

RESEARCH ARTICLE

A fablab at the periphery: Decentering innovation from São Paulo

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Abstract

In recent decades, many tech spaces have emerged worldwide to promote innovation. Based on ethnographic research, this article examines one of such initiatives in Brazil—a public laboratory of digital fabrication located in a low-income neighborhood in the periphery of São Paulo. While scholars have exposed the neoliberal aspects of fablabs, this article aims to de-center hegemonic understandings of innovation by attending to its situated practices. Analyzing the techno-optimist aspirations and institutional legacies behind this laboratory, I explain how the US-based fablab model was reconfigured in light of community concerns and previous Latin American experiments of digital inclusion. Against a monolithic image of tech collectives, I show how lab workers cultivated a diverse range of audiences and creative practices, specifically those of working-class women. The article concludes with a call for more anthropological attention to overlooked tech practices as a means to imagine fairer and more solidary forms of innovation. [*computing, development, digital inclusion, innovation, technology*]

Resumo

Em décadas recentes, muitos centros de tecnologia têm emergido globalmente com o propósito de promover inovação. Baseado em pesquisa etnográfica, este artigo examina uma dessas iniciativas no Brasil: um laboratório público de fabricação digital localizado numa comunidade da zona sul de São Paulo. Dado que os aspectos neoliberais dos fablabs já foram expostos, este artigo pretende descentrar entendimentos hegemônicos de inovação através do estudo das suas práticas situadas. Analisando as aspirações tecno-otimistas e os legados institucionais por detrás deste laboratório, explica-se como o modelo Estadunidense de fablab foi reconfigurado à luz de preocupações da comunidade e experimentos Latino-americanos de inclusão digital anteriores. Complexificando imagens monolíticas de coletivos tecnológicos, mostra-se como os trabalhadores do laboratório cultivaram uma gama diversificada de públicos e práticas criativas, especificamente de mulheres de classe trabalhadora. O artigo conclui com um apelo por maior atenção antropológica a práticas tecnológicas negligenciadas como meio de imaginar formas

mais justas e solidárias de inovação. [*computação, desenvolvimento, inclusão digital, inovação, tecnologia*]

Resumen

En décadas recientes, muchos centros de tecnología han emergido globalmente con el propósito de promover innovaciones. Basado en investigación etnográfica, este artículo examina una de esas iniciativas en Brasil: un laboratorio público de fabricación digital localizado en una comunidad de la zona sur de San Pablo. Dado que los aspectos neoliberales de los fablabs ya fueron expuestos por investigadores, este artículo pretende descentrar entendimientos hegemónicos de la innovación a través del estudio de sus prácticas situadas. Analizando las aspiraciones tecno-optimistas y los legados institucionales detrás de este laboratorio, se explica cómo un modelo estadounidense de fablab fue reconfigurado a la luz de las preocupaciones de la comunidad y experimentos latinoamericanos anteriores de inclusión digital. Complejizando imágenes monolíticas de colectivos tecnológicos, se muestra cómo los trabajadores de laboratorio cultivaron una gama diversificada de públicos y prácticas creativas, específicamente de mujeres de la clase trabajadora. El artículo concluye con un llamamiento a una mayor atención antropológica a prácticas tecnológicas desatendidas como medio de imaginar formas más justas y solidarias de innovación. [*informática, desarrollo, inclusión digital, innovación, tecnología*]

The hustle and bustle announced another busy day at the laboratory. Tables were being dragged around and reassembled into a large surface, metal needlework boxes clinked to the rhythm of hurried footsteps, a headless mannequin slid into the room. The Sewing Study Group had decided to move their meeting to the entrance hall. Vitoria, the intern who supervised these meetings, expected the session to be well attended, so they needed the extra space. Besides, she explained, this would create some distance from the back room, where the robotics workshop was about to start, and liberate the laser cutting area in case any desperate architecture students showed up to work on last-minute projects. The result was a cheerful cacophony of people and activities. While the women gathered around the improvised table, sharing ideas and materials they collected, curious teenage boys passed by, looking for their computer stations, and children, brought in by their mothers to learn “a bit of technology,” ran around, entertaining themselves between fabric scraps and circuit boards. Impervious to this agitation, Fabio, one of the

permanent lab technicians, worked in a corner, frowning worriedly at his laptop screen. He was crunching the lab's monthly numbers to report back to management and looked visibly frustrated. "They must understand that people don't come to the lab *just like this*," he snapped his fingers, "especially here in the periphery!" I was puzzled. I knew the pressure for meeting outcomes was high, but we were at full capacity that morning.

Nestled in a slope in the southern part of São Paulo, the Fab Lab Livre in Heliópolis resembles many other tech hubs that have recently sprouted around the world. Comprising four sequential rooms organized along a long wall of glass windows, this fablab—a contraction of the English "fabrication laboratory"—is equipped with computers, 3D printers, automated milling machines, a laser cutter, and essential woodwork and electronics tools, such as soldering accessories, breadboards, microcontrollers, saws, and drills (Figure 1). However, a glance through the windows reveals a more complicated story. A massive backdrop of precarious brick houses crammed along a tight mesh of winding streets rises before the eyes in a typical *favela*¹ landscape. Open from 9 a.m. to 6 p.m. on weekdays and Saturday mornings, this fablab operates on a "public, free, and open" basis with the intent of uplifting a poor neighborhood in the periphery of one of the largest cities in Latin America.

[FIGURE 1 ABOUT HERE]

This article focuses on Fab Lab Livre as a state-led project for promoting innovation and entrepreneurship across the city of São Paulo. I start by examining the uneven techno-optimist visions behind this initiative, arguing that the tensions between these visions enable the reinvention of these laboratories of digital fabrication. Through ethnographic work at the fablab in Heliópolis, I then explain how global market-oriented models of innovation are negotiated and transformed vis-à-vis the interests, practices, and concerns of people from the neighborhood. To

show how the community appropriates the fablab, I delve into the strategies used by lab workers to maintain that space despite pressures for particular outcomes and make it locally relevant. Specifically, I describe a regular sewing gathering organized by a group of working-class women whose creative practices and subject positions challenge the dominant innovation paradigm. Building on Zoy Anastassakis (2019), I explore how these practices offer glimpses of a *chthonic innovation*, understood as innovation practice that generates new ways of coming together in arrangements that are both productive and caring.

