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A terrestrial Internet from the quilombos: the transatlantic evolution of baobab from colonial to digital capitalism

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ABSTRACT

Based on ethnographic fieldwork, this article examines the origin and development of "*Baobáxia*," a digital network for sharing community-produced content. Baobaxia emerged in "*quilombos*" (communities of run-away slaves' descendents) in Brazil in the early 2000s and expanded to other marginalized groups in South America, Africa, and Europe. Our focus on the essential roles of baobab trees in this network raises the question of material resources sustaining the Internet and digital capitalism. Baobaxia turns out to be a "terrestrial Internet" that exposes the capitalist illusion of dematerialization and demonstrates a different approach to technology development amid the planetary environmental crises today. The analysis reveals the articulation of ancestral knowledge and new technologies in the building of Baobaxia, a network that is adaptive to local-geographical, ecological and infrastructural conditions and that supports community resistance, autonomy, and sustainability. The development of Baobaxia, historically rooted and future-oriented, is an enlightening grassroots experiment in exploring and sharing ways of making a world that may sustain life. Our study of the five-century transatlantic evolution of baobab challenges the often limited spatio-temporal framework in ethnographic research. We thus call for methodological openness to alternative perspectives from ethnographic interlocutors to guide academic understandings of the world.

KEYWORDS
Materiality; terrestrial Internet; reterritorialization; baobab; quilombo

PALAVRAS-CHAVE
Materialidade; Internet terrestre; reterritorialização; baobá; quilombo

PALABRAS CLAVE
Materialidades; Internet terrestre; reterritorialización; baobab; quilombo

Uma internet terrestre a partir dos quilombos: a evolução transatlântica do baobá do capitalismo colonial ao digital

RESUMO

Este artigo, baseado em trabalho de campo etnográfico, examina a origem e o desenvolvimento da Baobáxia, uma rede digital para compartilhamento de conteúdos produzidos em comunidades. A Baobáxia surgiu no Brasil em comunidades quilombolas no início dos anos 2000 expandindo-se para outros grupos marginalizados na América do Sul, África e Europa. Focamos no papel essencial

que a árvore baobá exerce nessa rede, levantando a questão dos recursos materiais que sustentam a Internet e o capitalismo digital. Em nossa análise, a Baobáxia exemplifica uma "Internet terrestre" que expõe a ilusão capitalista de desmaterialização e revela uma abordagem diferente para o desenvolvimento de tecnologia em meio às crises ambientais planetárias recentes. O artigo demonstra a articulação dos conhecimentos ancestrais com as novas tecnologias na concepção e construção da Baobáxia, uma rede adaptável às condições geográficas, ecológicas e infraestruturais, fomentando a resistência, autonomia e sustentabilidade comunitária. O desenvolvimento da Baobáxia, historicamente enraizada e voltada para o futuro, é um experimento esclarecedor na exploração e compartilhamento de maneiras de criar mundos que sustentam vida. Nosso estudo sobre essa evolução transatlântica do baobá, nos últimos cinco séculos, desafia o quadro espaço-temporal frequentemente limitado da pesquisa etnográfica. Desta forma, defendemos uma abertura metodológica para perspectivas alternativas de interlocutores etnográficos para orientar a compreensão acadêmica sobre o mundo.

Una internet terrestre desde los quilombos: la evolución transatlántica del baobab del capitalismo colonial al digital

RESUMEN
Este artículo, basado en un trabajo de campo etnográfico, examina el origen y desarrollo de Baobáxia, una red digital para compartir contenidos producidos en comunidades. La Baobáxia surgió en Brasil en comunidades "quilombolas" a principios de la década de 2000 y se expandió a otros grupos marginados en América del Sur, África y Europa. Centrándonos en el papel fundamental que juega el baobab en esta red, nos lleva a cuestionarnos sobre los recursos materiales que sustentan la Internet y el capitalismo digital. Baobáxia resulta ser una "Internet terrestre" que expone la ilusión capitalista de la desmaterialización y demuestra un enfoque diferente al desarrollo tecnológico en medio de las crisis ambientales planetarias de hoy. Los análisis revelan la articulación de saberes ancestrales y nuevas tecnologías en la concepción y construcción de Baobáxia, una red adaptable a las condiciones geográficas, ecológicas e infraestructurales; fomentando la resistencia, la autonomía y la sostenibilidad comunitaria. El desarrollo de Baobáxia, históricamente arraigado y orientado al futuro, es un esclarecedor experimento de base para explorar y compartir formas de hacer un mundo que pueda sustentar la vida. Nuestro estudio de la evolución transatlántica del baobab durante los últimos cinco siglos desafía el marco espacio-temporal a menudo limitado de la investigación etnográfica. De esta manera, defendemos una apertura metodológica a perspectivas alternativas de interlocutores etnográficos para orientar la comprensión académica del mundo.

