects, given the importance of Arduino for the substantial market increase and areas of application for AVR chips.

After releasing a new board, the Arduino project distributes documentation, software libraries, schematics, and design files of the boards under one condition: users and customers are allowed to use and replicate as long as they do not use the Arduino brand, which is a registered trademark. The openness of the platform generated a global dispersion of Arduino compatible boards and clones, some of them of lower quality, some others with improved design, such as the Seeeduino board. The core engineers and educators behind Arduino keep the information about new projects in secret until a new project is launched as a public Open Source hardware product. When purchasing an original Arduino board, it comes with a booklet and stickers which evoke key symbols with expressions such as "I love Open Source", "Hacked," and "DIY." The booklet brings a "certificate of origin" which describes the importance of manufacturing in Italy: "We point out that all of our boards are made in Italy because, in this globalized world, getting products for the lowest possible price sometimes translates into low pay and poor working conditions for the people who make these products. At least you know that people who made your board were reasonably paid and worked in a safe environment." The booklet also comes with contractual information and a "limited warranty statement" regarding the company Smart Projects which is responsible for manufacturing in Italy. No information on Open Source licensing is provided and the customer is pointed to the website of the project for further information and documentation.

Arduino-clones, which have been produced and distributed in mass quantities in

China, were one of the main reasons Banzi came to Hong Kong and visited major cities in Mainland China, including Shenzhen, Shanghai, and Beijing. Addressing a group of professionals and students of design in his keynote at the City University of Hong Kong, Banzi asserted why "design works:" when they started to carefully work on the design of Arduino boards, he affirms, the sales went up. Another key distinguishing feature of the Arduino project was their work on community support. They offered a forum in English and paid engineers to write tutorials and libraries for the Arduino platform, so their boards could interface with various extensions, such as sensors, displays, LED panels, network interfaces, among others. *You stop*, Banzi suggested, *seeing the customer as someone you dump your projects onto*. The Arduino project has been adamant in its defense of openness by refusing to sign NDAs with semiconductor companies and potential partners in the course of its brief history. The openness of the project, however, has been challenged with respect the usage of closed technologies in the newest Arduino boards.

After Banzi's keynote presentation, I joined a group of DSL members for lunch and we went to the DSL space. A week before the announcement of Banzi's visit to DSL, jokes were circulating about the need to hide the Arduino boards people acquired through the Chinese online e-commerce portal Taobao. For the most part, they could not be distinguished from "original" ones, but it was very likely that founding members of the Arduino project could spot them easily. This humorous remark implied that members should refrain from asking Banzi to sign their Arduino clones, because he was known in the community for being strongly against them[73]. He wrote a post in 2012

73 There is an official announcement of the Arduino Project on "How To Spot a Counterfeit Arduino"

that became famous among Open hardware practitioners in which he taught how to tell a "fake" from an "original" Arduino. Upon our arrival at the space, Banzi was treated with respect and reverence of an accessible celebrity. People asked to take pictures with him, asked for autographs on their Arduino boards. No Arduinos clones surfaced during the meeting and various members made the effort to be at DSL to welcome Banzi during the afternoon of a regular work day. When discussing with the group why he came to visit China, he said he was told that people make Arduinos in China because *they needed money to get married. People build Arduinos in China,* he pondered, *because it is "quick money."* Even though this was not the case for DSL members, who were avid consumers of hobbyist products, Banzi's visit had the purpose of surveying the state of affairs in the distribution of Arduinos and partnering with local hackerspaces to have their Italian-made boards being distributed. After his tour in China, he wrote a blog post for the influential Make magazine, "Making in China" in which he evaluates the relationship between his project and the Chinese context of hobbyist electronics:

> "It's understandable, in a way, that an Arduino made in Europe tends to be quite expensive for most of the people in China. We know that the interest in Arduino is very high and we are working on how to provide official Arduino boards in China. As we often said, it's not only about making boards and selling them. It's about creating all the official documentation in Chinese, having an official forum and social media presence, and making videos and sharing them outside of YouTube (inaccessible for many Chinese people). We clearly need to change the way we do things to be able to interact with the Chinese community. It's going to take a bit than just focusing on providing accessible boards[74]."

The example of Arduino's struggle against widespread infringement of its

(source: http://arduino.cc/en/Products/Counterfeit, accessed 10/04/2013) and a polemic article, "Send in the Clones" authored by Banzi (source: http://blog.arduino.cc/2013/07/10/send-in-the-clones, accessed on 06/25/2013). Both articles teach customers how to discern between fakes and original boards by spotting details on the silkscreening, PCB traces, and components populating the PCB.

74 Source: http://makezine.com/magazine/making-it-in-china/ – accessed on November 15, 2013.

trademark highlights the constitutive ambiguity of Open hardware projects as entanglements of gifts and commodities. Following the theoretical work of Mauss, Gregory (1982) suggests that a gift is a measure of the person while a commodity is assumed to be an objective relation of equivalence between things or a measure, so to speak, of things. As Open Source hardware, Arduino boards are usually confused in these two registers as their specification and their intangible assets are freely distributed online, while their tangible products, the original manufactured boards from Italy, are deemed by the hackerspace community to be too expensive, which is one of the most common justifications for cloning. The issue, however, is not cloning *per se*, but feeding off of the whole Arduino project and its supporting resources (with its web platform, online forum, documentation, software, hardware libraries, etc.). The project is caught between the legal and the moral, the commercial and the communitarian as their founders try to draw and render visible the boundaries between public and private, sharable and non-sharable, commercial and unrestricted, safeguarding its trademark, as well as its authorship as the conditions for public and commercial engagement with Arduino.

The tension between gifts and commodities is one of the constants in the experience of hackerspace members. At DSL, Arduino boards were to be found everywhere, powering many projects or serving as the basis for workshops and prototyping. At the occasion of an informal discussion on "Chinese counterfeit boards for Taobao," various members expressed their puzzlement with regards to the very idea of a "fake" Arduino board. If it was Open Source, they questioned, to make copies was not only accepted but highly encouraged. What this observation, which is very common in other contexts including online forum discussions, did not take into account was the negative contours, to borrow Alfred Gell's metaphor in his discussion of technique, art, and magic (Gell 1994) of the very practice of Open Source hardware business or, to put it in other terms, the moral and technocratic injunction toward "proper" and innovative derivatives. Not a mere copying, but the derivative copying which advances the original or puts it to a new usage without dispensing with the restrictions of the Arduino trademark. Innovation, in this context, as we saw in the previous section, creates a threshold for participation in the Open Source hardware economy of gift-commodity hybrids. During the informal exchange regarding "good" and "bad" clones, most DSL members, including me, could not tell the fake from the original. It was assumed that it did not matter in terms of functionality as most of the improperly cloned boards performed as the original with the difference that they could be acquired online and be sent in large numbers from China for much cheaper than they would if acquired from authorized Arduino distributors. This line of reasoning, which was common among hackerspace members in and outside China, was not necessarily grounded as one of the key portions of certain Arduino boards, the USB-to-serial conversion chip made by the Scottish company Future Technology Devices International (FTDI), became the center of an online controversy when the company started to modify fake FTDI chips to render them unusable under a certain popular, proprietary operating system. Holding fake and original boards side-by-side and inspecting them, we had trouble to say which was which. Accessing the online article by Banzi on poorly manufactured clones which displayed the Arduino logo, we had a real pedagogical moment in which we learned to perceive minor differences in color, part number, chipset, routing, and silk-screening. After the exercise, however, most of the DSL members were still skeptical of the relevance of this type of discussion regarding the distinctions between clones and originals as it would stand in respect to the structuring principle of Open Source, which, interestingly for this case, expressed a very practical and pragmatic perception of openness as the ability to read, study, modify and substitute various components of Arduino boards—from board design to the integrated development environment (IDE), libraries and bundled software, including compilers and additional files for supporting various extension boards. As one DSL member suggested when comparing subversive copy-based technological production in China and its counterpart in the Euro-American context: *people say there is not innovation in China. I think there is, but it does not look the same as it does in America and Europe. It is not only about copying, it is about copying and improving, localizing, adjusting for local needs.* The same evaluation criteria or, to put in more direct terms, the "imposition of innovation" pervades both free/open and non-open as valued conditions and parameters for technological development.

4.4. Tokyo Hacker Space

Four months after the Great Tohoku earthquake and the unfolding of the Fukushima Daiichi nuclear power plant disaster of March 11^{th}, 2011, I arrived in Japan to carry out fieldwork. In search of meetings of computer professionals, enthusiasts, and activists I found Tokyo Hacker Space (THS), a place for technical exchange and gathering of itinerant computer scientists, artists, engineers, and computer hobbyists run on a membership basis by a group of Euro-American expatriates. By attending their regular meetings, I started to learn far more about radiation measurement than one would expect from a group of computer technicians, engineers, and hobbyists.

I first approached THS with a friend from a Japanese company specialized in Free Software-based networking services. Every Tuesday night, following the "hackerspace design patterns," THS opened its doors to the public, attracting curious and enthusiast hobbyists, itinerant hackers, artists, and IT professionals. We squeezed at the entrance door of the space given that the main room was crowded, accommodating about 20-25 people. Following the protocol of having a round of presentations, newcomers emphasized the relevance of the projects they were conducting or technologies they were interested in mastering. It was, then, our turn. My friend, speaking in a very low, shy, and stuttering manner told the audience about his work on network monitoring in a few, sparse sentences. I mentioned some of my early experiences as a computer technician and my background with Free Software, ending my presentation with a brief explanation of what brought me to space. I explained I was an anthropologist studying Free and Open Source communities, projects, and places for training and knowledge sharing. In my previous introductions, I have provoked a mix of scorn and puzzlement. *Anthropology,* technologists would ask, *is not science or engineering, right? So, why are you interested in Open Source?* I would then provide an answer in two parts, one in technical vocabulary and another using a popular expression half-jokingly: "I am interested in understanding how people acquire the skills they need to participate in collaborative projects at spaces like THS." In order to add a bit of humor to my introduction, I would also say: "I am also trying to find an antidote to flamewars, so we can create a more welcoming environment for people to collaborate." After our introductions, one of the founders of THS put us on the spotlight by asking: *Who is the best engineer?* I promptly pointed to my friend and thought with myself how far I was from engineering in my academic training in anthropology given the big divide—which was organizational and structural, perceptual and intellectual—between sciences and humanities and despite ongoing efforts to bridge them as one of the unfulfilled promises of science and technology studies.