Over the last few decades, innovation has come to signify more than an invention that found its path to wide diffusion and commercialization (Godin 2015). It has become a status symbol used by people, organizations, and nation-states to signal progress and modernity in the twenty-first century. Worldwide, a plethora of labs, hubs, studios, and the like has flocked around this trope's spiraling seduction, presenting themselves as spaces of innovation and entrepreneurialism. Seen from a distance, these spaces are easily conflated, and it might be tempting to assume that they all follow the same trajectory, welcome the same people, and support the same practices. This article's ethnographic look complicates this monolithic view.

Contributing to the growing field of anthropology of design and innovation that is emerging from digital anthropology (Hjorth et al. 2017) and kindred disciplines such as human-computer interaction and communication studies, this article contends that attending to situated innovation practices and genealogies offers the potential to imagine innovation otherwise. To do that, I build on two main trends in the scholarship on design and innovation, which represent two approaches to these notions coming from different research contexts and concerns. On the one hand, there is the growing critique of standard design and innovation discourses and institutions. Dedicated to revealing the violences and exclusions produced by tech hubs, this strand resonates

with what Keith Murphy (2016) calls the anthropology *of* design. This style of exposé is hinted at in formative scholarship by Lucy Suchman (2011) and features prominently in recent works by Lilly Irani (2019) and Silvia Lindtner (2020). On the other hand, there is the attempt to deploy certain intellectual traditions—particularly feminist and decolonial theories—to reformulate design beyond its capitalist matrix, exploring its possibilities to create more inclusive worlds. We see this restorative effort in the works of Arturo Escobar (2017), Daniela Rosner (2018), and many scholar-practitioners who have strived to decolonize design (e.g., de O. Martins and de Oliveira 2016; Tunstall 2013). Working with these two approaches, I propose an anthropology of innovation that unsettles the dominant imagery of tech production based on elite expertise, disruptive novelty, intellectual property, and entrepreneurial risk.

The case of Fab Lab Livre demonstrates the conflicting political agendas, institutional genealogies, and tech practices that materialize the promise of innovation. Combining a model established at the Massachusetts Institute of Technology (MIT) with previous experiments in technological inclusion that took place in Brazil throughout the 2000s, the initiative was conceived at the complex intersection of market-oriented and welfarist visions. As I will explain, recognizing these particular genealogies is crucial to prevent our imaginaries from becoming arrested by geographically and politically narrow understandings of the institutions that sustain innovation in the contemporary moment. It is only by attending to how these initiatives are translated through messy and frictional processes (Tsing 2005) that we can start disentangling the many possible lives of tech collectives.

This perspective from Latin America pushes against the mainstream view of non-Euro-American regions as mere importers of foreign models of technological development (Medina, Marques, and Holmes 2014). Whereas scholars have been keen to recognize the progressive

lineages of tech spaces in the United States and Europe (e.g., Maxigas 2012), state-led tech hubs in the Global South can be hastily relegated to an amorphous category of development emanating from a supposedly Western neoliberal matrix. This reproduces a misguided view of fablabs and makerspaces as simply propagating in space, spreading with them European and North American concerns and aspirations to the rest of the world. In this article, I emphasize Fab Lab Livre's distinctive legacies and trajectories not to erase the problematic impacts of innovation discourses in the lives of marginalized communities but to contribute to undoing the "myth of digital universalism" (Chan 2013; see also Philip, Irani, and Dourish 2012) and cast light on how innovation discourses are appropriated, refracted, and transformed on the ground. In this sense, this work echoes what Sareeta Amrute and Luis Felipe Murillo (2020) call "computing from the South." Understanding the South not as a geographic location but as a power relation and as a method to expand "the archive for the geographies and the possibilities for the present and future of computing" (Amrute and Murillo 2020, 3), the South in this article is a fablab at the periphery of both a megacity and the dominant model of innovation.

Methodologically, my analysis builds on field research conducted at the Fab Lab Livre network between 2018 and 2019, particularly at its laboratory in Heliópolis, but not only there. This research started with a one-month stay at the NGO that manages the laboratories, where I observed life at the office, participated in team meetings, and revised reports and other official documentation. It followed a four-month period of immersive fieldwork in and around the Heliópolis's fablab, where I conducted participant observation by taking part in daily lab activities, attending and organizing workshops, learning about the neighborhood, and participating in community events. In addition, I conducted in-depth interviews with fablab staff, users, administrators, policymakers, and key political actors that have been involved in the

project since its conception. Since this period of immersion, I have returned to the fablabs on multiple occasions and kept in contact with its community through WhatsApp groups and other means. Most actors in this article have been anonymized through pseudonyms.

Back at the fablab, I offered to help Fabio, but there was not much I could do. He was upset, as there were no new projects to report back to the municipality, at least not the type of projects that were expected from the lab. In the ambition of turning São Paulo into a global player in the innovation scene, municipal administrators decided to prioritize a specific type of fablab project—product-based, with clear commercial potential, and carefully documented in a digital portfolio. They assumed that there would be scores of people queuing outside the laboratory, waiting to use the 3D printers to produce prototypes for new products, but somehow that was not happening. It was time to get creative. It was decided that we would make some phone calls the day after. We would reach out to local schools and the residents' association and organize a few more workshops to raise awareness for the possibilities of that fablab as a public resource.

MUNICIPAL ASPIRATIONS

Created by the São Paulo municipality in 2015 and administered by a subcontracted NGO since then, the fablab in Heliópolis is part of a larger network of public laboratories of digital fabrication officially intended for “innovation and creativity that promote digital inclusion and *provide autonomy to the citizens*” (Fab Lab Livre SP 2019; emphasis added). The network's geographical spread shows an effort to reach very different audiences, from creative freelancers in middle- and upper-class areas to unemployed individuals in poverty-stricken communities. From the thirteen laboratories that now compose Fab Lab Livre, three serve the city center, while

ten are scattered around the city outskirts, where autoconstructed brick-and-cement neighborhoods like Heliópolis abound.

