

Making in Brazil: can we make it work for social inclusion?

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Abstract

Brazil is a country where many initiatives connected to making have recently emerged. It is also a country in which poverty and social exclusion are still major problems. Seeking to address these problems, experiments in “social technologies” – artefacts, processes and methods oriented towards promoting social inclusion – have developed in the country. There are also interesting examples of “gambiarras”, creative technical solutions produced under scarcity. We review points of connection between these different cultures, making use of the idea of technology scripts to consider how each challenges dominant norms for technology in society, and provides alternative scripts for more inclusive development. The paper then explores the actual and potential role of makerspaces in the city of São Paulo, arguably Brazil’s making capital and the first municipality in the country to create an effective public policy to foster socially inclusive making initiatives. By doing so, we seek a better understanding of how makerspaces may contribute to more socially inclusive relationships with technology.

Keywords: making; inclusion; exclusion; development; Brasil.

Introduction

Over the last few years, a lively debate around making and makers has arisen (Anderson, 2012; Hielscher and Smith, 2014; Claude, 2017). The notion that any person or group has the potential to create and modify material objects using increasingly accessible digital tools is attracting large numbers of people to have a go themselves. The phenomenon is also intriguing significant numbers of observers and academics, who try to explain developments, as well as interesting

a variety of cultural, educational and innovation institutions and agencies, such as libraries, schools, museums, and local authorities, who wish to engage and support this activity for their institutional purposes.

Many aspects define making and differentiate groups within the broader maker movements. But perhaps the fundamental characteristic of making that we wish to explore here is the notion that it subverts the boundary that traditionally separates producers and users; whether collapsing these two identities into a new maker identity, an idea explored by Gauntlett (2011), or inserting ambiguity and complicating assumptions about relations between them.

Granted, the generic idea of crafting any given artefact is not something new, nor altogether rare. Countless cultures, particularly in non-mercantile societies, are familiar with this practice and continue to practice it. Making, however, has a special significance in Late Modern societies, due to the way in which industrialized consumer goods are generally produced, distributed and commercialized through processes that are increasingly distant, complex and unfathomable for individual consumers.

Thus, a fairly complex artefact, such a personal computer or a mobile phone comes to be through the coordinated efforts of different firms that supply their different components and parts, and afterwards travels through intricate distribution and marketing channels until it reaches the hands of a consumer, who buys it as a branded consumer good and puts it to use. All this is part of the dynamics of capitalist economies, through which a kaleidoscope of sociotechnical processes is engaged and roles are performed, including the construction of the producer/user boundary. This notion is present in the critique of “Conventional Technology” inspired by the Appropriate Technology movement and its theoretical and political offsprings, such as in the elements around the concept of Social Technology (see Dagnino, 2014), on which we will later elaborate further.

Making in such circumstances is interesting because it subverts many pre-ordained roles. Such subversion can often be playful and personal; but it can also be understood as a political act, even if it is not intended to be one, because it

has the potential of challenging, and perhaps even changing, the sociotechnical order from within. Whether it is curiosity, pragmatism, nonconformity or any other impulse that drives makers (and there seems to be quite a number of different motivations), making presents quite a striking attitude towards technology, and whose origins include a hacker ethic that is sometimes overlooked, but that should not be ignored. Making at its most intriguing involves an ethic that drives people to “open up” technology, to hack it, to create new uses and new forms.

Whilst many have explored the implications of these features in making, they have tended to do so from a North American or European position, and thus consciously or unconsciously tend to reproduce certain situated assumptions about manufacture, design, technology and society. This outlook often overlooks how these features are experienced and perceived from different positions around the globe, and how they fit differently into global manufacturing and consumption systems, or sit apart from them, in places situated differently in the history and geography of production and consumption systems. Given the predominant vantage point, we attempt through the following pages to contribute to the discussion by offering a view from a somewhat different place and angle, by considering how making plays out alongside pressing issues of social inequality in Brazil.

The paper is divided into four sections, apart from this Introduction. In the next section, we delineate some of the fundamental aspects of how artefacts are normally produced in Late Modern Societies. We look into the main ideas and motivations of maker movements which, we argue, are capable of disrupting and generating changes in the apparently unshakable order of production and consumption. In order to make our argument, we use the concept of ‘technological scripts’ developed by Madeline Akrich (1992), which permits an exploration of what the designers, users, and hackers of technologies intend and negotiate in their development and application. Section three is dedicated to the discussion of strategies for supporting and developing maker initiatives, which if negotiated appropriately we believe could have a positive effect on sustainability, inclusion and democracy. This is done by considering and tracing connections between making, inclusive innovation and the practice of “gambiarra”, a technical

subversion of sorts rooted in a culture of improvisation indigenous to Brazil. Based on these ideas, we move to an empirical exploration of these possibilities in inclusive making, and their limits in section 4. We discuss the case of the Fab Lab Livre Cidade Tiradentes, which was established to promote inclusive making in Brazil. In this paper we use this experience as an illustration of sorts. We are confident a deeper analysis of the case would provide very interesting new elements, but our goal here is different. We merely wish to reflect on some broader theoretical questions by connecting them with our initial empirical observations in a way informative for future analyses. Lastly, in section 5, we present some closing remarks based on the material covered in the paper and advocate for a stronger research agenda for inclusive making.