THS was conceived at Barcamp[75] in Tokyo in 2009 when a group of expatriates found themselves sharing the common interest of having a space for bringing artists, engineers, and IT professionals together. Mitch Altman happened to be visiting Tokyo at the time and got registered to give a talk on hackerspaces. Several participants in the

75 "Barcamps" are spontaneous gatherings for technologists, activists, and technology enthusiasts. It originated in the Bay Area as a counter-forum to bring together technologists who did not have the opportunity to join the invitation-only technology conference, FooCamp, sponsored by Tim O'Reilly (source: https://en.wikipedia.org/wiki/BarCamp#History, accessed 08/24/2013). Barcamps follow the "unconference" format, that is, all the topics of discussion and all the presentations are decided upon during the first hour of the event. The format is informal and flexible, accommodating various forms of interaction, from demonstrations to parallel conversation to more organized, structured talks. Participants are encouraged to present on a certain topic or offer a workshop instead of being mere spectators. Since its inception, it has become a very popular event outside United States, having ignited a distributed network of events around the world.

attendance got inspired with the idea and went on to register a domain name on the spot, “tokyohackerspace.com.” From the original group of Barcamp participants came the idea of renting a more permanent space. They published an announcement online about their intent to start a hackerspace, hoping to attract members, and for a couple of months they held meetings at restaurants to make plans for securing, organizing, and maintaining a new space. In the summer of 2009, the first physical location for THS was rented in the upscale neighborhood of Shironakedai in Tokyo.

In comparison to Dim Sum Labs, THS was also very intimate given its relatively small area[76]. It was impossible to be at the space and not to be noticed, however invisibility sometimes took place when difference was marked, that is, when persons of different ethnic groups or women were present. In contrast to Noisebridge, access to the space was regulated. Technologists who paid membership had keyed access, whereas for others it is only possible to visit the space during workshops, public events, and “open house” meetings on Tuesdays. Similarly to Dim Sum Labs, there was no formal procedure for accepting or declining a membership application. There has never been a membership declined, but once a person was disruptive of the activities at the space, and members had private meetings to discuss what to do. This person would come to the meetings, argue with other members about political matters and request for technical work to be performed on his behalf. At one occasion, he cried when speaking during a public meeting about a deceased friend, apparently a bright computer programmer. For events of perceived disruption such as this, there was no clear

76 THS moved to four different locations since its inception. I did fieldwork in the first two locations, the first in the upscale region of Shirokanedai and the second in the commercial center of Shibuya.

procedural guidelines. All the decisions were *ad-hoc* and carried out by an affinity group which was composed by members who were more active in the space as well as those who upheld the legal responsibilities for the rental property. The core administrative group was also formed by some of the founders of the space. Among the founders, there were people with engineering backgrounds, computer scientists, software programmers, and system administrators.

Technical interactions at THS followed a general pattern that was to be found in other spaces. Upon entering the space, more experienced and seasoned members embodied a mode of interaction I would call "pedagogical" with an emphasis on instructive language acts with argumentative dispositions. In an ordinary occasion, a novice approached one of the most prestigious members with a USB device to be diagnosed. Questions were asked about potential ways of going about to diagnose and fix the device. In another instance, after asking basic questions about the new electronic door-lock mechanism, I was lectured by one of the members and guided step-by-step through his code to control the mechanism operating the lock. Given the prevalence of a discourse on collaboration and information sharing, visitors and members entered the space to engage in a mode of interaction that combined particular dispositions and modes of attention: technical discussions were heated, playful, and informative; at times, they involve making fun of the opponent's arguments for not knowing about a particular technical and scientific subject. The mood tended to be playful most of the time even when disagreements surfaced. Joking and arguing served the function of displaying knowledge and saving face. It served primarily a pedagogical function, which was not perceived as such, but usually involved disseminating information about certain technologies through hands-on guidance or "screen work" (pointing to and discussing over digital objects on computer screens). Public and regular workshops at THS functioned as occasions for inviting newcomers to learn how to solder, to pick up computer programming skills and techniques, improve and inspect electronic circuits, and tinkering with all sorts of materials, from fabrics to wood and spare computer parts, as well as sewing, gardening, video editing, beer brewing, and cheese making. This openness is a fundamental shared characteristic of hackerspaces as sociotechnical and political projects: they are wide open to experimentation, conviviality, and imaginative projection, even though most experiments are never carried out or completed. The technical quest was generally more important than its end result.

Learning to Perceive the Fukushima Crisis

I came to THS headquarters once on an early afternoon to find one of the key engineers in a conference call with hackers and activists in Germany at the camping event of the Chaos Computer Club, one of the oldest and most prestigious hacker collectives in Western Europe. On the German side of the call, there were Open hardware specialists, members of various hackerspaces (including Noisebridge) and one anti-nuclear activist who had taught himself a great deal about radiation monitoring after the Chernobyl incident. The general tone of the exchange was one of mutual interest with no room for secrecy: both sides explained their projects in measuring and assessing the situation in Japan and Germany, bridging expertise on nuclear crisis assessment from Chernobyl to Tokyo and Fukushima. The outcome of the online gathering was converted into a publicly editable (*wiki*) electronic document with information on monitoring tools and techniques. As we headed back home after the online gathering, I thought with myself about health risks and what it meant to be in Japan after a series of major nuclear accidents. Risks I could not assess, feel, nor visualize without specialized equipment. Breaking the interim of silence, I asked how the THS member felt about his own life and health in Japan for the years to come. He confided he was not concerned with his own health, since there was nothing he could do to change the situation, there was no other place for him to go. *If you hang out with us*, he sentenced, *you will learn a lot about radiation.*

Out of several opportunities to interact and observe how openness was framed, implemented, and performed, one of the weekly meetings was particularly revealing. Project presentations by itinerant hackers were commonplace at THS, given the extensive international network of some of its active members. Generally reserved for the end of the open house meeting, the "show and tell" is a dedicated session for members and non-members to show off their hacking skills, publicize their projects, and seek potential collaborators. As part of a weekly rite, discussions of new projects were prefaced by a basic description and an argument for why one should care about what is being presented. Only in rare instances was Safecast, a volunteer-based project for collaborative assessment of radioactive contamination which spun off THS in the subsequent months after the Fukushima disaster, not a major topic of discussion and the focus of attention among participants, Euro-American expatriates with permanent residence in Japan. At this particular occasion, a Safecast volunteer delivered an explanation of the project for the newcomers—an explanation I heard countless times as

I regularly followed the meetings, public activities, and discussion lists of both THS and Safecast—taking the opportunity of having the floor to triumphantly declare that, while the project used to be a joke among Japanese government officials, it had now become one of their official sources of radiation data. The reference was one of the major accomplishments of Safecast: the Fukushima prefecture administration included Safecast's radiation data in their official maps. After the Fukushima accident, one of the earliest beneficiaries was Yahoo! Japan, which created a website to display radiation data using Safecast's public domain data set.

After March 11th 2011 to be actually or virtually present at THS meant to be surrounded by Safecast volunteers and to participate, even as just a passive listener, in debates over monitoring techniques and challenges, technical possibilities and design challenges for making Do-It-Yourself (DIY) Geiger counters and other radiation measurement devices. Volunteer engineers and hackers were eager to discuss for countless hours what they could do or what could be done in the face of the unfolding nuclear crisis. Several tasks were available as new positions were created for volunteers and advertised at the regular meetings. As an anthropologist, I took part in some of the simpler technical tasks, such as soldering circuit boards and conducting a field trip to collect radiation data. As part of my personal commitment to the open circulation of knowledge, I volunteered for data collection and attended various iterations of the Geiger counter workshop at THS and during public events for Safecast. By following the group of hackers-turned-*quasi*-scientific data collectors, experiencing their informal exchange sessions, and attending to the intricate details of radiation measurement tools and procedures, I started to ethnographically map relations I observed on- and offline, tracked through interviews and more informal conversations, and started to populate network graphs—for my own use—to describe ties between technologies, technologists, and institutions. Learning to perceive the crisis demanded going through a collective experiential path, in which volunteers taught themselves as they advanced their tools, volunteering as well in their spare time to inform others who had the background to follow explanations and to engage in hardware design and software development practices. More widespread and, one could say, mundane concerns, such as their own health and level of exposure were not ranked highly in comparison to the attention dedicated to advancing the technical art of collecting, measuring, mapping, and visualizing radiation data for the next years after the onset of the nuclear crisis.

Open Source Responses to 3-11 in Japan

Despite logistic impediments to reach THS right after March 11th, members were relieved to see each at the regular Tuesday meeting, inspired by an uncommon agenda: "hacking for crisis relief." Given the exceptional conditions of livelihood after the disaster, hacking was perceived as a shared skill with which to work and help to recover Japan. This early call for help expresses the initial reaction to the perceived crisis:

> "To all the people on the good planet Earth, the crew of Tokyo HackerSpace has a message that we would like to send to you: by now, everyone knows of the crisis in northern Japan. It will still be a few weeks before life is under control here. We are looking forward to the day that the power plants are safe and the tremors have subsided. Many of our members have been cooped up in our homes waiting out the storm, but not laying idle. […] We also have on the way several Geiger counters and Geiger tubes, from which we will be making community sensors, in order to help to keep the public in harm's way informed on a minute by minute and hour by hour basis. While the initial exposure has been low, our concern is the long term effects, food and

water supply, and ground soil conditions over the next several months. Or longer term projects include solar cell phone charging stations, low energy cooking equipment, internet, wifi, and laptop loans, and other technical concerns. We are calling upon Hacker Spaces all over the world, and friends of Hacker Spaces, and friends of friends of Hacker Spaces, to help out" Source: http://tokyohackerspace.org/en/japan-in-crisis, accessed June 12th, 2012.

Hardware projects and small businesses were represented at THS by active members. The membership included technical writers, Open Source hardware shop owners, senior engineers, and professionals working for the IT industry in the area of research and development, security, and network administration. Out of an interest in deploying cheap microcontrollers to automate gardening tasks came the idea of the "Kimono Lantern," which was initially meant to serve as a simple solar-powered light for a member's restaurant business. After 3-11, the project became the first Open Source hardware project to be offered to the communities affected by the tsunami in Northern Honshu. Soon after the publication of the "Kimono Lantern" design files and the circulation of the call for help in hacker news outlets, THS become a *locus* for bringing foreign engineers and software developers together. From regular brainstorming sessions at THS emerged a set of projects for crisis relief. Assessment tools and accessories were designed and developed until completion, such as battery chargers, environmental sensors, solar panel applications, seismic sensing, Geiger counter hacking, and a very detailed Wiki with key information sources and scientific reports on the triple crisis.

Other groups of technologists were also mobilized both online and in face-to-face meetings to discuss viable technical tools to help assess the escalating nuclear crisis. A small group of data visualization technicians and designers from Japan, Germany, the United Kingdom, and the United States was formed around an Internet service platform called at the time "Pachube." Its goal was to collect, localize, and publicly distribute data from personal radiation monitoring devices of citizens. Another key grassroots initiative was led by an influential Free Software developer from Japan with a group of local volunteers from "Open Street Maps" who rapidly put up an instance of the crisis information platform under the name of "Sinsai.info". Aiming to collect and distribute geo-tagged information about relief efforts, they helped coordinate tasks of local crisis response teams. In metropolitan Tokyo, a group of Internet entrepreneurs organized the "New Context Conference" to evaluate the usage of Open Source and Internet technologies to measure radiation levels. Due to prestige and a wide network of business and personal contacts of the main organizers, the conference served as a hub to facilitate collaboration between hardware engineers and software developers with another Internet-based initiative across the Pacific named "RTDN.org," a web service for aggregating and distributing geo-tagged data. The conference proved to be instrumental in attracting experts from various fields outside Japan—from radiation measurement to data visualization and hardware development. At the conference, "RTDN.org" was renamed to Safecast under the suggestion and offer of a domain name from Ray Ozzie, a consultant and former top-chief software architect at Microsoft.