As an initiative, Fab Lab Livre mirrors larger trends. In the last decade in urban centers worldwide, there has been a proliferation of spaces that promise new productive articulations between digital technologies, collaborative work, and individual enterprise. These spaces are often supported by nongovernmental organizations, grassroots movements, and private institutions—such as corporations and universities—but not only these. In fact, a growing number of governments seem to be investing in tech hubs like Fab Lab Livre. From Brazil to China, many of these spaces have described themselves using English terms like “fablab,” “makerspace,” and “hackerspace,” intentionally signaling their kinship to US-born trends gone global.²

From the varied types of tech collectives, Fab Lab Livre emulates a particular one: the fablab, a model born out of MIT in the early 2000s. Developed at the Center for Bits and Atoms, the fablab was envisioned as “a place to play, to create, to mentor and to invent: a place for learning and innovation” (Fab Foundation 2020). Fablabs foreground computing and design skills, particularly programming and digital modeling, and are typically targeted at university students and liberal professionals in the so-called creative industries. As an outreach initiative, the concept has proven very successful. In 2018, there were about 1,600 fablabs distributed across more than one hundred countries registered with the Fab Foundation, the institution responsible for coordinating these labs internationally (Fab Lab Network 2019).

Compared to similar spaces elsewhere, Fab Lab Livre is unusually accessible. Although many state-led tech hubs are public in theory, in practice, they are not *for* the public, as they tend to be located in rather exclusive areas, such as university campuses and science and technology

parks. In contrast, the São Paulo laboratories are located in public galleries and community centers, and they make no distinction between privileged and underprivileged areas in terms of the equipment they offer. Aware of these distinctive features, São Paulo's municipality has promoted the initiative as "the largest public network of laboratories of digital fabrication in the world."³

In a way, Fab Lab Livre reflects what scholars working on tech for development have described as techno-optimism, or "the enduring belief that technology use and production are promising for humanity" (Avle et al. 2020, 238). Techno-optimism has found expression in fields like humanitarianism, where authors have noted the growing framing of poverty alleviation in terms of design and innovation (Schwittay 2014). Peter Redfield (2012), for instance, reflects on the growing popularity of devices like the LifeStraw, a portable water filter developed by the innovation center of a market-minded corporation in Europe. Humanitarian goods such as these are innovative, small-scale, and consumer-oriented solutions that promise to address structural problems with individual fixes. Education has been another fertile milieu for techno-optimism, as illustrated by Christo Sims's (2017) study of an experimental school in New York aimed at reinventing education for the digital age. Sims examines what he calls "disruptive fixation," or the abiding idea that society can be radically transformed by fixing the educational system and teaching individuals the right skills. As he explains, this fixation itself is not new, since it lies at the heart of many past educational reformist movements. Nonetheless, there is now a techie inflection that transforms what counts as the right skills that ought to be taught for the greater good. This type of educational and design-oriented techno-optimism is strongly at play in Fab Lab Livre.

The link between techno-optimism, development, and skill is conspicuous in the Global South. Following Arturo Escobar's (1995, 36) famous analysis of the emergence of development discourses, we can say that, in the postwar moment, it was believed that technology "would not only amplify material progress, it would also confer upon it a sense of direction and significance." Referring to the vast literature on the sociology of modernization, Escobar argues that "technology was theorized as a sort of moral force that would operate by creating an ethics of innovation, yield, and result" (36). From an initial focus on technology transfers and impressive infrastructural projects (e.g., Larkin 2008) to more recent approaches aiming at incorporating the poor into market structures by turning them into "bottom of the pyramid" entrepreneurs (Dolan 2012), technology and technical skills have occupied a crucial position in national and international development programs. Recent examples in the anthropological literature of projects aiming at fostering socioeconomic development through the cultivation of tech skills include the distribution of low-cost laptops to underprivileged children in Peru (Chan 2013), projects of digital mapping in informal settlements in Kenya (Poggiali 2016), educational reforms aiming at fomenting tech entrepreneurialism in India (Irani 2019), and state-sponsored hackathons and start-up bootcamps for young college graduates in Mexico (Beltrán 2020a).

Just like the idea of development itself (Ferguson 1990), tech-based development projects present their challenges, limitations, and ideological biases. Commenting on Redfield's humanitarian objects and other similar projects, Elizabeth Chin (2016, 486) points out that the chronic inefficacy of tech for development results from the constant sidestepping of infrastructural approaches and the uncritical acceptance of "problematic utopian claims about technology and the future." Still, techno-optimism endures beyond flaw, as people can remain faithful to the promises of a better future through tech even despite evidence to the contrary (e.g.,

Sims 2017). In the case of Fab Lab Livre, one of the key frustrations that has haunted the initiative since its launch is the struggle to build an entrepreneurial audience in the periphery.

The municipal narrative of Fab Lab Livre aligns with what has been described by scholars studying innovation and tech spaces in the Global South as the rise of entrepreneurial subjectivity. Lilly Irani's (2019) work in India is insightful. Situating the proliferation of tech hubs in the context of larger politico-economic transformations—particularly the consolidation of innovation as a value—Irani calls attention to the subjectivities and exclusions that accompany these spaces. Focusing on entrepreneurial citizenship in India, she discusses the deceptive aspects of innovation as a development strategy. She shows that despite its promises of all-inclusive economic uplifting, standard practices of innovation subsume a plurality of knowledges and desires to elite interests, thus dissuading oppositional politics without ever challenging deeper structural asymmetries. An important lesson here is that initiatives like Fab Lab Livre are not politically neutral; they can be seen as advancing a certain neoliberal ideal of the entrepreneurial individual who “pulls themselves up by the bootstraps,” preferably using digital technologies.