1. Introduction

The Internet has been long called a virtual space or virtual world as if it is detached from the material world. The development of the Internet has often been associated with the

high technology industries in North Atlantic countries as if it is transcendental to natural resources or grassroots populations in the Global South. Therefore, in the ever-accelerated advancement of the Internet and digital capitalism, often rendered much less visible are the impacts of the extraction of natural resources necessary to sustain the Internet such as lithium from South America (La-jes 2018; Kaunda 2020), the marginalized populations' basic needs of technology access such as those explored in ICT4D (Information & Communication Technologies for Development) studies, and the innovative contributions made by communities from the margins or outside of capitalism such as Creative Commons and the hackers movement (Evangelista 2014; Murillo 2019; Shaw 2011). Recalling the original definition of the Internet as a "network of networks" (Abbate 1994; Hall 2011) rather than a single uniform one, this article examines a grassroots network called *Baobáxia* from Brazil. It aims to understand how the Internet materializes down to earth in specific spaces and why a locally materialized Internet in marginal communities matters to the broader world (González 2021).

Baobaxia is a transatlantic decentralized digital network developed collaboratively by marginal communities to share community-produced content in their continuous resistance to capitalism. It emerged in *quilombos,* communities of run-away slaves' descendants in Brazil dated back to as early as the sixteenth century. It soon expanded across South America and into Africa and Europe. Throughout the centuries of quilombo community sustainability and resistance, the baobab trees, originally brought over from Africa, have been continuously serving as a major source of food and tools and as the community site of political and cultural activities. With minimal digital infrastructure in the quilombos, the baobab trees have become part of the infrastructure for data sharing between and, later, beyond quilombos. The baobab, including its physical sites, tree parts, the name, and the memories, has been essential to the development and adaptiveness of this network to the local-geographical, ecological, and infrastructural conditions. This study focuses on the "non-human actors," living and nonliving beings (Haraway 1988; Latour 1996, 2005), in the Baobaxia network, especially the baobab trees, more than on conventional technology devices, to bring forth the "terrestrial" actors (Latour 2018, 2019) in the materialization of a digital network. While this network is not necessarily high technology in the mainstream sense, its earth-bound bottom-up collective development is especially revealing of the materiality of the Internet. Thus, it guides us to reflect upon the "terrestriality" of the Internet as a whole in today's digital era. Focusing on the materiality of the Baobaxia network, we suggest calling it a "terrestrial Internet" (Suárez and Lehuedé 2022).

This research is based on on-site and online ethnographic fieldwork from 2017 to 2021. The on-site fieldwork included participant observation, in-depth interviews, and informal interviews conducted in Baobaxia-networked communities and government offices in the Federal District and the states of Goiás, São Paulo, and Amazonas. Participant observation was conducted by attending cultural events, observing technology use, and experiencing everyday life during weeks of living in Baobaxia-networked communities. In-depth interviews were conducted with 13 key interviewees: 5 were members of Baobaxia-networked communities (including non-quilombo urban ghettos), 4 "technology recyclers" and free software developers, and 4 involved (ex-)government officials or social-cultural activists. Interviews outside of our focused communities, such as in the State of Rio Grande do Sul and after our on-site fieldwork in Brazil, were done using email and video

conferencing softwares. The informal interviews occurred during casual conversations and participant observation. We also conducted extensive searching, collection, and theme coding of online visual (image and video) and audio data from the Baobaxia database, individual quilombos' websites, and social media platforms, including Facebook. The majority of the interviewees and communities are anonymized here to avoid any potential risk, considering many of the quilombos do not have official legal status, and some of their data (e.g. music) sharing activities might be taken as violating legal regulations of copyrights.

The following section of this article discusses related works on marginalized communities, especially quilombos, from colonial to digital capitalism. Section 3 introduces this article's conceptual framework, which is built on the two associated concepts: materiality and terrestriality. Then section 4 describes the initial digital networks of quilombos in Brazil. Section 5 presents the upgraded network Baobaxia across the Atlantic. Section 6 analyzes the evolution and implications of the Baobaxia network in broader contexts. At last, section 7 offers a summary and makes conclusive remarks.