From the outset, the Safecast project was adopted under the umbrella of Momoko Ito Foundation, an NGO dedicated to the research of cultural exchange between the United States and Japan. The foundation served as the legal counterpart of Safecast, handling donations and the project's trademark. Unlike other independent mapping efforts, such as Geigermaps JP and Japangeiger, which were organized by Japanese locals, Safecast managed to secure funding and donations, partnerships with educational institutions, and fostered a volunteer workforce of engineers and software developers on an international scale over the Internet. In a thirty-day span, the project formed a core team of technicians who would develop some of the key technologies and define replicable data collection procedures. There were no previous friendship or work ties among most of the technical volunteers of Safecast, who hacked together simple Geiger counter devices in less than a week of cooperative work. What they shared, instead, was the familiarity with Open Source technologies, background in scientific training, and the capacity to harness considerable technical potential through Internet-based ties. As one of the key THS engineers referred to their independent achievements: *it is time now for us to show the commercial IT guys what a bunch of dirty hackers can do.*

Despite concentrated efforts in fostering larger public participation in the aftermath of Fukushima, most independent hardware projects in Japan did not succeed in creating a community of volunteers, being therefore limited in their scope of action to the distribution of affordable Geiger counters. In contrast, Safecast grew in public participation and in the number of partnerships, delivering tangible results in a matter of a few months after the disaster, attracting attention from the media and securing funding from a wide range of domestic and international sources. Volunteers can be counted on the order of hundreds, including partner associations in Japan and abroad. Funding from Softbank was injected into the stationary sensor network project built with Keio University. Substantive financial support also came from four crowd-funding initiatives: two Kickstarter and two Global Giving successful campaigns. In May 2011, Safecast was invited to an art exhibition on "sensing places" organized by Ars Electronica. Safecast's Geiger counter prototypes were put on a glass display at the exhibition dedicated to contemporary intersections of place sensing, digital technology, and design. In September 2011, Knight Foundation offered a grant in recognition of the journalistic qualities of the radiation mapping effort. Safecast headquarters was initially housed at the Tokyo Hackerspace and benefited from its intensive brainstorming sessions and wide circulation of foreign hackers. As the project and its data set grew over time, a bigger office space was allocated at the Creative Commons-inspired design firm Loftwork in Shibuya, Tokyo; a move which also contributed to the eventual separation of THS and Safecast a year later.

The public fostered by Safecast used open mailing-lists mainly as a vehicle for circulation, translation, and discussion of news reports on the Fukushima crisis, as well as distribution of information from official sources, such as Tokyo Electric Power company (TEPCO) and the Ministry of Education, Culture, Sports, Science and Technology (MEXT). By reading the archive it is possible to identify the distribution of active participants within a spectrum of technoscientific and political positions, ranging from lay persons who went online to ask questions regarding risk of radiation exposure to experts making decisions and implementing new tools and techniques. Safecast has a closed mailing-list and Wiki which are dedicated to managerial discussions and technical decision-making among geographically dispersed board members, directors, and technical volunteers. Most of the tasks in the context of the project are designed by technical and core members, and conducted by smaller, parallel, and independent parties of a few individuals, identified by the board members as geographically dispersed "silos."

As we distance ourselves a few years from the outbreak of the disaster, other problems related to long term exposure to radiation and food testing have begun to gain more attention among volunteers. Related issues were brought to the center of the debate involving more expensive testing equipment, re-introducing the scientific controversy over measurement and evaluation of health risk. Not to the center of the activities of Safecast, however, but peripherally in the mailing-lists and in the horizon of things-to-do in the context of the project.

Hacker as Bricoleur

MRE was part of the group of early and faithful THS supporters, being one of the members who was heavily invested at times of financial hardship to keep the space running by offering workshops and organizing fund-raising campaigns.

MRE was introduced to hardware hacking at the time of his first encounter with computers. His first machine was a Timex/Sinclair Z80-based personal computer and grew up surrounded by electronic toys. His mother is a care taker, working for the medical field. His father was in the US air-force and has been a lifetime enthusiast of tinkering. After joining the military his father was trained in electronics and worked on the specialty of cruise missiles. *I think I got it from him, but I do not know where he got it from. When he was young, he was also taking things apart like me. It started for him with engines. So, he was repairing cars, lawnmowers. Everything that was dangerous and* *moved he would tear apart and put it back together again.* His father modified their early computer to attach a new keyboard as he disliked the machine integrated keyboard very much. He also attached a new power supply, so he could keep the contents of the static ram chip. *It was like a flop of spaghetti.* The overall look of the machine was completely different from the tame, inoffensive look of commodity hardware, resembling more of an electronics experiment with several wires coming out of the mainboard without a case. MRE's incentive to experiment with various types of technology came before his self-training in electronics however. *Before learning about electronics, I learned about car engines. Helping* [my father], *not that he taught me how to* [fix cars], *I was just handing him tools, handing him car parts. I was around that environment a lot. As he did stuff, he taught me what the thing did. He was more of a curious person* [...] *He never professed to know anything. But he always instilled the idea of being curious about stuff, playing around.*

They moved from the United States to Germany and his father got a new computer, a Commodore 64 and, later, a Commodore 128. It was MRE's first hands-on experience with programming which he studied by gleaning information from assembly and BASIC program listings from computer magazines. *Most of the time, it was a good one hour and a half, two hours typing in that stuff. We would take turns: I would read and* [my father] *would type, or I would type and* [my father] *would read. When we got it all done, we would save it to the disk. We would run it and it would be some boring game* [...] *Back in those days the fun was more about actually the trials you had to go through to get to the joy, then the actual joy itself.* He was eight years old when he learned how to solder, playing with electronics projects from RadioShack kits and putting together simple circuits on breadboards.

Hacking is something he identifies with his early experiences with electronics tinkering. He circumscribes the meaning of the expression to his personal experiences accessing a local BBS, his early electronics projects and recognized accomplishments when fixing broken objects around the house. *What I think happens to most people involved in this field—and has happened in the past but hopefully will not happen in the future—is that we are loner types, we tend to do our hobby alone. There are purely practical reasons for that. Six people cannot sit at a table and work on an electronic circuit like you do when you play Monopoly* [...] *It is a completely different process that is involved, it is not conducive to being in groups necessarily. So, I pretty much spent most of my life growing up with the feeling this is something I do in my spare time* [...] *it is not something I thought of as a community experience.*

The perception of the impossibility of doing his hobbies in groups changed as he entered college. MRE was the first in his family to pursue college education in electronic engineering and he did so reluctantly. *I felt like I already knew a lot, and the things I didn't know, I could probably sit down and learn.* He first entered college for a year and quit as he had a job in electronics at the time and felt he was doing what he wanted to do without the need of a degree. He returned to college when he was 27 years old and felt it would make much more sense to form a group with his classmates and study together, since he had a lot of practical experience, than for each one of them to pursue their education individually. *I wanted to start something that, at the time, would have been a hackerspace but I would not recognize it as such; I just wanted to start a robotics, electronics, and computer programing club, providing some tools and bringing* *people together. It did not really worked out. I did three or four times and nobody showed up, people were just busy.*

MRE's first practical experience with a hackerspace was with THS. *Suddenly this hackerspace explosion came up. Actually, when hackerspaces started to build up, I started to build up in the hacker community. Before hackerspaces, I would never consider the possibility of publishing a book or even contributing blog entries to technology stuff. Or, even that a community really existed. I knew there were people doing stuff and the information was out there, but the idea that there was a community of people interested in what I have to say or in what I do know, that was a revelation for me.* His experiences of engagement proved to be fruitful. After a couple of years of participation, he wrote a book on hobbyist projects for the Arduino platform which sold copies in North American cities with hackerspaces. He was not surprised to see the geographic distribution of his book sales map neatly onto the very geographic distribution of the hackerspace network in the United States.

After college, MRE moved to Japan, hoping to get immersed in the technological mecca of Akihabara, Tokyo's "electric city." After a couple of years of residence in Japan, he was on the verge of returning when he stumbled upon the announcement of the Barcamp group for starting a hackerspace in Tokyo. *People come and go very easily in Tokyo. Considering it is mostly foreigners in our hackerspace, foreigners in Japan are very much transitory.* [Three THS founders] *are some of the few people that are really settled* [...] *I would have left Tokyo have it not been for the hackerspace. It was the very first time I felt that I truly, really belonged to a community* [...] *The space keeps me going, and Akihabara makes it really difficult to leave.*

When it comes to the values he identifies with his hacking practices as everyday technical practices, he sustains, *to give freely* [your knowledge], *give freely your skill-sets and help people as much as you can, those are the kinds of things* [I believe] *in. When we are young, we understand what it means to be human, and we lose that as we get older.* When inquired about his strong dedication to THS, he confides he was driven by a desire to craft: *I like knowing that what other people see as junk, I see as potential, something that can be made into something, some kind of tool or something helpful, or something fun. I am not an artist* [...] *Can't sing, can't dance, can't play music, can't play guitar, can't play piano, can barely play sports and only a few of them. For me, the ability to craft is the replacement for all the other talents. What drives me is the joy of having something that makes me interesting and unique.*

Open Source Hardware *Bricolage*

Both Tokyo Hackerspace—as a self-funded laboratory for collaborative work—and Safecast—as a spin-off project of technologists and Internet entrepreneurs—can be productively described as sites for the practice of hacking as a form of *bricolage* for they are situated between modes of reasoning and cultural practice in Open Source development and the established physical and computer sciences. Following Traweek's (1988) study of group histories through the development history of its instruments of knowledge, I describe in this section the development process of Safecast's instruments as *bricoleur's* artifacts in their rapid prototyping, concurrent revisions, integration of software code, and distributed information.