Some thoughts on the place of making in Late Modern Societies

In *Technics and Civilisation*, originally published in 1934, Lewis Mumford anticipated that:

“As our basic production becomes more impersonal and routinized, our subsidiary production may well become more personal, more experimental, and more individualized. This could not happen under the older regime of handicraft ... for the acquisition of skill necessary for efficient production on a handicraft basis was a tedious process, and the slow tempo of handicraft in the essential occupations did not give a sufficient margin of time for achievement along other lines ... With electric power a machine shop may have all the essential devices and machine tools – apart from specialized automatic machines – that only a large plant could have afforded a century ago: so the worker can regain, even within the machine occupations, most of the pleasure that the machine itself, by its increasing automatism, has been taking away from him. Such workshops connected with schools should be part of the public equipment of every community” (Mumford, 2010 [1934], p. 415).

For most of the 20th Century this vision failed to materialize. Though there are experiences that converge to what Mumford predicted, it is safe to say that, to a great number of people in developing consumer societies, the everyday, creative act of producing something with electric-powered devices was far off. Instead, we have grown so accustomed to conceding agency to the unshakable presence of increasingly complex technologies in our lives that we tend to overlook the way technical progress generates and requires scripts in Late Modern societies that reinforce an apparent move from the social to the technological milieu. This, as

Ellul (1990) claimed, would be one of the core moves in the emergence of “technological societies”.

In a way, technical progress clouds our perceptions of how technology effectively changes the way we live. We have grown accustomed to a sense of technological determinism, and to follow the lead of artefacts. In so doing, people can overlook the myriad social choices taken in the design, development, and use of those technologies – the scripts that are followed - and thereby ignoring the fact that technologies are permeated by politics, as Winner (1986) reminds us. As consumers of goods we often tacitly accept the decisions and cues made by creators, designers, engineers and developers, to which we will broadly refer to as “producers”. It is their decisions (evidently, conditioned by a wide array of social and technical factors) that are eventually materialized through design or expressed in documents such as licenses, warranties or terms and conditions.

Even if it is within the capabilities of users to deviate from the intended forms of use of certain goods – computers, cell phones, domestic appliances, automobiles and so on – such deviations are usually met with some kind of sanction or risk to the user, warranty voidance being one of the most common. Hardware is still mostly “closed”, in the sense that it does not grant users absolute freedom to explore boundaries and stray at their pleasure. Artefacts are produced within established technological frames (Bijker, 1986), in which theories and ideas, tacit knowledge, engineering practices, technical procedures, user routines, and so forth are anticipated and folded into production. This set of conditions generate the structures under which problems are identified as technological and solutions are developed and implemented. Conceiving and designing technology involves charting a desired course to be taken by users. Of course, once out in the wider world, such technological intentions do not always go to plan, but these originating designs are nevertheless the intent, and producers are in the privileged position of setting the initial coordinates. Embedded in technologies are the ideas and expectations of those that produce them, as in a script for the rest of us to interpret and perform.

Akrich (1992, p. 208) points out that those designing and producing technologies generate and follow scripts about their purposes and uses. Producer scripts “define actors with specific tastes, competences, motives, aspirations, political prejudices, and the rest, and they assume that morality, technology, science, and economy will evolve in particular ways. A large part of the work of innovators is that of “*inscribing*” this vision of (or prediction about) the world in the technical content of the new object”. Through this process, technology communicates an intention, be it evident or not. This is what Akrich calls a technological “script”.

Scripts generate a particular order, envisioned by producers, that is to be followed by users. There are, however, routes of flight from the directions of technology producers, and that allow these devices to be ‘de-scripted’ by more subversive users, or more simply because for some reason actual users do not stick to the intended script (Akrich, 1992). The mechanisms and functionalities envisioned by producers may, therefore, be deconstructed and reconfigured by users.

With the above in mind, we could consider making to be an extreme example of de-scripting. Computer-numerically controlled machine tools and rapid-prototyping technologies intended originally for the purposes of automation in industrial settings, and which promised to deskill and displace manufacturing workers, are being appropriated by makers for more creative, human-centred application in other settings, and for hence for wide varieties of purposes. The new script involves hacking and defying the norms of the incumbent technological order, seeking technologically-facilitated autonomy rather than subordination. What we might call hacker scripts. That said, makers are systematically facing the risk of falling back into line with the adapted scripts of producers, who now see maker designs, prototypes, and enthusiasm as open innovation amenable to appropriation by incumbent global manufacturing circuits (Smith, 2017). Nevertheless, even these more conformist scripts, susceptible to capture, are nevertheless renegotiating earlier scripts.

What Akrich describes in her concept of scripts is ultimately a process through which technology is defined by a negotiation between different meanings and uses, but not necessarily through changes in design. Most common forms of de-

scripting involve generating new ways to use any given technology different to the ones defined by its producers. E-mail inboxes, for instance, gradually shifted from being just an interface through which online messages were read and sent to becoming a virtual storage device, where users keep a secure and organized virtual data archive. But users did not have to promote any changes in their e-mail accounts to do so. They simply started to use this particular technology in a new way: categorising and storing messages and discussion groups. Similar things have happened elsewhere, such as with the telephone, SMS messaging, drum-machines, bicycles and so on through a long list of many devices.