PINK GENEALOGIES

Despite the US genesis of the concept of fablab, Fab Lab Livre workers prefer to emphasize the initiative's Latin American roots. In his usual pitch for first-time visitors, Fabio explains that the idea emerged after former Workers' Party mayor Fernando Haddad visited a fablab in Colombia. He reenacts the scene with a comical imperious voice: “Haddad was so impressed that he said, ‘I don't want just one lab for São Paulo. I want *twelve* spread all over the city!’”⁴ With the help of scholars from the University of São Paulo and a group of Brazilian policymakers with experience

in digital inclusion, the Fab Lab Livre network was quickly inaugurated. The project followed all the standards established by MIT, with one exception: it did not join the international Fab Foundation. In fact, the initiative had no formal connection to MIT until mid-2019. Hence, for several years, the municipality appropriated the fablab brand, using its reputation while maintaining independence from its regulatory structures. Simultaneously, it re-created the fablab concept by turning it into a public resource with unique social and geographical scope. In a way, Fab Lab Livre hacked the fablab.

This reminds us that below a surface of apparent similarity, tech collectives may have many different trajectories. While recent scholarship has rightfully exposed the neoliberal cooptation of fablabs, makerspaces, and hackerspaces (e.g., Söderberg and Delfanti 2015), one should not forget that many of these collectives have also drawn on critical and radical lineages, such as Californian counterculture (Turner 2010), the free software movement (Kelty 2008), computer hacking (Coleman 2012), and Italian autonomism (Maxigas 2012), to name a few. Luis Felipe Murillo's (2020) work on Noisebridge in San Francisco, for instance, illustrates how hackerspaces can prefigure more collaborative and open computing practices. Although these radical lineages seem to be more visible in the literature on North American and European tech collectives, they are not exclusive to these regions (see Eglash and Foster 2017). To consign all tech initiatives in the Global South to an amorphous category of development, mythically emanating from a neoliberal Euro-American matrix, is to erase these spaces' powerful local histories and political potentialities. As Sasha Costanza-Chock (2020, 139) warns apropos of the idea of design justice, "We should not allow neoliberal discourse about these sites to erase their past, present, and future radical possibilities. There is a deep history, or alternative genealogy, of hacklabs and media/tech convergence centers as spaces tied to social movements."

Indeed, to make sense of Fab Lab Livre and its specificities, one must put it in the context of a longer tradition of social movements and government programs oriented toward building technological capacity in Latin America (Dias and Smith 2018). Particularly during the 2000s and what came to be known as the Pink Tide of new center-left governments in the region, many countries invested in projects of social innovation that aimed at devising community-driven solutions for tackling social problems through new technologies and public services (Fressoli, Dias, and Thomas 2014). In the case of Brazil, scholars and activists agree that the government of Lula da Silva between 2003 and 2010 represented a high point for experiments in digital culture (Costa 2011; Fonseca 2017). Here, I will briefly highlight two initiatives from this period that I see directly reflected on Fab Lab Livre: the first is the Telecentros program, and the second is the promotion and diffusion of social technologies.

For several of my interlocutors, the main models on the horizon of Fab Lab Livre at the time of its conception were not only internationally recognized fablabs in places like Barcelona and New York but also, and especially, the Telecentros program, a landmark of the Brazilian policy of digital inclusion (Nemer 2022). Created in 2001, Telecentros were public computer labs strategically located in low-income neighborhoods that provided free internet access and open workshops on skills such as searching for jobs online or crafting a resumé. This was a radical intervention at a time when the majority of the Brazilian population did not have a computer, let alone internet access. Some Telecentros became so popular that they persist to this day, including one in Heliópolis, which is administered by the residents' association (Figure 2). According to a former municipal policymaker,⁵ Fab Lab Livre was envisioned as “an updated version” of the Telecentros program. The goal was to create new spaces adjusted to a novel

vision of digital inclusion in which the priority was no longer to simply provide access to computers but to enable people to use them to prototype new products and ideas.

[FIGURE 2 ABOUT HERE]

A second important experience informing Fab Lab Livre is the promotion and diffusion of social technologies, a development approach that gained momentum among scholars and activists in Latin America throughout the 2000s (Dagnino 2011) and that gave origin to the NGO that manages the fablabs. According to the Fundação Banco do Brasil (2019), a key proponent of this approach, social technologies can be defined as “replicable products, techniques, or methodologies that are developed in interaction with the community and introduce effective solutions for social transformation” (translation by author)—typical examples are things like low-cost biodigesters, wind- and solar-power techniques, and systems of solidarity economy. To make these technologies widely available, the foundation holds a biennial contest that selects the best emerging social technologies and documents them in a public database so they can be reproduced.⁶ In an interview with Nana, the leader of the NGO that manages Fab Lab Livre, I asked how she saw social technologies and fablabs coming together. She explained,

We always follow the [municipal] calls for tenders, and one day we discovered the fablabs’ call. We thought: if the goal is to make technology accessible to all, then it goes well with our vision, it has to do with social technology. And we have to implement fablabs in communities in the periphery—fine, popular dialogue is something I do since the 1970s.⁷

Nana is in her late seventies. She is a Workers' Party founder who served in several Base Ecclesial Communities in the industrializing peripheries of São Paulo during the military dictatorship (see Caldeira 1986). Turning the MIT model on its head, she believes that “Fab Lab Livre is not the place for start-ups,” approaching it instead as a program of technical training that prepares citizens for a new wave of industrial transformations. In her view, these fablabs support entrepreneurship in the sense that they provide “an opportunity for people to fulfill their projects and wishes,” but only as long as these contribute to collective well-being.