Offered as an illustration of the operational logic or "socio-logic" of mythical thought in his book "The Savage Mind" Lévi-Strauss introduced the figure of the "*bricoleur*"—a French expression for a "jack-of-all-trades" who uses whatever materials he or she has at hand to fix and re-purpose technological artifacts. In the metaphorical sense, *bricolage* stands for a distinctive kind of knowledge acquired through a hands-on approach with a clear definition of a project. It prioritizes second-hand over raw materials and roundabout, patchy ways over formalized procedures. According to Lévi-Strauss "the poetics of *bricolage* stems, above and all, from the fact that it is not limited to meet or execute; [the *bricoleur*] does not only 'speak' with things, but also through things" (Lévi-Strauss 1966:37). The *bricoleur*, we are reminded by the author, creates facts with the ability to change the world, whereas the engineer uses facts to create structures. This opening of the world for change is also a breach for novelty and improvisation. The practice of *bricolage* "decomposes and recomposes factual sets in the physical, sociohistorical, and technical plane" (*ibidem*, p. 49). Surpassing the distinction between the *bricoleur* and the scientist/engineer, research in STS has described the ways in which *bricolage* is also constitutive of scientific practice. Examples can be found in the early work of laboratory science studies (Latour and Woolgar 1979; Lynch 1985; Traweek 1988), as well as in more recent interventions in the context of sociology (MacKenzie 2003) and history of science (Biagioli 1992). In his discussion of *bricolage* as creative scientific practice, McKenzie describes the performative dimension of economic theory and finance. Through the analysis of the appropriations, detours, and tinkering in the history of "option pricing theory", the author demonstrates the *ad-hoc* fashion and the unpremeditated course of action for actors of the financial sector who are involved in theoretical work. Under the rubric of "social *bricolage,*" the historian of science Mario Biagioli demonstrated how the success of emerging scientific disciplines in late seventeenth-century Italy depended on matching the patrons' legitimacy, the establishment of new scientific institutions and the prestige of their locations with the creation of professions around new scientific disciplines. In a broader sense, the concept of "social *bricolage*" circumscribes and identifies a particular political, cultural, and economic formation in which new scientific knowledge practices were made possible. Both authors point to an orientation in STS to contextualize the practice of science by disentangling practices, histories, and artifacts. A quick parallel would equate the Lévi-Straussean figure of the *bricoleur* with the science practitioner, therefore problematizing the separation between the domain of theoretical work and the domain of practical application. Turkle and Papert's work on epistemic plurality in computing has the merit of being the first to point out the proximity between the "logic of the concrete" in the Lévi-Strauss treatment of the subject and the *bricoleur* approach of certain practices in the field of computing. The authors concentrate the discussion on programming styles to illustrate the interplay between concrete and abstract reasoning in what they call the "epistemological pluralism in computing" (Turkle and Papert 1990:153). As Turkle and Papert diagnose in respect to distinct organizing practices in software development, "there is a culture of computer virtuosos, the hacker culture, that would recognize many elements of the *bricolage* style as their own" (*ibid*, p.141). In a review of the usage of the metaphor by Lévi-Strauss, Johnson (2012) exposes the backdrop in which the gendered figure of the scientist was elaborated in "The Savage Mind": the nuclear physicist of the post-war and the emergent moral critique of the ethical dimensions of the scientific pursuit. If the scientist is Promethean, the author suggests, seeking to solve mysteries and advance knowledge of nature, the *bricoleur* is Epimethean, working around the limits of his familiar surroundings. In sum, the practical knowledge of the engineer is supposed to be open and "projective", that is, "it is able to invent its future without reference to its instrumental past", whereas for the *bricoleur* tools and materials "are over-determined by history of their usage [and] under-determined as for their potential use" (Johnson 2012:362). Through ethnographic rapport, one is able to see how much over- and under-determination is to be found in hacking and to what extent its practice stands in close relationship with the instrumental sensibility of *bricoleurs* and the logical discipline of scientists or engineers.

The goal of revisiting the metaphor of the *bricoleur* is to reinstate its heuristic value. Previous conceptual work was done to recuperate the metaphor of *bricolage* from the structuralist project and to re-situate it in other theoretical and methodological domains, such as sociology of memory and imaginary by Roger Bastide (1978), and for an all-encompassing critique of Western logocentrism advanced by Derrida (1978). The retrospective look I suggest here, however, is meant to tap primarily into the conditions for the collective mobilization and exchange, borrowing, copying, distributing, excluding, and extending in the context of transnational Free and Open Source projects. For they are important to be studied, not only because of their salient points, such as the rhetoric of collaboration, transparency, and freedom, but also for their imponderables—that is, the active technical, moral, and political ties which constitute the very experience of Free and Open Source technologists.

Collaborative work around materials (and Open Source intangibles accessed through the Internet) at hand in Japan post-March 11th reveals itself as a form of *bricolage* for crisis assessment. As soon the nuclear crisis in Fukushima became mainstream news, radiation measurement devices became hard to find. Outage of Geiger counters and Geiger–Muller tubes in and out of Japan was felt rapidly as local citizens searched for alternatives in the face of government denial and conspicuous secrecy in dealing with the nuclear fallout. University experts were quoted in popular commercial media outlets asking the population to leave expert systems to technoscientific experts. The take-home message was simple: data from cheap Geiger counters are not reliable, and untrained lay-persons should refrain from spreading unreliable data.

New and unlikely actors came to the fore as technical responses were articulated locally and internationally. Japanese, Spanish, Chinese, and North American hardware designers and small vendors offered their own Geiger counters on the Internet based on established low cost prototyping platforms, such as Arduino with its extension boards. Engineers from Tokyo worked on hobbyist platforms and posted regular information about the development process in blogs, such as Tiisai.jp and Open Geiger. Moving beyond the hobbyist domain, some of the projects attracted commercial and public attention after March 11th, turning small Open Source projects into products for the niche of portable Geiger counters, such as the case of Open Geiger and its commercial distribution by Atarashimon, Inc. Tokyo Hackerspace held workshops on radiation and assembly of Geiger counters which were open to the public.

Parallel to the rapid development of networked stationary sensors in a partnership with Keio University, Safecast put together a Geiger counter inside a bento box and named it “bGeigie.” By integrating available technologies for a mobile radiation detection device, some of the highly skilled volunteers teamed up to create a portable device with sufficient autonomy and reliability to conduct measurements while driving across Japan. The mobile approach to radiation mapping was initially tested with a laptop attached to a GPS device and a Geiger counter. This technique was inspired by a traditional practice of wireless network mapping and exploration called “war-driving,” in which network experts survey a particular region with a computer equipped with a wireless device and an external antenna. The practice of “safecasting” (or “radiation war-driving”) proved itself not to be only feasible, but also very efficient: by attaching the bGeigie to a car and asking volunteers to drive around Japan, radiation data started to be collected for the project, properly located by the integrated GPS module, and stored on an SD card for later publication on the Internet. After achieving an initial positive result in their mobile approach, engineers and volunteers went through countless hours of trial and error, teaching themselves and their peers by sharing information about prototyping platforms and radiation monitoring.

The *bricoleur* work for the bGeigie stands out as an achievement of integration and multiple field expertise coordination. Working with the informational resources at hand, hardware hackers assembled the device from various technologies and projects that were combined into a watertight plastic box. One of the early precursors of the bGeigie was a “hacked” analog Geiger counter converted into a digital device to be integrated with an Internet service for real-time data visualization. After circulating their call for help on the Internet, THS received two old Geiger counters from a surplus outlet shop of government, scientific, and industrial grade equipment called Reuseum.

Driven by the same orientation for *bricolage*, on May 1st, 2011, the first Safecast prototype for data logging and geo-tagging was announced. Shortly after the publication of the whole design and fabrication process online—step-by-step with pictures and explanation of the technical challenges—the device was made Open Source by publishing its schematic and firmware code online. The development of the "Netrad" extension board was done by the same skilled engineer of Safecast who hacked the old military Geiger counters and who happened to have a machine to place and solder very small (surface-mounted) components onto circuit boards, thus speeding up the process of prototyping considerably. When he first approached a company to buy a "pick-and-place" machine and install it in his apartment in Tokyo, he recalls being laughed at, but he set the record as being one of the first individuals to make such a request for industrial grade equipment to be installed in a non-industrial setting. The first reproducible Open Source hardware prototype was meant to be integrated with International Medcom Inspector devices donated to Safecast shortly after the Fukushima nuclear power plant accidents. One of the founders of Medcom joined Safecast in the very early stages, sharing his expertise in radiation monitoring which he had amassed since the Three Mile Island nuclear accident in 1979. He also offered much needed advice on calibration and measurement techniques, helping to evaluate Safecast's prototypes *vis-à-vis* solutions of the nuclear industry. Collaboration was actualized on the basis of reciprocity: as he legitimized Safecast with his industrial grade sensors, his company benefited from Open Source designs to release a new product for the nuclear industry, the newest version of the bGeigie "Nano."

Software code for the bGeigie was integrated by branching public repositories of

Open Source code from other Japanese and international initiatives in hardware prototyping. Software for the Arduino-based Ethernet extension board came from the crowd-mapping initiative developed by a prestigious hardware designer from Japan, who rapidly became a respected contributor among Safecast and THS volunteers. One of the THS members recalls reading his code for the first time and being delighted with his coding discipline, organization, cleanness, and elegance. They had to meet the extraordinary author, so they invited him to come to THS to give a presentation. Design files and code examples from other initiatives laid the groundwork for further *bricolage* in the context of Safecast as well as for several other Geiger counter kits that became popular among computer aficionados in Japan. The end product of the bGeigie—log files with device identification number, GPS coordinates, radiation levels, and timestamp—was defined by Safecast as public domain data. By releasing all the radiation data under a Creative Commons zero (CC-0) license, no restrictions were imposed for reading, copying, modifying, or even legally appropriating the data without attributing the source. The orientation for this decision came from one of the board members of Safecast who happened to be also in the board of directors of Creative Commons and other Internet companies.

It was not part of a shared goal among Safecast volunteers to displace other volunteer initiatives in Japan, but to aggregate and publish open data through what they assumed to be the right approach to the problems of unavailability and unreliability. Volunteers tended to signal Safecast's position as that of a mediator between the government and the public. In doing so, Safecast members often compared their work with that of other projects, and criticized governmental and private sector initiatives for their inefficiency, technical opacity, and lack of procedural transparency.

One of the most important governmental attempts at radiation mapping and longitudinal monitoring was implemented by MEXT. Public outcry and heavy criticism was directed toward the aerial radiation monitoring performed by the ministry, which started in January 2012. The public was skeptical of the low readings published in a governmental report after the survey and questioned the sampling method as an attempt to cover up the situation. Another similar radiation monitoring initiative came out of a partnership between Kyoto University and National Instruments R&D labs in Japan and the United States. The project "Kurama" consisted of a system for radiation monitoring installed in public transportation vehicles of the Fukushima prefecture. Kurama closely resembled Safecast in its mobility, but proved to be too costly, non-replicable, and closed to public scrutiny; hence its critique as just another non-transparent and ineffective government-sponsored partnership.

Opening the black boxes of the MEXT monitoring stations did not take too long to happen. Manufacturing and installation of monitoring stations were arranged by MEXT with private contractors such as NEC, Aloka, Fuji Electric, and Rhinotech in order to deploy a large number of solar-powered monitoring stations across Japan, having larger concentration in Fukushima. The stationary sensors were meant to provide localized and longitudinal data, which are displayed in navigable maps on the website of the Nuclear Regulation Authority. In a typical hacker approach, the MEXT stations were probed and examined in detail by two Safecast volunteers. In one of the Safecast drives, one of the volunteers found a broken station. By investigating its internal parts and taking photos so he could share his finding with other engineers, he helped to identify the fact that the stations were not weather-proof and tended to fail quite often. Data provided by the monitoring stations have been criticized by several individuals from local citizen and activist groups, such as the Association for Citizens and Scientists Concerned about Internal Radiation Exposures (ACSIR) and Greenpeace. The alignment between critical voices in respect to governmental data, as "manipulated data" to convey smaller figures for affected areas, and hardware hacking, as a political practice meant to achieve more transparency, was only momentary given the consensual position within Safecast to avoid speaking in heated public debates regarding nuclear power.