Making, on the other hand, implies a deliberate attempt to tamper with design, either by executing incremental changes in hardware, revitalizing broken or obsolete objects, customizing mass-produced goods or crafting new artefacts altogether. As Gauntlett (2013: 233) claims, “the idea of making and sharing is already a political one”. It is the result of a new attitude towards technology, even if it is sometimes an unconscious political act. And it is significant because it redistributes power by unsettling the sphere in which things are produced and opening up to new interventions. Makerspaces and hackerspaces create a more or less inviting environment for this to occur and for users to become involved.

Of course, some grassroots movements have been trying to “open” hardware for decades (Pearce, 2012; Smith, 2014; Hielscher and Smith, 2014), much as others have been doing the same with software (Deek and McHugh, 2008). Makers are among these groups who have been trying to appropriate, redirect and repurpose technologies. Part of the maker culture bears a revolutionary character because it defies the production-consumption logic described (and scripted) above. Making might be a political act if it is based on a conscious choice of not following the predetermined technical script, and awareness of the implications of becoming involved in other scripts.

There certainly are different motivations and purposes that lead people to create, craft, fix or improve artefacts. It might be the outcome of a pragmatic attitude towards technology, as when a specific, punctual problem is met with a fitting technological answer seeking to solve or alleviate it, or when a broken gadget is

fixed by the user. It might be a result of curiosity, as in a pursuit of personal satisfaction through creation and craft (e. g. as it is common among hobbyists). It might be an instrument for entrepreneurs to generate innovative products that may propel start-ups. Or it might be a downright subversive deed, a deliberate act of technological non-conformity, such as extending and repurposing the life of products and challenging consumerism. Or... it might be a combination of all of the above.

Evidence collected by Smith (2017), shows that there are many differences among makerspaces and groups often identified with making. Some do act in ways we might call “technological non-conformists” and as emphasised in our focus here on subversive describing. A great number of makers, though, seem happy to embrace at least part of the global manufacture script, thus joining in “a wave propelled by a celebration of entrepreneurship and individual initiative, whilst often inattentive to any associated downsides, such as new forms of exploitation and precariousness” (Smith, 2017, p. 9).

Important here is the social aspect of individuals and groups organized in workshops or “makerspaces” such as HackLabs, FabLabs and tech shops. Through systematic sharing and networking, these myriad activities are gradually evolving into communities that, as Hielscher and Smith (2014) stated, might be considered part of a “peer production movement” based on social interactions rather than on the sole efforts of DIY hobbyists.

Gauntlett (2011) emphasises making is about connecting. It is about bringing people together to solve problems, to create and craft. And it provides and strengthens connections not only between individuals and groups, but also between people and technology. The maker movement is evidence that other ways to interact with technology are a real possibility. It shows that we can transcend the strictly utilitarian, passive production-consumption connection we have built with technology throughout Modernity, and to ask questions about establishing deeper, and more active link with the artefacts that help constitute our worlds.

But where is the maker movement now, exactly? Anderson (2012: 17) claims,

“Here’s the history of two decades of innovation in two sentences: The past ten years have been about discovering new ways to create, invent, and work together on the Web. The next ten years will be about applying those lessons to the real world”.

There is an alluring straightforwardness to this script. Maker movements have, indeed, managed to build social and cognitive capital that enables the growth of new material practices. A very disperse set of early initiatives is now taking an increasingly transnational shape, as collectives of makers interact through newly opened channels such as workshops, fairs, blogs and websites. Although these links are still mostly present in the Northern Hemisphere, makers based in developing countries are also joining these networks, while international development agencies have shown an appetite for helping make the connections.

These trends have led authors such as Anderson (2012) and Troxler (2013) to speak of a new industrial revolution in its own right, with making at its core. By exploring the potential of rather complex technologies made progressively more accessible due to their falling costs, as is the case of 3D printers and scanners, computer numerical control (CNC) machines and laser cutters, makers have made a very clear point regarding the latent innovative potential that lies outside of the borders of conventional firms.

If this attitude towards technology indeed heralds a revolution it is still early to tell. It is not uncommon for predicted technological revolutions to be frustrated. That, however, does not mean we are not facing valuable “scenarios of experimentation” through which potentials may be explored and some realized (Fressoli and Smith, 2015).

Therefore, even if the transformative potential acclaimed by enthusiasts of making is elusive, it is nevertheless possible to identify some elements within the maker movement that open up to renewed scrutiny received scripts about producers and users and about technology-society relations. First of all, there are new tools (and new uses to “old” tools) that enable people to create, prototype and craft new products; second, there is an impulse among makers, a tacit norm

of sorts, that leads them more towards sharing and collaboration than to economic competition; lastly, there is a wide set of common archive sharing formats that allow makers to further adapt and develop new scripts. The latter also brings with it the possibility to link with commercial producers, enabling prototypes to be produced at scale, and thus connecting entrepreneurs to the more established scripts of producers. Taken together, these elements constitute a new milieu for technology scripts. Amidst this new, old and hybrid scripts being generated, one can perceive promising mechanisms for promoting social inclusion and which may assist certain countries in seeking alternative strategies for development.

Inclusive innovation, social technology and gambiarra: potential links to making

From the perspective of a developing Latin American country, a change in scripts seems long overdue. In fact, much of the regional and Brazilian literature on science and technology policy produced during the last four decades point to incompatibilities between imported high-technology scripts and the local social, economic and cultural contexts for large parts of the population (Medina et al, 2014). Despite these observations, policy-makers in Brazil and the region have been tenacious in following what we could call a “catch-up” script: trying to emulate policies and develop knowledge and technology from Northern economies so that the country can follow its richer northern counterparts more productively and competitively. Implementing this script has sometimes created enclaves of advanced development, but has largely failed in delivering the associated promises of widespread social development.