Nana's vision for the fablabs resonates partly with what Silvia Lindtner (2020) calls the “socialist pitch.” For Lindtner, the global rise of the maker scene results from two main factors: the general disillusionment with the tech industry in the aftermath of the 2008 financial crisis and the progressive displacement of tech development to new regions—especially China, but not exclusively. In this context, makerspaces promised an alternative way of producing tech that appealed to socialist sensibilities. Reframing hacking values, which were specific to the geek counterculture, into the idea of making, which can be practiced by all, the socialist pitch “derives its power from producing an affect of interventionist capacity and change” (Lindtner 2020, 215). While agreeing with Lindtner's critique of the socialist pitch as concealing forms of structural violence, it is important to distinguish between different socialist pitches. In the case of Fab Lab Livre, the welfarist foundation I just described does not only precede the maker scene but is also rooted in distinctive Latin American tech experiments that aim at addressing social inequality, thus defying more individualistic approaches to innovation and entrepreneurship. This pink genealogy is not inconsequential, reverberating through the fablabs in fundamental ways. For instance, in the spirit of social technology, Fab Lab Livre adopted a registration system in which users are required to document their projects in an open public database,⁸ much to the annoyance

of a few users who dwell in hopes of patenting their ideas. Another aspect already highlighted is that most of these fablabs were placed in underprivileged neighborhoods, showing an attempt at integrating these communities rather than excluding them. Altogether, the variety of visions inhabiting Fab Lab Livre generate frictions regarding what is expected from these laboratories. Such frictions also open up opportunities for new audiences and practices to occupy them.

EVERYDAY APPROPRIATIONS

As we enter the Fab Lab Livre in Heliópolis, pictures on the walls remind us of the history of the neighborhood outside. From the multiple waves of occupation of unused land by poor immigrants from the Brazilian Northeast Region, starting in the 1970s, to the fierce rallies for basic sanitation, schools, and land rights, and against violence and crime, Heliópolis's history, like the history of many autoconstructed peripheries in São Paulo (see Holston 2008), is one of political struggle and resistance. It is also a history of resourcefulness and creativity, as it is told by its residents (Persoli and Santis 2013). The fablab is yet another expression of this relentless fight for infrastructure, lying at the heart of a recently built educational complex where there is constant buzz—kids playing, teenagers dancing, professors and parents running around—as well as activities for all ages and tastes, including Zumba, theater, and poetry slams.

The fablab is run by a couple of technicians—often local college students, or recent graduates—with the help of one or two temporary interns. In addition to administering workshops, assisting users with their projects, and performing technical maintenance,⁹ every month, technicians must translate database registrations, sign-up sheets, and scattered notes into tight spreadsheets of outcomes to make sure their fablab is meeting the municipality's expectations. Keeping up with modern standards of accountability (Strathern 2000), the policy's

success is measured through quantitative indicators of which the most valued is the production of “innovative entrepreneurial projects.” Here, Heliópolis performs poorly when compared to the fablabs in the city center, even though it is one of the busiest labs in the network.¹⁰ Thus, when Fabio said that people do not come “just like this” and snapped his fingers, he did not mean that they have no users but rather that people from the community do not show up to the lab on a whim, in their spare time, wanting to engage in cutting-edge DIY projects and entrepreneurial ventures. As noted by him with a hint of sarcasm,

In Alice’s Wonderland, we would just sit here, and people would come to work on their projects. . . . Sure, I would love it if a craftsman from the community knew about this place and came here to produce his piece, making things easier for him. But it just doesn't work like that.¹¹

At least in theory, the quintessential fablab project is one that combines the skills of the entrepreneur, the activist, and the artist, producing a hybrid object that generates revenue while also tackling social issues, preferably with a polished aesthetic. Consider, for instance, the example of Senior Ludens, a domino game for people with dementia created by designer Livia Nishibe (Figure 3). Winner of the 2019 contest for the best academic project developed at Fab Lab Livre, Livia’s creation immediately won the jury’s hearts after she told how, in order to communicate with her grandmother, she created a beautiful product that can be sold to heaps of families and nursing homes. This is the type of project Fabio wished he could report in the municipality’s spreadsheets and share on social media. At this level, as I explained above, Fab Lab Livre resembles many other tech hubs around the world, echoing promises of self-reliance and social change through innovative products. As pointed out by Lilly Irani (2015, 800) with

respect to hackathons—short events that bring programmers and other creative professionals together to collaborate in solving specific problems, often with a social intent—participants in these initiatives tend to “imagine themselves as agents of social progress through software.”

[FIGURE 3 ABOUT HERE]

In Heliópolis, however, the fablab falls short of supporting the creation of so-called innovative products and businesses. And there are many reasons for this mismatch between official expectations and the reality of what the space delivers. In interviews and conversations during my fieldwork, users from the neighborhood used to point out that many residents do not understand the purpose of a fablab or what they can do with it, and when they do, they may feel like the space “isn’t for them,” partly because it looks “so modern,” with its minimalist logo, bare walls, and peculiar machinery. Furthermore, the lab’s schedule coincides with the working hours of those who often have to run around a megacity to make a living out of an amalgam of precarious jobs in the already quite entrepreneurial hustle of everyday life. The predicament of tech hubs serving impoverished communities is thus that, although they are vital to cultivating inclusion, their mere existence is not sufficient. That is, just because the labs are there, and are free and open to all, does not mean they are necessarily seen and used by everyone equally, which puts in perspective the excitement around these fablabs as agents of social and economic development.

In the city center, on the other hand, says Fabio, “everything is more organic. Because it’s in the center, people are more independent, so to speak. They go to the lab searching for something, and since they have more studies, they end up going on a more individualized path.” The disparities within the Fab Lab Livre network reflect the deep social inequalities of São Paulo, where the privileged white population lives predominantly in the city center and the Black

working-class resides in the peripheries. Unsurprisingly, the central fablabs attract individuals who are more likely to immediately recognize the utility of a public laboratory of digital fabrication. Therefore, whereas in the center users come to the fablabs knowing exactly what they want—e.g., to 3D print a part for a particular project they might be working on—in Heliópolis that is less common. Of course, presuming that everyone is equally knowledgeable of how to navigate the abundance of open workshops, free tutorials, and other scattered resources of the largely English-speaking online world of DIY contradicts these spaces' goal of digital inclusion as dreamt by Nana. It aligns, however, with the municipal vision of a new culture of greater self-reliance, a world where citizens are held responsible for their own learning and economic uplifting.