"Safecasting" Gunma

In order to learn how to contribute data to Safecast, I borrowed monitoring equipment and traveled to Gunma prefecture. My field-trip had two goals: continue conducting life-history interviews with Gniibe and collect data for Safecast's public dataset. I first met Gniibe during the summer of 2011 in Tokyo, right before a meeting of the Free Software Initiative Japan. Since this period, we have met in many occasions to record interviews and have long conversations about his trajectory and his technical interests, which I presented in the previous chapter. For meeting and recording interviews, I came to visit Gniibe in his hometown, Maebashi, and we both went to a "Safecast" drive around the city. I attached the monitoring equipment to the window of his car and turned the device on. I had another piece of equipment, the "Ninja" which displayed real-time information about radiation levels in a small 7-segment display. This device was produced at THS by a Safecast volunteer who was instrumental in helping the project in its early phases of hardware prototyping and field-testing. Arriving at Mount Akagui, Gniibe pointed to a lake to express his disappointment with the current situation his fellow inhabitants of Gunma were facing. The local government had recently passed a ban on fishing due to high levels of radioactivity found.

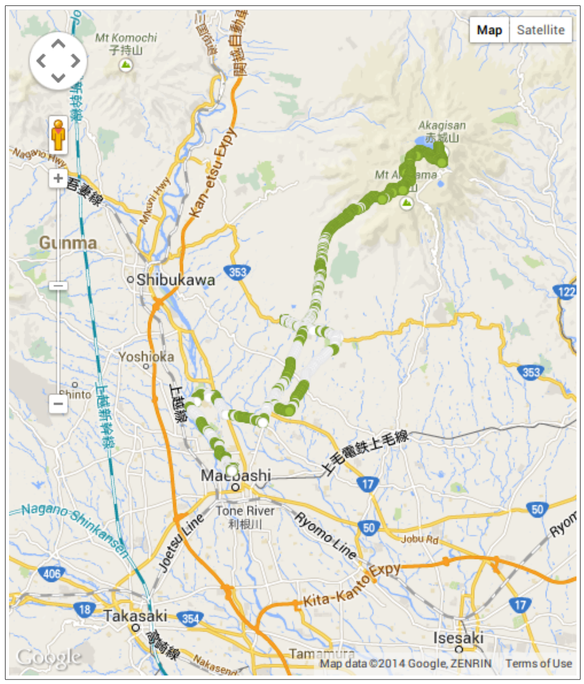

Fig. 3. Monitoring Gunma: collected data points from Maebashi

Upon my return to Tokyo, I uploaded the data and had access to the Safecast map (fig 3.) with the representation of collected data. The green and white dots represent low levels of radiation exposure of 0.15 microsieverts on average. For this monitoring drive, we conducted 3.453 measurements which contained GPS coordinates, identification number of the device, version of the firmware, and the measurement of the estimated radiation dosage in micro-Siverts. Despite his initial support of the data collection and measurement initiative, Gniibe expressed a critical position in respect to the ethics and effectiveness of the Safecast project. Instead of engaging himself as a volunteer given his engineering proficiency with Free Software technologies, he relied on the prefectural government to conduct measurements at his children's school and affirmed not to put too much trust on the governmental data. When it comes to his ability to participate by creating technologies to facilitate the collection and distribution of radiation data, he expressed his disagreement with the way Safecast has been conducted: *if their movement is for education on how to build Geiger Counters, or build more Geiger Counters, I could support the idea, but if they exercise their power to measure radiation and they just upload the raw data and distribute it without interpretation, it is a kind of irresponsible* [action].

Responsibility of Open Source *bricoleurs*

In the aftermath of Fukushima disaster, the unlikely group of technoscientific experts came to the rescue—a group self-identified and identified by peers as "hackers"—but not without help from Internet entrepreneurs, journalists, and other volunteers. In a matter of days after the Tohoku earthquake and tsunami on March 11th 2012, computer programmers and engineers self-organized online and elaborated on technical solutions to address the expected effects of the disaster.

Recent contributions from Science and Technology Studies (STS) helped to re-position the issue of environmental and technological crisis in face of disasters within the frame of inherent and relational risk of technoscientific platforms (Beck 1992; Lash, Szerszinsky, and Wynne 1996), moral education of experts and non-experts in scientific training (Gusterson 1996; Epstein 2006), and the reconfiguration of inter-relations between life, technology, private interests, and State power in respect to shifting notions of risk, scientific control, and governance of crises (Fortrun 2001; Petryna 2002). Contributions from STS and anthropology of science serve here as a backdrop for the discussion of openness and its instrumental character in technical responses with effective political outcomes. Open Source-based initiatives for crisis assessment help us to identify shifting power relations in regards to the capacity of Japanese and other nation-state bureaucracies to generate more comprehensive and reliable radiation data than volunteer-based organizations. By looking at the patterns of relationships among research institutions, governments, funding agencies, instruments of knowledge, and expert communities, this chapter described a form of political action which is not only mediated but practically exercised through technical means, promoting a reconfiguration of the relationship between expertise and responsibility. In respect to the question of who gets to speak the truth about the risk of radiation exposure in the context of Japan post-March 11th.

The Fukushima crisis has been an object of a wide range of citizen, academic, and journalist accounts, forming a public sphere with multiple perspectives in dispute. From within this space of discursive struggle, Safecast carved its own space as an influential citizen scientist group. Its volunteer work, broadly conceived, consisted not in feeding the heated international debate on "natural *versus* anthropogenic" classifications of the disaster, which became central after their appearance in the report of the Nuclear Accident Independent Investigation Commission appointed by the National Diet, but in highlighting and establishing the distinction between information and evaluation due to its prestige, drawing a symbolic division between the goals of the volunteer-based project and the role of scientific experts. By looking at the constitutive connections of Safecast alongside its public manifestations, it is possible to identify the efforts in rendering boundaries between experts and non-experts visible:

> "We're actually working very closely with Keio University at the moment and a number of their members are going with us on the data collection drives. We have already been discussing with them about data collection procedures and how to make them scientifically credible. They are also helping to establish a facility to handle checking and calibrating equipment that we'll be distributing. This will be done by radiological experts within Keio University but I'm hoping to document their procedures and making them transparent". (Source: http://blog.safecast.org/2011/05/safecasting-with-keio-university).

The technoscientific orientation informing the practice of THS and Safecast hackers does not stem from the polarized domain of anti-nuclear and pro-nuclear discourses post-3-11. Contrary to a likely prediction, Safecast hackers do not subscribe to the anti-nuclear movement, but engage mainly in defining hacking as a form of innovative and integrative tinkering for information openness. The key symbol in Safecast, which operates as a hierarchizing concept (Mauss 1950), is the concept of Open Source. It functions by guiding notions and practices around the project, creating ties and rendering them evident and meaningful to participants and newcomers. Safecast does not stem from the genealogy of hacker and anti-nuclear activism. Among other collectives which are integral to this genealogy in the United States and Japan (Downey 1986; Kindstrand 2011; Ogawa 2013), examples of hacker activist groups include Netstrike.it (an Italian activists' initiative against military nuclear programs in

Europe) and WANK ("Worms Against Nuclear Killers", which infected NASA's network as an anti-nuclear statement by Australian hackers against the potential release of plutonium from the Galileo space probe in 1989 as reported by Dreyfus 1997).

Safecast's Other is the official governmental response to the nuclear crisis. Despite ever-growing national anti-nuclear mobilization, it is not by partaking in the anti-nuclear discourse and sentiment that the project advances and enrolls new volunteers. It is by articulating a network of Open Source enthusiasts among IT specialists and brokers from prestigious institutions who have connections in Japan and worldwide to render the project a multi-sited and well-funded effort. The perception of belonging to a collective agent working against monolithic and oversized State bureaucracies is not translated directly into Safecast's public relations, but debated internally and frequently surfacing in considerations of "Japanese culture" and its purported tendency towards the passive observation of hierarchical orders. In respect to the controversy, one of the founders of Safecast fashions himself as a "hacker of bureaucracies" in reference to his pivotal role in promoting openness in educational and organizational levels.

> "All the core people [at Safecast] are very diligent about trying to stay objective and neutral and not trying to take a political side on any of the many political issues that are around this, both on food contamination or appropriate usage of nuclear energy, all of that stuff, it is incidental [...] we have a strong shared vision, which is to gather the data, to share the data, to promote Open Source, Open Data. More data, more people sharing it, it will alleviate ignorance and anxiety. That is what is common among people in Safecast" (Interview, 07/03/2012).

As the Free and Open Source software (FOSS) logic expands beyond software development with a dispersion of legal devices to overcome intellectual property restrictions, it faces new challenges which impose a reconfiguration of openness in very specific ways. Open hardware projects deal with issue of competition for electronic components and parts, as well as with the question of scale in production and distribution. Not only does the materiality stand in the way, but the scarcity of multi-field expertise as most projects bridge analog and digital electronics, mechanics, optics, 3D modeling, software programming, and knowledge of communication protocols, among other areas of expert knowledge and practice. For Open Data, the issue is not only a matter of license definition but also increasingly of accountability and responsibility. Open Data initiatives often face other problems which are added to the mix with hardware issues: given the institutional black-boxing based on division of labor and organizational hierarchies, certain aspects of information systems are not publicly available nor accessible; and the problem of generation, organization, and interpretation of data in the face of heterogeneous information systems lacking in interoperability amounts to the challenge of achieving openness.

All of these issues attest to the limits of openness which is also hampered by established organizational structures and long-lasting, exclusionary forms of training in science and technology. The question of openness speaks directly to the problem of responsibility within Safecast: who is the legitimate agent to interpret the public domain data they generate and release? Or, as an anonymous contributor once posed the question to the Safecast team: "If Safecast is going to be seen as having an authoritative teacher's voice, what will underpin that authority?" One is able to hear repeatedly from the active members that *Safecast does not want to be involved in societal decisions*. This consensual stance has its own long trajectory within the project. It started with a message thread between two of the key members over the question of interpretation of data around the question: Is Safecast going to help people interpret data or only take up the role of data provider?