Social exclusions tend to be glossed over by these policies, and seen as a separate distributional issue, rather than requiring action inherent to the technological scripts themselves. More critical voices have long argued that alternative technological scripts, that are more inclusive by design: authors such as Amílcar Herrera, Oscar Varsavsky, Jorge Sábato and José Leite Lopes

proposed such a strategy for the region a long time ago (Thomas and Dagnino, 2005).

More recently, over the last fifteen years or so, a number of experiences in “social technology” in Brazil have been trying to develop a more inclusive script, based in cooperation, solidarity and inclusion, rather than on the mainstream policies that currently shape technological development (Dagnino, 2014).

Social technology is the Brazilian counterpart to “inclusive innovation”, “grassroots innovation”, “pro-poor innovation” and other similar expressions presently in use. Social technology refers to approaches that, while recognizing the limits of mainstream technology strategies for development, propose alternatives centred around the need for *promoting inclusion through technology*, and even more democratic approaches to technology development in some instances (Dagnino, 2014). We believe there is a promising relationship to be fostered between these social technology approaches and maker initiatives.

As pointed out in Smith (2017), “the design, development and control of technologies can be key in determining patterns of social development” (p. 3). That being true, some fundamental questions regarding strategies to make makerspaces more open and concerned with social technology issues such as inclusion and democracy-building should become part of the broader discussion.

In these terms, if making could be and should be more inclusive, there seems to be some possible interesting connections to other scripts that could be explored in order to promote maker inclusiveness. Through the next few pages we briefly explore two of these potential links with scripts concerning inclusive innovation and the practice of *gambiarra*.

Concerns regarding the relationship between innovation and inclusion on its many levels are not particularly novel, but have attracted renewed interest over the last years. Several authors have recently stressed the importance of fostering initiatives that have fallen under a wide variety of labels, such as inclusive

innovation, pro-poor innovation, base-of-the pyramid innovation, below-the-radar innovation and grassroots innovation (Heeks, Foster and Nugroho, 2014).

Chataway, Hanlin and Kaplinsky (2013) argue that, apart from China, there has been a significant uncoupling between economic growth and social and economic development, partly due to the conventional trajectory of innovation, which draws from “increasingly capital intensive, large scale and environmentally damaging technologies to produce goods and services for rich consumers” (p. 23), and what we called the “catch-up script”. This global trend, they believe, may be countered by an alignment of other factors:

“A key development has been the growth of technological capabilities in the south, and allied to the rapid growth of low- and middle-income consumer markets in these economies, we have begun to witness a major transition in the market orientation of profit-seeking investment and innovation. An increasing number of private sector actors are targeting inclusive innovation as sources of sales and profit. Allied to this, large scale Development Funds and governments and aid agencies have also begun to direct resources to promote inclusive innovation and sales” (Chataway, Hanlin and Kaplinsky, 2013, p. 23).

On a similar note, Cozzens and Pereira (2008), recognizing the limits of mainstream science, technology and innovation (STI) policies in generating inclusion through a fairer distribution of income, and they too have advocated for a new policy model to go beyond what they have dubbed the “Knowledge Economy Policy Paradigm”, and be fundamentally oriented towards reducing exclusion and inequality through science and technology under a “Social Cohesion Policy Paradigm”. While observing some promise on the shaping of “integrated, multi-objective frameworks for STI policy”, Cozzens and Pereira stress that “the full development of that framework and agenda depends, however, on sustained, long-term work to develop new performance criteria, new objectives and different accountabilities” (p. 25).

We agree with this diagnosis. While there is promise and potential in the attention these proposals have received amongst some development agencies (OECD, 2015; World Bank, 2012, 2014), a successful shift of STI policies and practices towards inclusive innovation will depend on the alignment of the discourses,

interests and agendas of diverse actors. But, where we might differ, is in our scepticism about relying upon policy elites to make this shift themselves or through exhortation in academic debate and elsewhere, not least because many of those elites benefit from the prevailing paradigm.

In this sense (and again trying to address the question on whether making can be more inclusive), we believe that there are many benefits to be reaped through a stronger interaction between promising scripts through concrete activities that build changes from below. As we have pointed out before, there seems to be a latent potential for making to become a widespread tool for promoting inclusion on its many levels. In challenging dominant technology scripts, and building alternative scripts, maker movements might help – when aligned with more powerful social movements - to circumvent policy-makers, and work more directly with scientists, engineers and entrepreneurs to develop alternatives that eventually pressure policy-makers to catch-up with the inclusive script. Rather than opening up the innovation agendas, policies and processes in order to include poor and marginalised groups *as a result of elite strategies*, a maker-enabled approach would include groups *as part of* the development of new policies and strategies.

So, how could making begin to play such a role, and how is it doing so already? What features, good and bad, of existing practices should be taken into account in order to foster the creation of effective inclusion-oriented maker spaces?