Seen through this prism, Fab Lab Livre merely entrenches existing inequalities, which is, unfortunately, a common story. As many scholars have pointed out, fablabs and other comparable art, tech, and design spaces have tended to reproduce elitism, white privilege, and patriarchal “bro-cultures,” even when their intentions are transformative (Chin 2016; Costanza-Chock 2020; Troxler and Maxigas 2014). And this criticism does not come solely from academia. Past the initial fascination with the emancipatory promises of tech collectives, increasing internal critiques to these spaces prompted efforts to make them more diverse. In her work on diversity advocacy in tech spaces, Christina Dunbar-Hester (2019) discusses the limitations of these voluntaristic endeavors to produce a significant impact. Interestingly, she notes that tech activists in North America and Europe have foregrounded diversity of gender, race, and ethnicity in their agendas, overlooking class. Elsewhere in the tech world, however, class differences become more pressing, particularly when we consider who composes the IT workforce globally (see Amrute 2016). At Fab Lab Livre, class disparities are also inescapable,

since they mark a variety of practices and experiences across the laboratories in the city center and the periphery.

But while the Heliópolis fablab underperforms in supporting local entrepreneurs, it thrives in many other respects. For one thing, placing a trendy public resource next to a favela is a bold move that attracts much attention. Over the years, the lab became an emblem of the municipality's investment in tech and innovation for both left-wing and right-wing administrations, featuring in national broadcast media, welcoming prominent political visitors, and establishing partnerships with private companies offering things like free game-design and app-development classes. The multiple visions upon which the project was built gave it a degree of political malleability that has made it viable across the partisan spectrum, enabling its continuity beyond particular mandates. This stands in contrast to what often happens to community-oriented hubs like these, which tend to be short-lived due to precarious support (e.g., Laboratorio para la Ciudad in Mexico City).

At the same time, college students from wealthier neighborhoods started traveling to the fablab to use its equipment. These were usually architecture, design, and engineering students working on graduation projects, such as making a robotic arm controlled by Arduino or crafting an architecture model in layered cardboard. Although lab workers were critical of privileged individuals taking advantage of community resources, their visits were also convenient given the pressure to meet certain numerical goals. As a result, the lab turned into a space of contact between people of different social classes, but not without its share of mockery—a running joke among lab workers being that these folks would have never set foot in this part of town if it were not for a vacant spot at the laser cutter.

Most notably, lab workers became creative with how they build an audience and bring people to the fablab. Through emails and phone calls, they began reaching out to local institutions such as schools, NGOs, and the residents' association, inviting them to visit and use the lab. This improvised strategy was only possible because of the relentless work of technicians who, like Fabio, knew the area well and could draw on personal contacts to establish these relationships. For Fabio, actively inviting groups to the lab is in perfect alignment with the social and political history of the neighborhood, since "most things [in Heliópolis] have been done in collaboration anyway." Striving to make the fablab relevant, he and his colleagues created new workshops that appealed to the community, which they then combined with more typical fablab offers. For instance, when a signboard for a communal garden was needed, they organized an open design and laser cutting session. Thinking of professors, they came up with short courses for making educational games. A variety of workshops were also devised to introduce school students of different ages and backgrounds to the possibilities of digital fabrication.

Despite the official lingo around entrepreneurship, the fablab's day-to-day came to depend much more on community involvement than on individual enterprise. In the process, the lab also became more diverse, welcoming groups traditionally excluded from tech hubs, particularly women and Black people, who were now being directly called to occupy this space. As Dulcilei Lima and Taís Oliveira (2020) remind us in their work about Afro-Brazilian women in tech, although marginalized groups have been structurally barred from tech careers, this does not mean they do not engage in tech practices. Afro-Brazilian women, they explain, have long drawn on web design, game development, and social entrepreneurship to form communities of knowledge, express themselves, and give visibility to their concerns (see also Bahia, Agustini, and Barenboim 2018). In the case of Heliópolis, the appropriation of the fablab by the

community might not have turned the lab into a “subaltern design site” in the strict sense of the term (Costanza-Chock 2020), but it revealed a hegemonic design site that, by virtue of its situated characteristics, *enables subaltern design practices*. This nurturing appropriation brings to mind Zoy Anastassakis’s (2019) work about a public school of design in Rio de Janeiro that, in the face of financial struggles, was bravely kept open by students and professors. Invoking Donna Haraway’s (2016) chthonic entities, Anastassakis (2019, 16) speaks of “chthonic design” as design practice oriented toward “response-abilities in precarious times.” In what follows, I zoom in on an episode of what can be called *chthonic innovation*, understood as innovation practice that is not strictly about making new products but rather about generating new ways of coming together in arrangements that are both productive and caring.

TECHNO-FUXICO

No one knew what to do with the eight donated sewing machines that the municipality distributed by the fablabs. They seemed out of place—sewing machines in a digital fabrication laboratory. But not for Vitoria. A twice-widowed single mother of two who had become a lab intern through a reemployment program, Vitoria had little familiarity with computers but had plenty of experience with these vintage devices and saw in them an opportunity to make herself useful—to the point of irreplaceability. She started by sewing by herself in the downtime between admin responsibilities, awakening the tacit knowledge that had been buried by years without touching a machine. With the help of the residents’ association, she spread the word about her skills. Her solitary practice quickly became a group activity, launching the Sewing Study Group at the Heliópolis fablab. Born out of a group of women that assembled around

Vitoria, the Sewing Study Group took place consistently on Wednesday and Saturday mornings for more than a year between 2017 and 2019 (Figure 4).