The proposition for "neutrality" among Safecast members won over various demands for intervention, despite minor divergences in opinion within the project. During one of the Safecast workshops for the general public, while a technical volunteer explained the characteristics of their DIY sensors to an academic nuclear physics specialist, it was clear the expert researcher seemed uncomfortable and skeptical, interjecting at every sentence to contradict the volunteer's explanation. The latent conflict was settled when the volunteer finally concluded: "We decided to leave interpretation to specialists, we just collect data to be analyzed by them". This instance of interaction brings to the fore recurrent language practices of boundary-making between Open Source practitioners and other scientist experts in the context of crisis management and mapping. An invisible wall between areas of expertise emerges as a reaction to criticism from field specialists, pointing to more established forms of (scientific) authority and legitimacy of those who get to interpret the data and to say what the dangerous radiation exposure levels are.

The question of risk is recurrent in the mailing list, but it is considered a hard one and, for this reason it has been constantly avoided by the core members. In several public interventions, Safecast members digressed from the topic of risk, trying instead to offer information on how to carefully evaluate different forms of instrumentation and measurement. In a mailing-list post, one of the members—himself a computer security expert by day and an active volunteer by night—addressed the problem of risk by exposing the specificities to be taken into account and not by addressing the question directly, therefore leaving it open and echoing an interesting continuity in the context of the project. The following statement was made only a month after the project was officially launched: “again we want to make it clear that we are not radiation experts nor health physicists—we aren’t making any claim about how safe, or not, any of these measurements might be—rather, we are trying to find and provide data that could be important for residents of these areas so that they can make informed decisions on their own.” (Source: http://blog.safecast.org/2011/04/first-safecast/).

In the context of Open Source projects such as Safecast, expertise is performed with a discursive function within a network of institutions and technoscientific discourses authorizing subjects (volunteers) as technical experts. At the same time, expertise relies on skill as form of embodied technical competence—the ability to manipulate technical objects and tools (virtual and actual) and to carry out technoscientific projects. Drawing the line between Open Source experts, anti-nuclear activists, and nuclear scientists serves Safecast to avoid engaging with political disputes and heated scientific controversies. While members struggled to position themselves as trustworthy technical volunteers, gaining respect from the private and public sectors in Japan, Safecast as a collective enterprise struggled to guard its borders by identifying and inviting skilled engineers who are not activists to join the core group, therefore controlling levels and forms of public participation. In this regard, hackers have a double relationship with the discursive function of expertise and the performative dimension of technical knowledge: their practices rely on established institutions as much as they criticize them and try to distance themselves as an attempt to create conditions for more autonomy and openness; a certain distance is maintained to strike a balance between the need for technical mastery and improvisation (grounded in several years of cultivation in electronics, computing, engineering and science) with the normative guise of a broader technopolitical project for openness. As a form of self and collective identification, it functions by breaking away from the institutional practice of science, while still operating on its edges, accessing grants and taking advantage of prestigious research centers, using its language and procedures, free from the career-building constraints and self-disciplinary practices and sensibilities from within the academia.

Expertise and responsibility are interpretative keys for understanding possibilities and impossibilities of collaboration and coordination in the context of technoscientific responses to the Fukushima disaster. They are fundamental in providing a window into organizational structures of public projects, offering a vantage point for the description of the practice of technical and political *bricolage*, as well as the constitutive ties of collaborative spaces, such as Tokyo Hackerspace, and Open data, software, and hardware projects, such as Safecast. Efficacy of symbolic boundaries dividing specialists in relation to other specialists, as well as the lay public in relation to experts is anchored in perceived and enacted forms of technoscientific expertise. Responsibility is an open question and has yet to become an important concern in the case of Safecast and Tokyo Hackerspace as they champion openness, at once, as an advantageous point of departure, a desired outcome, and a technical practice for humanitarian reasons.

4.5. Conclusion

What do these four instances evoke in respect to the network formation of hackerspaces? What do we learn from the experience of attending to local collectives while focusing on the transnational circulation of technologies and technologists? In what follows, I will address these questions to present points of convergence and divergence.

In this chapter I described a set of cultural practices through which spaces of symbolic and material circulation were articulated to constitute alternative places of technical conviviality. In the introduction I suggested framing the study of hackerspaces as "heterotopic spaces," that is, spaces and places of difference in which social and technical ties are built and experienced in parallel as well as against established locations of technical practice in academia and the IT industry.

In respect to their interconnection, there are specific pathways linking all of these four spaces (and other spaces that were not part of this monograph) in distinctive ways. Noisebridge has been one of the key symbols for the international articulation of the hackerspace network. Drawing from the European experience with computer clubs, it helped to bootstrap with other collectives in the United States a country-wide network of community spaces for experimental and pedagogical work on various techniques and technologies. As important as a symbol for collective mobilization, the presence of its members in other community spaces in East Asia has been instrumental for the extension of the network. Its location and its prestige as a technological mecca contributed substantially to its success in China, leading to many open doors in the industry and academia. Chaihuo was connected to Noisebridge through the circulation of their respective members: on an annual basis, technologists would visit Chaihuo from Noisebridge, and Chaihuo members and Seeed Studio staff would come visit Noisebridge for workshops and demos, facilitating the exchange between local Chinese industrialists and young engineers, and Open hardware designers from Western Europe and the United States. Similarly, Tokyo Hacker Space modeled itself after the North American hackerspace network with an emphasis on shared notions of "do-ocracy" and horizontal governance. Its location and its demographics contributed to the formation of one of the flagship projects of the hackerspace network, the Safecast project. The importance of THS as an experimental laboratory for Open hardware development was taken up seriously and influenced the original founders of Dim Sum Labs to start their own community space in Hong Kong. Despite its geographic closeness to Chaihuo, its members mainly searched overseas to Noisebridge and THS for inspiration. The personal experience of DSL founders with Noisebridge and Western European hackerspaces helped establish stronger linkages with Euro-American spaces rather than with its closer Chinese neighbors. Other key element of political history contributed to this distance: the establishment of Hong Kong as a Special Administrative Zone and the contentious relations between Hong Kong residents and mainland China visitors. Dim Sum Labs has also been one of the key points of passage for the traveling hacker contingent: as for Tokyo Hacker Space, many of its members and visitors were more transient, expatriates than settled inhabitants of the island. Despite these differential (and difference-producing) linkages, there are important distinctive features to be accounted for each of these four spaces.

Noisebridge was built upon the material prosperity and countercultural legacy of Northern California as a memorial, interdiscursive space of autonomist political identification and aspiration. It created its place in opposition to and yet with financial dependence upon the surrounding big IT businesses of the San Francisco Bay Area. It was bootstrapped with members who built the workbenches, gathered an impressive library, constructed a communitarian kitchen with professional grade appliances, equipped a workshop for metal and wood-work, organized a sewing area for experimentation with wearable electronics and remodeled the building by reworking the floor, repairing the electrical installations, wiring computer networks, and replacing doors and windows. Walls were painted with political graffiti, repainted, and, soon enough, they were covered in graffiti again to tell stories of marginal icons such as Nikola Tesla and Chelsea Manning. Posters of hacker conferences, zines, and pamphlets could be found scattered around with pointers to anarchist and queer politics. To be physically present at Noisebridge was to be surrounded by an atmosphere of creative chaos, indeterminacy for potential creation. Given this environment, the space attracted political activists, homeless adolescents and young adults, jobless middle-aged men and women, hacker activists, and IT technologists with high-paying jobs, plus a miscellanea of individuals from all walks of life whose participation was more out of curiosity than allegiance to the goal of advancing hacking and autonomist politics espoused by some of the founding members. Given its constituents and their trajectories, cryptographic technologies and support for server infrastructure for anonymous Internet navigation were not only encouraged but used to sustain a technical collective in place through coordination and governance hurdles and with the perception of the dire need of anti-surveillance tools. Projects with political and combative dimensions, such as TV-B-Gone and Noisetor, were native to Noisebridge, inspiring technologists in different community spaces domestically and abroad.

Since its inception, Chaihuo has been serving as a hub for young Chinese engineering graduates and entrepreneurs, interfacing with the local electronics industry to launch start-up companies and create commercial and collaborative ties with Euro-American engineers, designers, and companies. Its space was conceived, after its first iteration as a regular office space in a more remote part of Shenzhen, as a store front for Seeed Studio products. Its location in the "creative center" of the OCT Loft with its art galleries and purposefully designed-to-look-worn-out warehouses for art installations indexes the desire to bridge practices of design and OSHW-driven manufacturing as technical means for artistic expression and economic prosperity. Chaihuo served mostly as an experimental extension of Seeed Studio and a co-working space for local start-up companies. It once housed the local independent community of Free and Open Source technologies enthusiasts which soon moved to their own space with the explanation that Chaihuo was not conducive in their opinion for *actual work*, just conversational exchange. A common complaint was that Chaihuo was *not a hackerspace, it was not a place for hacking* since it was only equipped with basic tools for electronics work, whereas heavier equipment such as their laser-cutter was not used because it was not permitted by the Overseas Chinese Town Loft (OCT Loft) administration. Heavy or even light machinery would certainly upset the surrounding businesses which included boutiques, an upscale hair saloon, a jazz club, and a fine furniture shop among other multinational businesses in the area, such as a Starbucks coffee shop. In this milieu, Chaihuo's staff and community members found a model for prosperity in big, foreign Internet businesses with their wide-ranging and increasingly global cast of symbols and information technologies: from discourses on IT-driven innovation and creativity to the adoption of OSHW as a profitable business model. They joined the space of global circulation by attending international events, visiting hackerspaces, and companies in the San Francisco Bay Area on an annual basis. Over time, Seeed studio raised to the ranks of established international OSHW businesses, serving as a broker for Euro-American designers and engineers. Approaching international Free and Open Source communities abroad has helped it to achieve what the Euro-American hegemonic stance and held prejudice found to be impossible: the observance of intellectual property licensing through moral not legal ways in mainland China; that is, through the contact and tacit contract with the creation of social ties among local engineers and industrialists with Open hardware engineers and companies abroad.

Throughout this chapter I described the business of Open hardware in Southern China in terms of the organization of a supply-chain involving designers, manufacturers, distributors, and communities of users, designers, and competitors. In respect to the moral and political economy of Open hardware specifically, I explored what practices identified by the actors as *doing Open Source right* or *completely wrong* entailed. By looking at the particularities within intersecting networks of hackerspaces, Free and Open Source projects, and businesses through the case of Seeed Studio, we positioned ourselves better to examine how ties were created, maintained, and severed for carrying out a profitable enterprise, fostering both publics and businesses on a transnational scale.