The Brazilian experience with social technology – “tecnologia social” in Portuguese (see Dagnino 2014) – presents some relevant lessons for promoting social inclusion through technological change. Amongst social technology’s lessons of potential use to more inclusive scripts for maker practices, is the notion that when it comes to social technology the processes are often more important than the artefacts they generate. When building a rain-water cistern for promoting access to clean water, or when designing an urban farm to produce food for a poor neighbourhood, it is crucial to involve users in all stages and build transferable capabilities and solidarity amongst participants. This helps reinforce social bonds, to develop a stronger sense of community and to empower

individuals and groups. It positions any technology production and use as an inherently social, and even political, activity under the control of the community of users, rather than a product gifted from outside. It seems there is a valuable lesson for makers here, since the hype around the tools and equipment that inhabit makerspaces, much as the objects and gadgets that emerge from them, tends to overshadow the daily practices and routines that may act as significant vectors of inclusion (as well as distracting from frank reflection on practices that currently exclude).

Another element that, as we have previously stated, may contribute to shaping inclusive making strategy particular to Brazilian is the culture of *gambiarra*, celebrated in the country as a testament to the creativity and innovativeness of people who lack the means to access or buy ready-made products and solutions.

Brazilians celebrate *gambiarra* as an intangible heritage. It is an ethos that involves temporary, often low cost, sometimes illegal solutions to daily problems, and which involves mixing and mashing together whatever things can be found to hand in order to make a working artefact. From hair clips or nails to fix the straps onto flip-flops, to adaptations to old VCR players that enable them to (illegally) receive paid TV signals, *gambiarras* are widespread. Bouffleur (2013) presents a comprehensive discussion on the topic, identifying some notable and curious examples of common Brazilian *gambiarras*, from simple adaptations to significantly complex re-engineering.

Beyond the quaint and folksy presentation of *gambiarra*, we believe there is strong creative potential that could be explored in order to promote more inclusive making, and hence explore alternative scripts for technology in economic and social development. Bouffleur (2007:7) states that *gambiarra* is “basically the act of improvising material solutions with utilitarian purposes from industrialized artifacts” (authors’ translation). According to the author, it is, simultaneously, a form of technical improvisation, of utilitarian readjustment and of subversion of conventional industrial design, somewhat like Ernesto Oroza’s studies on “technological disobedience” explored in the film “Cuba’s DIY Inventions from 30 Years of Isolation”.

In this sense, it is a form of technological transgression through which users expand the intended functionalities of industrial artefacts. Thus, gambiarra is also a form of challenging the proposed technological scripts whilst shaping alternative scripts through social and technological improvisations that establish solutions to given (everyday) problems. Moreover, the scripting involved in gambiarra makes use of informal knowledge and everyday tools.

Understood as a way of not just dealing with technology, but as a method for developing new technology, gambiarra has the potential to boost Brazilian creative capabilities and to strengthen maker culture in the country, whilst translating the latter to local specificities. The serious, systematic analysis of gambiarras could offer insights on below-the-radar innovations in the country, and how digital fabrication can play an augmentative role.

Exploring its potential interface with maker culture, Fonseca (2015) points out that gambiarra, a sort of “everyday innovation”,

“refers to all kinds of improvised solutions to concrete problems that appear when one doesn’t have access to the proper tools, materials, parts or specific knowledge to perform a given task. It is all about repairing or re-purposing objects that seemed to be of little use but end up acquiring new value out of tacit, applied creativity” (p. 57).

Fonseca criticizes makers’ current obsession with emulating industrial methods and practices, which he believes reveals a difficulty in breaking away from conventional market and production assumptions and embracing the potential of making as a script for transgression and resistance. Through a gambiarra-inspired approach to artefacts, Fonseca sees the possibility for an alternative script to be written and performed by the maker movement, one that would be driven by everyday repair efforts and more technology for longevity and sustainability rather than by the endless production of novelty that tends to be celebrated currently. A script centred on users’ creativity and respect for materials, and not so much on mastery of tools per se.

If “making is connecting”, as Gauntlett (2011) puts it, then *gambiarra* may be a driving value to be incorporated into maker culture and scripts. After all, it is about accepting different bodies of knowledge and practice and reconnecting people to everyday doing and crafting.

São Paulo’s recent experience in inclusive making

In parallel to what is happening in different parts of the world, Brazil has also experienced a surge of experiences related to socially inclusive technology strategies. Over the last fifteen years, *social technology* – the local term used to address products, processes and methods aiming towards promoting social inclusion – has become an increasingly important element of the science, technology and innovation policy in the country, despite some recent setbacks (Fressoli and Dias, 2014). The notion that knowledge and technology should be understood as constitutive core aspects of social inclusion strategies has since become a generally accepted part of the country’s inclusion policy framework, which influenced the city of São Paulo’s experience we describe over the next few pages.

With a population of over 12 million people, São Paulo is by far the largest city in Brazil and one of the largest in the world. It is also a place of clear contrasts, where century-old buildings sit uneasily alongside skyscrapers built with metal and glass, where traditional family-owned businesses stubbornly subsist amidst giant commercial corporations, and where extreme poverty coexists with imposing wealth and luxury.

In this sense, the city of São Paulo is an emblematic example of the historic Brazilian socioeconomic condition. According to the 2016 IMF estimates, Brazil had a GDP of US\$ 1.534 trillion and a *per capita* GDP of US\$ 7,447. The city of São Paulo was responsible for a considerable share of this product, with an estimate GDP of around US\$ 180 billion (about 11,7% of the total Gross Domestic Product), according to the 2013 Brazilian Institute of Geography and Statistics (IBGE) Census, and a *per capita* GDP of roughly US\$ 15,000. São Paulo is a

rich, productive city, and a very unequal one: current data on the UN's Human Development Atlas show that the Gini coefficient for the city is 0,62, while Brazil's is 0.518, meaning that inequality in the city is above the country's average.