[FIGURE 4 ABOUT HERE]

These women—four to twelve of them, depending on the day, and mostly over forty years old—lived predominantly in the neighborhood. They were in the universe of informal labor, occasionally taking up domestic work in the city center and other menial jobs. When they had time to come to the lab, they would work together on creative projects. They began by using fabric scraps to make basic accessories: tablecloths, pillow covers, pencil cases. Next, they crafted clothing: skirts, pants, overalls. Gradually, they started incorporating other fablab equipment into their practices, in part due to the encouragement of Fabio, who saw in it an opportunity to make the activities count toward the lab’s numerical goals. Drawing on online tutorials and a heroic dose of persistence, the women used the 3D printer to make customized buttons and the laser cutter to produce patterned fabrics and embroidery loops. Plastic bags were recycled using an open-source technique and turned into colorful purses, tote bags, and belt packs. Through these experiments, the women became legible as innovators and proper fablab users in the eyes of management and were allowed to keep their meetings. They even experimented with crochet and LED light strips, creating illuminated brooches, home decorations, and techie forms of *fluxico*, a traditional technique for turning fabric scraps into round little puffs that can be assembled into home accessories, jewelry, and other objects (similar to yo-yo crafts in the United States). And in the spirit of *fluxico*’s double meaning in Brazilian Portuguese—where it stands both for the making of these crafts and for gossiping—they chatted away as they worked on their projects.

The expression *fazer fuxico* is particularly apt in this regard, for it reminds us of the tight knots between material and social creation (Ingold 2013), an idea that gets reinforced by the verb *fazer*, which means simultaneously “to make” and “to do,” thus collapsing the notions of performance and manufacture. As is customary in tech collectives, the Sewing Study Group was not only a space of creative production but also of intense sociability. At the fablab, the women worked together and shared their stories, some humorous about the mishaps of everyday life, some tragic about family and economic difficulties. In Brazil, women’s groups of mutual support have historically organized around churches and social movements (Sarti 1988), which makes a tech-oriented space like this an exception. Many reasons have drawn women to these groups, including a search for solidarity around traumatic experiences, self-esteem in the face of social stigma, and financial autonomy from husbands. In a study of a mother-operated hackerspace in San Francisco, Daniela Rosner and Sarah Fox (2016) confirm the well-known pleasures and healing properties of crafting things together (Sennett 2013), noting that “craft processes have figured strongly in women-organized hackerspaces by adopting elements of a therapeutic discourse” (Rosner and Fox 2016, 11). Tania Pérez-Bustos (2018) expands these observations in an experiment with embroiderers and engineers in Colombia by focusing on needlecraft as a form of productive care not only for others but also for oneself. “Sometimes everyone starts to cry, and this becomes a *roda de choro* [circle of lament]!” Vitoria explained with a loud laugh, making a pun with a popular musical genre. Those were the moments when she would step aside and delegate the situation to Fabio. He is known for being good with people. She, on the other hand, cannot stand tears. She says she has been through enough sorrow in her life.

For some, these practices might be nothing but simple little pastimes. As feminist scholars of science and technology have pointed out, there is a long history of gendered and

racialized craftwork being diminished as unskilled and uncreative (see Cockburn 1985; Wajcman 1991). This is particularly true in the computing and electronics industries, where such work has played a crucial role (see Hicks 2018; Hossfeld 2001). Writing about a semiconductor factory in the Navajo Nation, Lisa Nakamura (2014) shows that Indigenous women were often described by their employers as inherently suited for the assembly line because of their “nimble fingers,” among other so-called natural characteristics. In her research on core rope memory—an electronics device based on feminized needlework used in NASA’s Apollo program in the 1960s—Daniela Rosner (2018) adds a further contradiction. While craftwork in the American high-tech imagination can be associated with sustainable DIY practices and other progressive elite agendas, it quickly loses that status when it is performed by working-class women. At Heliópolis, these women might not have been immediately recognized as innovators, but they ended up becoming central to the functioning of the lab, making their practices constitutive of that space rather than residual, adjacent, or supportive (Beltrán 2020b). Moreover, there was nothing pastime-y about their work. Unlike other tech collectives that have celebrated hobbyism and failure (Davies 2018; Rosner and Fox 2016), for the women in Heliópolis, it was important to craft useful objects, objects they could sell, or, if not, at least wear or gift someone. Sewing was neither a hobby nor a speculative venture. Thinking with Silicon’s famous maxim that says, “you got to fake it until you make it,” we are reminded that risk is a value that not all fablab users embrace.

DECENTERED INNOVATION

The day-to-day at the Fab Lab Livre in Heliópolis thus gives us some elements of what decentered innovation looks like. Instead of a slogan in a vacuum, here we arrive at a portrait of

innovation that is deeply embedded in its social context, imbricated as these fablabs are with state and neighborhood politics, legacies of social movements, community networks, and particular actors and their interests and concerns. We also arrive at a portrait of innovation that is filled with heterogeneous, at times contradictory, visions and practices that are not exhausted by the usual elitist and market-oriented imagery we have of institutions aimed at promoting entrepreneurship and tech development. As performed throughout this article, decentering innovation means working through these particular instantiations with the goal of defamiliarizing hegemonic conceptions of innovation and enabling its existence otherwise. This is a way of challenging innovation, but it is a challenge through refraction rather than outright rejection.

As we saw, Fab Lab Livre's pink legacies do not automatically turn it into a liberatory project. After all, prioritizing the access of low-income populations to fablabs can be interpreted as a perverse attempt to incorporate the poor into precarious industries and avoid the responsibility of structural development by transferring it onto the poor themselves (see Dolan 2012). These public fablabs were not conceived to resist a dominant idea of innovation but rather to be in dialogue with it, strategically feeding on the fablab approach and adapting it to São Paulo's reality. Yet, in practice, instilling a new entrepreneurial ethos is one of the least important roles these spaces play in the communities they serve. This adds a note of caution to the techno-optimist discourses on tech hubs as motors of economic transformation, which predominate in state agendas and other official narratives. It also provides additional nuance to the literature on fablabs and makerspaces in the Global South that foregrounds the formation of neoliberal entrepreneurial subjectivities (Irani 2019; Lindtner 2020). In line with authors who have highlighted these initiatives' ambiguities (e.g., Beltrán 2020a), I believe it is vital not to

overestimate their purpose, coherence, or even effectiveness, at the risk of overlooking the multiplicity of practices they can enable.