Dim Sum Labs is similar to Chaihuo in partaking the technopolitical imaginary of emergent Internet businesses at the forefront of the new informational economy: producing, interestingly, open interfaces and discourses on the importance of openness while building proprietary infrastructures, creating small entry barriers for regulated participation while sacrificing privacy and data ownership with increased dependency ties. DSL fulfilled the role of a cosmopolitan and experimental laboratory in Hong Kong with Open Source projects that could potentially lead to new companies, products, or pedagogical experiences. It draw initially from the financial capital in the city and managed to attract the membership of expatriate technologists. DSL founders help build a place for exchange—outside educational institutions and for-profit organizations—mediated by hardware and software projects. Similarly to Chaihuo, it was not fully equipped nor spacious, but quite active in its public activities and gatherings, which involved teaching programming, hardware prototyping, CNC machining, and many other activities. At the space, one could find common tools that are part of every hackerspace, such as soldering irons, component bins, 3D printer, computers for shared use, projector for presentations, development boards, assorted cables, technical books, spare computer parts lying around, and a large table with power outlets for members and visitors to use. As a member of a European hackerspace tellingly described the experience of being in a hackerspace: *everyone around here is busy working on something; I feel guilty if I am* [at the hackerspace] *and I am not doing anything.* Hanging over the electronics bench, one can find a Guy Fawkes mask, symbol of the Internet group Anonymous which links some of the members of the group symbolically to political groups within the hackerspace network and their promotion of autonomist politics with the development of anti-surveillance technologies. The political understanding of "hacking" is, rather, a point of contention among DSL members (with the discussion we saw about "maker" *versus* "hacker"-oriented futures for their hackerspace) than a privileged symbol for articulating collaborative projects. The term "hacker" is both used colloquially to refer to any form of experimentation on the space with the question, *what are you hacking on*? as it is for evaluating someone's technical prowess, as in *he does not seem to be a hacker*. In this aspect, the space is very similar to the space of interactions within Tokyo Hacker Space and Noisebridge as technologists of various skills and areas of field expertise would come to interact and assess rather tacitly each others' worth through performance and demonstration of technical knowledge. In particular, the distinction between maker and hackerspace—which presents itself as a stronger marker for more politicized spaces such as Noisebridge or the avoidance of the term at Chaihuo—indexes a more profound schism between personal trajectories and contemporary narratives of innovation and competitive advantage. The distinction foregrounds the underlying practice of framing the group's social memory. At DSL, regular workshops and meet-ups for the study of Arduino technologies and electronics were perceived as basic steps for creating and fostering a community of tinkering through which innovative ideas and potential start-up businesses could be spun off.

At Tokyo Hacker Space's first headquarters, one could find various tools for hobbyist work in electronics, but it was not conducive to other types of activities such as metal or wood work. It did not fostered the radical and chaos-conducive openness which characterized Noisebridge's problems as well as achievements throughout its brief history. Through paid membership, participants are given unrestricted access, however. Despite lacking a bigger and more equipped space, THS allowed for encounters and collaborative work that was key for the creation of a major, volunteer-based radiation monitoring project using Free Software, Open hardware, and Open Data as symbols and technical means for collective action. Its locale was a hub for transient and established expatriates with strong connections abroad guaranteed its sustainability and relevance in relation to other spaces of the hackerspace network. After the Fukushima disaster, THS became the expatriate space for brainstorming ideas for helping Japan and its most affected areas of the coastal part of Northern Honshu. This event of a major disruption led to the harnessing of local and transnational competence and volunteering workforce to bootstrap a project of national scale for radiation monitoring with the subsequent creation of Open hardware prototypes, kits, and products, and a large dataset on radiation levels across Japan. Initially housed at THS, the Safecast project soon assumed proportions that not only caused conflict within the collective, but took over the activities, the space, and the focused attention of THS members. Other than a space for tinkering with network-wide recognition, THS struggled with problems such as rent prices, high turn-over of members, and difficulty of finding people with skills and time to offer public workshops.

There are also key specificities among these hackerspaces in terms of governance and political genealogy. These four cases range from the autonomist, consensus-oriented governance to top-down control and dependence, having Noisebridge and Chaihuo respectively at the end of each side of the spectrum. DSL and THS are similar in respect to their shared characteristics with earlier computer clubs and users' groups, displaying a more loose and unstructured form of *ad-hoc* governance. Except for regular membership fee obligations and book-keeping procedures which are open for members to audit, the governance of the space is only problematized after an event of “disruption.” Members discuss, delegate, or self-ascribe a particular task, such as taking care of maintenance fees and dealing with billing cycles. Events of disruption are directly related to the degree of openness of each space: conflicts tend to escalate to very problematic and harmful levels at Noisebridge, given its open door policy and openness to incorporate newcomers into decision-making processes. Chaihuo is considered the least problematic space in this regard, but also the most inactive and lacking in community projects. It represents the opposite of Noisebridge in which it can only be opened for companies or members who pay a “start-up member fee” for using the space. THS members find themselves mediating conflicts by themselves among a group of self-selected, more senior “administrators” and find themselves often losing members due to infighting and disagreements as much as Dim Sum Labs.

Another important aspect of these four hackerspaces is their cosmopolitan character which is rendered visible through the intensity of their associativist activities across transnational pathways between hacker and makerspaces, but also due to their formative ties with respect to their localities and global transit. This character is not only a general shared feature, but an actual political, socioeconomic, and cultural force binding technologists and technologies across locales. In this sense, THS and Noisebridge are major sites of technical pilgrimage[77], exerting a very strong imaginative

77 For a discussion on San Francisco as a place for queer pilgrimage see Howe (2001). For an in-depth ethnographic depiction of the circulation of Indian IT workers and the role of imagination of the United States as the “IT mecca”, see Xiang 2007.

pull over engineers and programmers. They represent sacred sites of technical utopia and euphoria: Akihabara for its entire district dedicated to all commodities "nerd" and "geek" from video-games and *anime* to computer and electronics stores; and San Francisco for its connections to Silicon Valley and its technical and historical relevance for the computing industry and early hardware hacking. Chaihuo and Dim Sum Labs are well positioned in relation to the electronics industry of Southern China. This proximity is not only an advantage, but also a key factor in the constitution those spaces and the membership base they attract. Imaginative linkages between these four spaces are not of a minor importance. Their cosmopolitan characteristic is that of their founders and most active members as most of them have accumulated experience abroad with other community spaces. Hackerspaces are for this reason places of transnational experience which are constructed symbolically as places of global networking in comparison and in connection with spaces and projects elsewhere.

	Noisebridge	**Chaihuo**	**DSL**	**THS**
Governance	*Consensus-driven and ad-hoc, educational non-profit in the US*	*Company-managed*	*Informal, ad-hoc with a small group of administrators, HK non-profit corporation*	*Informal, ad-hoc with a small group of administrators, no legal status*
Formation	*Counterculture movement, hacker activist, autonomist new-new social movements*	*Start-up, Open Source Hardware Businesses*	*Start-up culture, computer, electronics, and robotics hobbyist clubs*	*Computer, electronics, and robotics hobbyist clubs*
Demographics	*IT professionals, artists, political activists, hacker activists, mostly Euro-American male from different age groups* (from early	*Young EE Chinese graduates (in their 20's and early 30's), start-up owners, mostly male and predominantly ethnically Chinese*	*Mostly expatriate and local IT professionals, computer and electronics hobbyists, start-up owners, mostly*	*Mostly expatriate IT professionals, computer and electronics hobbyists, artists, mostly Euro-American male* (in

	20's to late 50's)	*with transient foreigners*	*ethnically Chinese and Euro-American male* (from early 20's to late 50's)	their 30's, 40's and 50's)
Projects	*3D printers, book scanners, information security software, network applications, Open Source hardware kits, game development*	*Makeblock construction kits, wearable devices, Seeed products*	*Internet-connected gadgets, electronic music instruments, programming language*	*Radiation monitoring devices, battery chargers, farming and gardening technology, solar power*
Sustainability	*Donations from big companies and volunteers, membership fees*	*Sponsored by Seeed Studio, small donations from workshop participants, membership fees*	*Membership fees and small donations*	*Membership fees, paid workshops, and small donations*
Accessibility	*Formerly 24×7 open door policy*	*Co-working space model*	*Open for members and during public events and workshops*	*Open for members and during public events and workshops*
Recurrent Issues	*Access control, conflict resolution, security, theft*	*Lacking community engagement, lack of space and tools for projects*	*Volatile membership base, funding, lack of space and volunteers for projects and workshops*	*Volatile membership base, funding, lack of space and volunteers for projects and workshops*

Table 2. Comparison between hacker and maker spaces

The question of who gets to become an effective hackerspace member opens up an analytical window for the examination of political dimensions of sociotechnical interactions. It also allows for the evaluation of the extent in which projects are created as functions of encounters across difference and collaborations among experienced and novice technologists. From and beyond their locales, hackerspaces operate as hubs connecting individuals, companies, non-profit enterprises, and projects in specific ways, but also serve to deny and denounce forms of institutionalization in computing with rigid forms of command and control. In a retrospective view of his scholarly work on the historical formation of the modern technologies of discipline, language, labor, life and the human as an object and subject of knowledge, Michel Foucault posited "we are in a moment [...] when our experience of the world is less that of a long life developing through time than that of a network that connects points and intersects with its own skein" (Foucault 1984:22). Maker and hackerspaces' own skeins are constituted by the persons and the technical objects which are brought together by shared symbols and technical practices in an ethical plateau (Fischer 2003). Given the expatriate, cosmopolitan membership of hackerspaces and their placing in global cities such as Tokyo, Hong Kong, San Francisco, and Shenzhen, they exert a centripetal social force to attract more technologists and techniques. As I described earlier in this chapter, the circulation of influential hackers with the mission of expanding the network of hackerspaces contributed decisively to the creation of new pedagogical spaces, bearing the promise of recreating relations of production as well. Ethnographic evidence of the importance of the circulation of prestigious hackers was addressed in various parts of this chapter, but more importantly demonstrated through the influential force exerted by Noisebridge on other spaces through imaginative ties encoded in language practices as well as guaranteed through the circulation of its founders to various community spaces around the world to entice technologists to bootstrap new spaces.

Technical and political projects were analyzed in this chapter as catalysts of moral and economic orientations, embodied skills combined with the affordances and constrains of locality and globality. Each hackerspace drew from Free and Open Source-based projects which circulate on the Internet as design, firmware, and source code files and in their material iteration as micro-controller boards, 3D printers, electronics kits, etc.. Various projects are identified with individuals but they invariably rely on a group of persons for their realization which includes, other than design, documenting, testing, distributing, and teaching newcomers. Economic return in private enterprises is guaranteed through the exploration of the digital commons as a starting point and launchpad for new business ideas, plans, and products. In sum, these four hackerspace instances reveal the process of place-making with the creation of new spaces of socialization, exchange, and a new instance of participation which is virtual and actual, therefore serving the fundamental bond to link the global space of circulation of technologies with the local place of technical and political conviviality.

CONCLUSION

On November 13th, 2013 I wrote in my field diary: "It is happening again. As I prepare for taking the train and saying goodbye to everyone at the space, I am assaulted by the same feeling, reluctance to say goodbye and uncertainty regarding a future meeting point. Paths can be so wide and multiple yet they might never cross again; or they might… no one knows. I am leaving with a bag full of new and incomplete hardware projects. I have voice recordings, memories. I have learned so much, and told by people I also taught. I carry with me people's words and thoughts, struggles and I can picture their joy at hacking sessions […] if is there anything that metonymically serves for the description of the experience of a collective is that of sharing projects, advancing them together; it is not [an] everyday [event], it is actually the exception, serendipitous expression, not the norm—magical as it happens." This magic in our professional circles often goes by the name of ethnographic experience and involves entering relationships with the risk of having trouble leaving them. It bears the promise of symmetry which starts with the "gesture of seeing how people see themselves in others" (Strathern 1991:29). It goes much further than the interpersonal and implicates personal, professional, and technical trajectories in their entanglement. In this sense, the ethnographic process is necessarily one, alongside many potential others, of implication.