São Paulo may also be considered a place where values such as entrepreneurship and innovation tend to be appreciated. It is certainly a national reference in terms of creative industry and it is becoming a modest hub for Brazilian makers: over the course of the last few years, several maker spaces and digital fabrication labs have emerged in the city. One set of makerspaces that stands out due to their nature is twelve of the city's fab labs are public, meaning that they not only are free and open to the general public, but also funded by the local administration and jointly managed with ITS Brasil, a non-governmental organization committed to fostering science and technology for social inclusion in Brazil, with significant former experience in social technology initiatives.

This network emerged as the organizational core of the Fab Lab Livre SP Programme, launched in 2015 by mayor Fernando Haddad as an initiative under the city's Secretary of Services, which set the general outline of the project. The twelve fab labs are spread throughout the city of São Paulo, as seen in the figure below:

[Figure 1]

Source: authors' elaboration based on data from the Fab Lab Livre SP Programme.

The Programme involves a team of about thirty people. It had an original budget of US\$ 2 million and was initially set to span a period of two years, with the possibility to extend its duration. 62.5% of the budget was destined to cover costs throughout these two years, while 37.5% were meant to fund the acquisition of tools, hardware and software. A significant – if mainly symbolic – aspect of the Programme is the contractual demand that all software used at the fab labs must be free software.

Though they share a common public nature, these fab labs also have some relevant differences between them. The majority of them are mostly visited by artists, designers, architects, engineers and college students and tend to be seen predominantly as spaces for creative expression. Others are mainly concerned with promoting education and are often visited by curious, enthusiastic children and teenagers.

As a whole, this network of workshops presents an opportunity for the broader script to be re-written, since it is offering users a chance to meddle into the technical establishment. It also offers possible inspiration for developing countries to write scripts of their own, based on their own challenges and goals, rather than by following the technological paths dictated by the so-called developed countries. This alone would seem like a relevant strategy to be pursued, making the São Paulo experience worthy of note.

There is one of the twelve fab labs, however, that stands out from the rest: the one situated at Cidade Tiradentes, on which we will focus here, not as a case study, but as an illustrative experience that may provide us with new elements to reflect on the possibilities of de-scripting through making. It is situated on São Paulo's very rim, on its eastern part. Cidade Tiradentes is one of the poorest neighbourhoods in the city, presenting indicators that clearly denote this status. Evidence presented by the Map of Inequality, a report published by the Nossa São Paulo Network (www.nossasaopaulo.org.br) in 2016, shows that Cidade Tiradentes is one of the poorest regions in the city. Fortunately, the neighbourhood's overall situation seems to have slightly improved over the last few years, according to recent data derived from the Network, partially due to the implementation of some basic public services in the region, such as schools, day-care centres and internet access points – the latter as “telecentros”, free neighbourhood lan houses.

The Fab Lab Livre Cidade Tiradentes stands out from its counterparts because it is particularly – and explicitly – concerned with social inclusion. Additionally, it was the first of the twelve fab labs to be opened, in December 2015. It operates from a large public complex, Centro de Formação Cultural Cidade Tiradentes,

which hosts an open library and theatre, a “telecentro”, as well as several workshops and courses open to the general public.

From the moment one enters the fab lab at Cidade Tiradentes, one of the most striking impressions it gives is in the contrast between the haphazard surrounding the building and the organized, clean disposition of the equipment and furniture inside the lab, as symbolically illustrated by the figure below.

[Figure 2: Contrast]

Source: authors' archive.

While most of the other labs in the São Paulo network are visited by its fair share of artists, architects, graduate students and geeks (much like other labs around the world), a large number of those who regularly visit Fab Lab Livre Cidade Tiradentes are children and teenagers (often on school field trips) and unemployed artisans, mostly masons and carpenters who live nearby.

These groups' motivations certainly differ, however: while the younger visitors are driven by curiosity and a fair deal of fascination towards the seemingly futuristic equipment at the lab, the artisans seek the means to craft and produce without charge for the use of the machinery. The lab receives roughly 1,000 visitors each month, including walk-ins or people attending some of the courses offered periodically (on themes such as electronics, digital fabrication, crafting, Inkscape, robotics and arduino).

Most of the activities developed in the lab have a strong connection with educational practices. Some of the lab's team members commented on how school visits had a visible effect on children's curiosity regarding fabrication, tools and equipment. But they also claimed that being in contact with the lab helped the overall improvement of school performance. As an example, they recalled that some children (around ten years of age) did not know how to properly use a ruler, and would often ignore the grading under the 1cm mark. They would also be lacking basic notions of space and size and would have difficulty in estimating the dimensions of furniture, for example. When challenged by the lab's team

members to 3D print some clothes hangers, they would initially struggle due to these issues. They were then invited and assisted to take measurements and to register the numbers they found, so as to produce proper, functional hangers. This brief example is instructive, since it shows how the access to making can aid in developing knowledge and competences sought, but not always gained, in formal schooling.