Amid pressures to produce so-called innovative entrepreneurial projects, Fabio and his colleagues cultivated a wide spectrum of audiences, institutional relationships, and creative practices at the Heliópolis fablab. They were the agents of extension that stretched the uses of the fablab and made it pulsate with people. The Sewing Study Group is one of the many stories of appropriation I could share. I selected this one because it shows the fortuitous possibilities of placing an open laboratory in an underprivileged neighborhood with strong community ties. In a moment when the United States and Europe are struggling to diversify tech collectives (Dunbar-Hester 2019), Vitoria and her friends offer an inspiring example of affirmation of feminized crafts in a fablab. This rather organic occupation of that space—which was never intended as an activist gesture, despite its radical contours—was facilitated by Fab Lab Livre’s peculiar combination of entrepreneurial and welfarist approaches, as I have shown, making the space welcoming enough to these women to take advantage of it when the opportunity arose. To this appropriation of the fablab, in which people experiment and create together and support each other and the communal intuitions they care about, I called *chthonic innovation*.

Arturo Escobar’s (2017) work on “designs for the pluriverse” is particularly inspiring here. Drawing on a range of Latin American social movements and intellectual traditions, Escobar proposes to expand the notion of design. By recognizing the ontological dimension of design—that is, how it creates modes of existence—design might be reoriented beyond capitalist ends toward values of autonomy and diversity. Similar efforts to reformulate design have been made by Daniela Rosner (2018). Focusing on design’s connections to marginalized practices such as craftwork, Rosner redefines design through “critical fabulations,” or “ways of telling

stories that open new avenues for design by awakening alternative histories” (101). Building on these restorative approaches, this article opens up the question of whether innovation can be put at the service of other values—social good over individual profit, solidarity over competition, friendship over disruption—in any sustained way. For that to happen, a more profound questioning of what constitutes innovation needs to happen (see Mavhunga 2014). The future is at stake. As Anne Balsamo (2011, 3) explains, innovation, culture, and imagination are intimately connected in the sense that “all innovations rearrange culture.” The way a society organizes and recognizes innovation practices not only expresses socially and historically embedded forms of technological imagination but is key to cultural reproduction. This article represents one step toward making space for de-centered ways of looking at innovation by bringing to center stage innovation practices and genealogies that often stay at the periphery.

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FIGURE CAPTIONS

Figure 1. Info session with professors and Arduino workshop. (Photographs by ITS – Brasil and Fab Lab Livre SP. Used with permission)

Figure 2. Telecentro in Heliópolis. (Photograph by the author)

Figure 3. Senior Ludens by designer Livia Nishibe. (Used with permission)

Figure 4. Sewing Study Group. (Photograph by the author)

ALT TEXT

Figure 1. A photo of a group meeting around a wood cutting machine next to a photo of students assembled around a table listening to an instructor.

Figure 2. A photo of a computer center with a few users.

Figure 3. A photo of a domino and cotton bag next to a photo of hands playing with the same domino.

Figure 4. A photo of people gathered around a table with sewing tools and fabric scraps.

IMAGE DESCRIPTIONS

Figure 1. There are two photos. On the left, six professors learn about the fablab from a staff member. They gather around a wood-cutting machine in the middle of the room. On the right, four students of varied ages attend an Arduino workshop. They seat around two central tables with indecipherable objects, their backs facing the camera. The instructor is in front of them, projecting slides from his laptop to a television.

Figure 2. A computer center in the Heliópolis neighborhood with bright blue walls. There are four rows of desks with sixteen computers available. Three teenagers play on two computers with their backs facing the camera.

Figure 3. There are two photos. On the left, a geometric domino and a white cotton bag are displayed against a light pink background. On the right, a group of three seniors plays with the same domino on a round wooden table. The photo is black and white and focuses on their hands.

Figure 4. A group of seven women gathers around a square wooden table. The surface is relatively small and is full of objects – sewing tools, cellphones, elastic bands, threads, fabric shapes, and scraps. Some are sewing, and others seem to be chatting. The photo is colorful and focuses on their hands.

Notes

¹ The notion of *favela*—sometimes translated into English as slum or shantytown—encapsulates a panoply of urban formations with variable degrees of precarity. In the case of Heliópolis, we are talking about a neighborhood that has been largely *autoconstructed* by its residents (see Holston 1991) but has also received considerable state intervention at the level of basic services and infrastructure. Furthermore, the term *favela* is politically charged. Since people from Heliópolis refer to their neighborhood as a *comunidade* and *periferia*, I will be preferring the terms community and periphery in the course of this paper. My use of the term “periphery” echoes the experiences of social and economic exclusion and the political struggles for visibility of Heliópolis’s residents.

² It has become customary to use the notion of “maker movement” to encapsulate many of these heterogeneous groups. Popularized by former *Wired* magazine’s editor Chris Anderson (2012) in his much-cited *Makers*, the maker movement is based on the idea that the cheapening of 3D

printers and other technologies of digital fabrication will trigger a revolutionary shift from proprietary forms of industrial production to more open, decentralized, and collaborative strategies of material creation.

³ Haddad, Fernando. Twitter Post. September 12, 2016.

https://twitter.com/Haddad_Fernando/status/775478899434262530.

⁴ In December 2020, a thirteenth laboratory was inaugurated in the Southern periphery, amid the COVID-19 crisis and during the mayor's reelection campaign.

⁵ Interview with former municipal policymaker, January 2019 (my translation).

⁶ Database of Social Technologies available at:

<http://tecnologiasocial.fbb.org.br/tecnologiasocial/principal.htm>.

⁷ Interview with Nana, June 2019 (my translation). Next two quotes from the same interview.

⁸ Database of Fab Lab Livre projects available at: <https://fablablivresp.art.br/projetos>.

⁹ Without formal training, technicians usually rely on a mix of self-teaching through online tutorials, collaboration with older staff, and trial and error to repair and maintain the labs' equipment.

¹⁰ Internal NGO report with data from July 2018 to October 2019.

¹¹ Interview with Fabio, September 2019 (my translation). Next quote from the same interview.