For the conclusion, I would have us return to the framing of the project to pose the question: What have we learned from the experience of attending to local technical collectives while focusing on the transnational circulation of technologies and technologists? I started the monograph with the observation that hacking has become a global symbol with indexical multiplicity. The importance of attending to its discursive dispersion and geographic distribution should now be clear: it has helped to create a horizon of political and technical possibilities for subjects as agents—moral and technical Maussean "hybrids" as in the epigraph I started this monograph—to find conditions and idioms of justification for personal and collective projects. I described the sociotechnical phenomenon of reappropriation of hacking by attending to its emergent spaces of exchange and circulation. The ethnographic material I discussed in the previous chapters allowed for further understanding of the interplay between experiential, sociotechnical, and spatial dimensions to better specify the conditions of possibility of hacking with its demands for self-cultivation.

In order to contribute to the literature on expertise, I carried out the study of hacker moralities through the description and analysis of personal and technical trajectories. In examining narratives of personal history, I stressed the importance of ethical problematization as a key vector of cultivation in the shared ethical plateau of computing. We saw in Chapter 3 how distinctive moral articulations of hacking do not create impediments for collaboration and participation, but actual and virtual conditions for self-cultivation through intimate forms of ethical reasoning. This very demand for self-training finds expression in different religious and political traditions with important implications: it renders the experience of active engagement in computing collectives meaningful, justifiable, desirable, honorable, and relevant for oneself in face of the other. As a condition for sustained participation, I demonstrated how one's technical ability is rendered into moral discourse and ethical problematization as technologists incorporate and transpose the globalized symbols of (software, hardware, data) openness and autonomy. This articulation speaks to the experiential dimension of recounting and, thus, rebuilding a trajectory of technical cultivation, grounded, at once, in distinct national contexts and shared transnational spaces of exchange. This amounts to important differences in the formulation of moral discourses and manifestations of ethical self-making. In spite of the common assumption of a shared codified and globalized hacker ethic, we find at the intersections of transnational publics with personal trajectories forms of intimate articulation of what matters the most for the technologists in their sustained volunteer and wage work. The hacker identification and stigma is built upon the Euro-American "globalized provincialism"—to use the felicitous expression coined by the sociologist Renato Ortiz—a manifestation of transnationality in which the practice of hacking is re-articulated with different moral idioms and conditions of possibility. We should be reminded with the literature I discussed on Chapter 1 that moral values do not vary widely but ethical practices of self-making do and are, for this very reason, worth researching in anthropology (Robbins 2013). In order to further investigate the mores of collaboration alongside the modes of coordination, I described historical narratives alongside narratives of the self, grounding shared technical and political histories in lived experiences. Probing further than the surface effect of political discourse and technical fetish, I have elicited distinctive elaborations on hacking through practical and personal engagement with the co-participants of the project.

In respect to the spatial dimensions of hacking, I described the interplay between proximity and distance in the hackerspace network to examine forms of circulation and interconnection as well as disconnect and interdiction among technical collectives. Noisebridge, for instance, in which the proximity to other makerspaces and IT companies in the San Francisco Bay Area served to guarantee its financial sustainability but also to foster an oppositional identity as a collective that is distinctively mobilized with an autonomist orientation. Community-driven spaces such as Noisebridge, Dim Sum Labs, and Tokyo Hackerspace were built and managed by the members themselves with variable organizational structure, usually with a tacit seniority rule, meaning the history of commitment to the group. They were spaces for technical encounter, exchange, and education for collaborative production. They figured in practice as places for pedagogical interaction which allowed for development of new skills, exposing their members to political debates and moral double-binds regarding science and technology. As an example, Noisebridge has served as a model for other spaces in terms of its organizational orientation and its core values (and challenges) of do-ocracy and excellence. Its prestige stemmed from its founders' technical work, whose regular trips to other hackerspaces have helped to bootstrap community spaces in various parts of the world. In sum, I would have us turn our attention to the salient shared characteristics of the community spaces I examined in this monograph: 1) governance: manifested as an *ad hoc* process of learning about community organizing through which members grappled with questions of power, transforming the collectivist orientation of their spaces into opportunities for pedagogical interactions; 2) bricolage: either as serendipitous engagement with materials and circumstances at hand or non-instructive, more dialogical and self-directed process of learning by doing with others, hackerspaces afforded an alternative path for the acquisition of technical skills which is not the traditional career path in the IT industry and academia (even though there are strong linkages with both); 3) moral order and ethical reasoning: the cultivation of sensibilities to evaluate and distinguish between projects according to their usefulness, elegance, and potential, as well as technical personas for their mastery and public display of knowledge and prestige through gift-giving. In the process of getting immersed in the network of gift prestations, technologists found opportunities for moral assessment of technopolitical projects of local and transnational scope; and, last but not least, 4) power dynamics between Global North and South: as we saw in the previous chapter regarding Open hardware production, engineers in Southern China are entering Euro-American networks first as brokers and service providers but increasingly as *bona fide* hardware designers and producers themselves. This is an important phenomenon which is fundamentally changing the dynamics between Global North and South in respect not only to the commercial dimensions of Open hardware but also to the local conditions of production of skills and moral sensibilities in respect to the digital commons. For the young mainland Chinese engineers to enter relations in the Euro-American context meant to unfold a new space of exchange which became increasingly guided through the moral commitment of returning the fruits of their digital labor through Open hardware and Free Software projects, despite the uncertainty with respect to the Chinese legal framework and the strong local competition of an ever-increasing population of capable and eager software developers and engineers.

In questioning established forms of computing expertise in the industry and academia, I described how hackerspaces were constituted at cross-cultural contact points to rearrange, challenge, and transform local practices, infrastructures, and political imaginaries with narratives of technological autonomy and global collaboration. Noisebridge with its organizational model, Tokyo Hacker Space through its participation in the efforts to help Japan cope with its unfolding nuclear crisis, Dim Sum Labs for fostering a local community for the purpose of identifying ideas to launch new businesses, and Chaihuo by serving as a space for fostering the creation of Open hardware-based products in a national context of increased economic integration with selective market liberalization. Inspired by Benedict Anderson's argument that "print capitalism" has helped to create historical conditions for the rise of national sentiment of imagined national communities, I sustain that the discontents of the informational capitalism have created the conditions for an imagined network of hackerspaces as pedagogical and cosmopolitan laboratories for technical exchange and political formation. In fostering new imaginations, institutional arrangements, productive activities, and forms of political action, hackerspaces realize, ideally and partially, the dream of convivial technologies Ivan Illich proposed in the 1970's, influencing a whole generation of autonomist projects.

In order to speak of the pedagogical aspect of technical exchange, my goal was bring the experiential, political, and transnational dimensions of hacking into simultaneous view through the study of its constitutive sociotechnical ties. By asking the question of "what counts as hacking in the contemporary," I worked to specify the geographic distribution and discursive dispersion of hacking with a focus on the blind-spots of Euro-American accounts of alternative, non-hegemonic manifestations of computing expertise. To analyze the translocatity of technical collectives beyond the core-periphery explanatory model, challenging the conventional wisdom regarding "right" and "wrong" places for technical training and production, was one of the main tasks. In effect, my argument was not articulated to deny the invaluable contribution of local and regional studies of computing but to provide a study of global (but partial) pathways which constitute contemporary technopolitical experiences. My contribution derived from a particular analytic framework and a comparative effort, not in the classical but its contemporary sense: that of a reflexive account of the production and usage of difference at unconventional and interlocked scales of anthropological analysis. Unconventional for having to be figured out *ad hoc* as the ethnographer follows a particular transnational phenomenon. Interlocked for being produced in the heat of articulatory practices at multiple scales.

As a peculiar manifestation of computing expertise, hacking can be interpreted through its prohibitions. Information hording and control over material and informational resources constitute one of the major interdictions as we saw among technical collectives. The demand for self-training and collective exploration operates in marking proscribed, not often voiced, cultural practices. In the course of this monograph, I have described practical instantiations of this positive operator drawing the boundaries between desirable and undesirable forms of interaction. The "wire clipper" metaphor of Tim May's Crypto Anarchist manifesto, despite its libertarian overtones, is fruitful in foregrounding a more general hacker orientation for cutting the barbed-wires around intellectual property enclosures. Hackerspaces created similarly the material conditions for proliferating metaphorical and actual wire-cutters, operating as laboratories where software, hardware, and tools are shared, cutting, therefore the barbed-wires of exclusive and exclusionary domains of technical development in academic and company-sponsored research laboratories. What is fundamentally different in respect to the experience of autonomist computer collectives *vis-à-vis* other spaces of technical practice, such as "skunk works" in the defense industry, university student groups, or robotics teams? They are, simply put, parallel developments which are fundamentally different in nature from the political project of hackerspaces. First, they are not meant to be public nor do they convey a public mission. Second, they do not partake the political genealogy of hacking with its demand for self-cultivation and for severing ties with centers of informational control and command. Hacking ties technologists with specific sociotechnical collectives. Hacking ties is an ethical imperative: it delineates the negative contours of computing expertise. Through its interdictions, it inaugurates a form of alter-globalized solidarity among computer experts.

One of the keywords for this project was "collaboration" in its imagined, actual, and constrained forms. As a contribution to anthropology more broadly, I offered an account of the ethnographic encounter with technoscientific groups which have their own organic intellectuals, promoting collaborative forms of digital work on global scales. The space of collaborative work emerged with a renewed orientation: very past beyond the brutal legacy of colonial enterprises, research work in anthropology necessarily entails should-to-shoulder work for debating and interpreting sociotechnical realities. I started to veer toward this orientation through my own work on small Open hardware projects. I also started to reflect on the topic of collaboration through the examination of the quality of the social ties I observed, described, and entered during fieldwork. It was personally difficult to leave relations when encouraged to stay. The difficulty represented the projection of another phase of work yet to be accomplished: one phase of research was done and yet I could only be allowed to know I was ready through the opening of a new possibility to continue through other means. As Fabian discussed in his remarkable book "Time and the Other" (1983), I became my co-participants' past so I could write about our exchange. In the process, I was transformed as ethnographers are to the extent that my co-participants were for engaging with my questions and proposing their own about themselves. The difficulty to leave the field was a powerful marker of a transformative experience: distancing myself from the field experience was a condition for returning to its domain of concepts, subjects, impressions, friendships, and intermediary states whereas before they were all indistinguishable, a condition for returning to the field as material, virtual register and memory anew. Every ethnographic or hackerspace project gestates many potential and actual others.

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