The example above also suggests the outline of a strategy for rescripting making for social inclusion. Just as schools and makerspaces might converge towards a common, relevant goal, inclusive makerspaces should be shaped as catalysts of further interactions among other actors. In other words, the educational use of makerspaces provides relatively limited social inclusion if participants are educating along the lines of predominant technology scripts that reproduce the exclusions experienced under catch-up technology policy. Education and training should include more critical and radical experiences and scripts for social technology development. Activity needs to consolidate rather than contradict the identity of the Cidade Tiradentes Fab Lab as socially inclusive, and there seems to be some connections being formed already. The nearby community theatre, in the same building, has used scenographic objects produced at the Lab's benches, a small yet significant accomplishment. In the future, objects and parts created at the Lab could also become visible throughout nearby schools and parks, on workers' cooperatives, in scrap collectors' carts, and so on.

For this to happen, it would also be strategic if besides providing access to tools and equipment to, say, unemployed artisans, the Cidade Tiradentes Fab Lab could map workers' skills and act towards creating links of productive cooperation between them. Gambiarra culture demonstrates the informal skills and creativity in communities. Connecting these skills with the resources and possibilities in Fab Labs is an important means to conveying value, status and commitment to such skills. Inclusion, after all, is not only about providing access, but shaping sustainable social and productive relations. It is something that should be on the horizon for this emerging makerspace, and for similar ones that are eventually created.

Besides putting people in touch with new, promising technology, the lab seems to play an important role as a space for people to come together and exercise their creative potential. In poor neighbourhoods in brutally unequal countries this is particularly meaningful, since it may help to fill certain gaps left by the state's historic absence. Gaps which have often resulted in public spaces that are unwelcoming to people or with limited access to precarious basic services, such as housing, education, sanitation, health and security.

Retrieving the powerful idea Gauntlett (2011) presented us with – the claim that “making is connecting” – we can think of the Cidade Tiradentes lab as a space that provides several desirable connections. It allows people to connect to technology just as it enables people to connect to each other. Additionally, it bridges complex technology and formalized knowledge to other epistemics, such as the creative informality of *gambiarra*, and thereby creating tensions that may lead to very interesting results (more on this a little further down). But it also connects the problems of a given territory to viable solutions, generated by the communities themselves. This is not a trivial thing. Rather, one of the main challenges to developing countries seems to be finding endogenous, sustainable responses to the social, economic, environmental and political problems they face. Experiences such as the Fab Lab Livre Cidade Tiradentes, in this sense, could also be understood as spaces in which making is connecting to the territory and through which communities and neighbourhoods come together to conceive solutions to address their common problems, as Ribera (2016) suggested.

In other words, it is about an opportunity to use powerful, sophisticated technology to generate real, sensible change – to take maker tools and equipment, practices and culture and translate it, generating a new script for inclusive making, more adequate to the context of developing countries, but still connected to the global network. The symbolic value behind it is also something that should not be ignored. It is a manifestation of the notion that people are allowed to create their own scripts with the help of new technology. It is a statement of access to technology and production as a right to everyone in the city, poor or rich.

Although there are numerous positive elements which can be drawn from this particular experience, there are also some points we believe must be addressed in order to boost the effectiveness of similar makerspaces, oriented towards promoting social inclusion. As a yet very recent experience, it represents possible outlines for a future that may or may not be fulfilled. In other words, though we identify promise on the Cidade Tiradentes initiative, it is important to note that there are important elements to be addressed in order for this initial experience to become a long-term model.

First, there is the issue of bringing forth the “materiality of inclusion” in inclusive makerspaces. As Kohtala (2016) reminds us, values, ideas and narratives are made concrete in the design of the material elements which are visible in makerspaces. We would expect a maker collective primarily concerned with sustainability to embrace sustainable-oriented design, for example. So, should we not expect an inclusion-oriented makerspace to be itself inclusive? This would likely contribute to creating an ambiance and set of practices that could increase the effectiveness of inclusive makerspaces. The FabLab Livre Cidade Tiradentes, as we have previously noted, contrasts heavily with the reality outside of its walls and windows. It could innovate by materializing inclusion in the layout and redesign of the space, which is to say invite neighbours to do the re-designing of the space or be involved in the process – and this could, perhaps, generate some positive outcomes and lessons. This is easier said than done, especially when one recalls inclusion is about inclusive processes in developing alternative technology scripts, involvement in opening up and critically reconfiguring technology, and inclusion in any resulting artefacts and services. As such, processes for taking activities out of the FabLab, and into the neighbourhoods, whether through citizen innovation labs in different districts, or in situ making, would demonstrate the intent to open up processes and take them to people.

On our visit to the Fab Lab on Cidade Tiradentes, it was mentioned that the children living nearby would sometimes walk inside the facilities with no shoes on – a reminder of the social and economic reality that encircles the lab’s pristine walls and seemingly magical equipment. Motivated by this image, we stress the need for a reframing of making (or for a change in its script) in developing

countries towards more inclusive practices and approaches seeking to address relevant social problems while actively engaging the community and linking to other complementary initiatives. This could be the basic elements for a *barefoot making* script.

Thus, the Cidade Tiradentes experience is an example of a small element towards generating a new, rewritten script. The script being shaped inside that particular Fab Lab is very different from what is found in a great number of makerspaces around the globe (and in the other ones that make up the São Paulo network). It tends to drift away from individualistic, market-oriented notions under the guise of alluring terms such as “entrepreneurship”.

Sadowski and Manson (2014) synthesize this process as follows:

“The maker movement is born out of, and contributes to, the individualistic, market-based society that has become dominant in our time. More specifically, the movement fits well into what, nearly 20 years ago, the media theorists Richard Barbrook and Andy Cameron called “the Californian Ideology.” According to this view, new technologies promise to create a class of high-tech entrepreneurs thanks to their ability to “empower the individual, enhance personal freedom and radically reduce the power of the nation-state.” All while allowing them to ignore or simply design their own way around the established political, economic and legal system.”

By framing problems using a different, unconventional approach, however, the Cidade Tiradentes Lab challenges the boundaries of making. Symbolically, it might be understood as a political act, a subversive maneuver inside a culture split between resistance and conformism.

Shaping inclusive technology under such a script, evidently, is no easy task. There are limits, in São Paulo and elsewhere, that tend to hinder the capacity of barefoot makers to turn their set of skills into the driving force behind new business models or social technologies capable of empowering communities and shifting their circumstances. After all, there are given political and economic relations that are much harder to be rewritten than other parts of the established script.

Closing remarks

We cannot help but to think about how wonderful it would be if typical makerspaces in Brazil and elsewhere – predominantly inhabited by white males, as observed by Grenzforthner and Schneider (2009) and more recently verified by Charter and Keiller (2014) – would become increasingly more plural. And not only for the sake of representation itself, but also because the interaction between different bodies of knowledge and practices often generates rather unique, creative solutions. The Brazilian experiences on gambiarra and social technology certainly make a very strong case for that.

Inclusive making experiences could benefit a lot from the interaction with other convergent initiatives. In Brazil, for instance, there is a strong network of workers' cooperatives and Solidarity Economy enterprises (see Lemaître and Helmsing, 2012) with which these makerspaces could interact further. By working closely together with scrap collectors, community house builders, urban farmers and other organized or semi-organized collectives, inclusive makerspaces could help to create a richer environment for inclusive innovations to occur. This should be a goal for experiences like the one in Cidade Tiradentes.

Additionally, there is the issue of converting a promising experience into a model for a sustainable public policy. This is not a simple task and tends to be particularly challenging in countries where policies are often discontinued simply for being strongly associated with the previous governments that created them (something fairly common in Brazil). Overcoming these vicissitudes and providing long-term planning and lasting financial and political support – from a variety of actors – are important conditions for keeping successful developments alive.

Although the mainstream script in maker culture often assumes a rather techno-optimistic protagonist, we feel that there are relevant issues to be addressed, particularly when we think about inclusive making. We have pointed out, based on some broader considerations and on thoughts provoked by São Paulo's Cidade Tiradentes FabLab Livre, that there is as much potential and possibilities

for inclusive makerspaces as there are challenges and limitations. In general terms, it is important to note that inclusive making strategies would benefit greatly from a stronger connection to the territory they are in and the neighbouring communities. This means they should seek to respond to local demands, necessities and problems, and learn the art of community development (Smith and Light, 2017).

In his book *Sagarana*, celebrated Brazilian writer Guimarães Rosa reminds us of an old saying: *sapo não pula por boniteza, mas porém por percisão*. It roughly translates to “the frog leaps not for the beauty of it, but because it needs to”. Inclusive making should draw from local knowledge and creative potential and be driven by real community or neighbourhood needs, drifting away from the obsession with beautiful gadgets and technologies and with making for its own sake. This notion is reinforced by the arguments presented by Gyawali and Thompson (2016), who evoke a related image of “toad’s eye science” to advocate for the pursuit of designing bottom-up situated responses to social problems, rather than a top-down “eagle’s eye approach”.

Evidence presented by some of the authors we mentioned along the preceding pages, as well as many others, lead us to conceive makerspaces as capable of strengthening bonds between people (and between people and technology) and shaping community identity. Makerspaces will be successful in opening up and writing inclusive technology scripts to the extent that they are successful in building inclusive communities. São Paulo’s Cidade Tiradentes, like many other places globally (such as Belfast, Detroit, Amersfoort, Bogotá, and others), illustrates attempts of developing script-making communities: building the capacity of people to appropriate technologies to autonomous local purposes. In the case of Fab Lab Livre Cidade Tiradentes, not only does it play an important role in spreading maker culture (much as the other labs in the São Paulo network), but it takes it to one of the poorest areas of the city, to people who most likely would otherwise be deprived from even knowing the most basic tools and principles of making. And yet, where considerable making skills already exist, hidden in gambiarra and the lack of recognition of these skills. Makerspaces need to learn to listen and connect with these skills, and bring their technology scripting

resources into an empowering relation with the skills and aspirations of the communities around them. However, such potential will only be fully realized when the experience feeds back into making and translates it to fit into the local context with its specificities.

In this paper we have tried to construct a dialogue between making, technology politics, and inclusion, all as seen from a particular Brazilian perspective. We wanted to imagine makerspaces providing a rich environment for inclusive making. The lessons provided by the experiences on social technology and the pervasive (yet often shunned) culture of *gambiarra* could help promote this development. These alone are unlikely to be sufficient, since other key factors – such as lasting government policies and stronger links with movements for social and economic justice – are still lacking. The São Paulo experience, however, represents a signal for what could become a promising trajectory for inclusive making. It could inspire similar initiatives elsewhere and provide valuable insight for policy makers and scholars.

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Acknowledgments

Some of the work going into this paper was funded by the Open Research Area/Economic and Social Research Council project, “The Knowledge Politics of Smart Urbanism”; and by the Coordination for the Improvement of Higher Education Personnel, Brazil.