2. From colonial to digital capitalism

There has been extensive research on the resistance and autonomy of quilombos in Brazil (de la Torre 2013; Escallón 2019; Gomes 1996, 2015; Leite 2000; Nascimento 1981, 2018) and similar communities across South America (Bledsoe 2017; Price 1996) since colonial capitalism. In colonial capitalism, capitalist relations developed in and through colonial networks of commodities, peoples, ideas, and practices, forming a planetary web of value chains connecting multiple and heterogeneous production sites across oceanic distances (Ince 2018). Brazil's official history tended to attribute quilombos to the colonial past, invisibilizing contemporary quilombo communities (Nascimento 2018). These free Black communities were founded by many of the five million Africans who escaped enslavement in the region (Walia 2021), and while their land rights were finally recognized in the 1988 Brazilian constitution, only a small number of quilombos have been officially recognized up till recently (Águas 2012; de la Torre 2013). The lack of official recognition is a fundamental issue behind quilombos' lack of basic infrastructure, including access to electricity and the Internet (Echeverry 2014; Oliveira 2020). Consequently, quilombos' common location in places of difficult access, a historical strategy of invisibility from (post-)colonial surveillance, also makes them continuously disconnected physically and digitally. In their centuries of self-sustaining, quilombos developed close relations to their land and plants, including baobab, thanks to their historical memory and ancestral knowledge (Águas 2012; Ribeiro et al. 2017). Comparative studies reveal that quilombos in Brazil and related African communities still share similar organizational and networking strategies for larger groups' survival and sustainability (Chaves 2014). Quilombos' remembrances of African culture and tradition, often through religious practices, fostered a shared identity and supported their collective resistance, community autonomy, and territory defense (Chaves 2014; Opoku 1993).

In response to the global "Digital Divide," scholars in various fields such as ICT4D have been exploring, evaluating, and advocating for aids of digital technology access for marginalized populations, especially those in the Global South. Recent works explored questions beyond technology access or aid delivery, focusing more on alternative uses and

community-led innovation of technologies (Chan 2014; Costanza-Chock 2020; González 2021; Nemer 2013; Amrute and Murillo 2020). More critical studies exposed continuing colonialism or new imperialism, for example, the "U.S. empire" in global digital industries as well as in ICT4D practices (Couldry and Mejias 2019; Kwet 2019). Attempts at innovative use and design in the Global South often encounter issues of intellectual property rights of technologies and data in the regulatory regime of digital capitalism (Irani 2019; Marques 2005) or when the Free Software and Open Source communities are involved (Evangelista 2014; Murillo 2019; Shaw 2011). Hence, some scholars take the global "Digital Divide" as a consequence of digital capitalism (Sadowski 2020; Betancourt 2016; de Rivera 2020; Schiller 1999; Pace 2018). Digital capitalism refers to the collection of processes, sites, and moments in which digital technologies mediate the structural tendencies of capitalism (Pace 2018). It is neither a structural totality by itself nor a disruptive break from history (Pace 2018; Sadowski 2020). It advances the existing capitalist relations and extends them to the distribution of benefits and harms of new technologies, with more harms and barriers disproportionately affecting the poor and marginal communities (Sadowski 2020). Our study focuses on a divergent case from the common ICT4D approach of top-down or North–South delivery of ready-made equipment, or "designs for social justice" (Escobar 2020, xvi). It is a case of endogenous and collaborative design of decentralized Internet by marginalized communities to overcome geographical and capitalist barriers.

3. Materiality and terrestriality of the Internet

Multidisciplinary scholars have explored and proposed radical approaches of innovation and design for social-environmentally sustainable ways of life beyond modern capitalism (Ekbia and Nardi 2017; Murillo 2019; Philip, Irani, and Dourish 2012; Escobar 2017) in the broader context of planetary environmental crises today, or "capitalist ruins" of Earth in Anna Tsing's words (2015). Derived from his early critique of Western modernity (2012), Bruno Latour traced the contemporary environmental crises to a fundamental crisis of globalized Western modernity, which is built on the belief of transcendence to its material constraints on this planet (2018). Despite this illusional belief, the planet Earth reacts to human actions in forms that are ever more visible and disastrous to human beings, such as global climate changes (Latour 2018, 2019; Sanchez, Osborne, and Haq 2011; Tsing et al. 2017). In this sense, the earth system, previously believed to be passive and external to human beings, stands more clearly as an actor that shapes the material conditions of human life. Latour (2018) calls this actor "the Terrestrial" (with a capital T) and reminds us that human and non-human life and human artifacts supposedly disembedded by modern capitalism are all "terrestrials" (with a small t). While the word material often means physical substance or matter as opposed to symbolic or spiritual in English dictionaries and in the common "Western conception of materiality," Latour's conception of it comes from a continuous semiosis rather than a dichotomous divide between material and symbolic (2014). Following this conception, the word material in this article refers to the material dimensions of technologies and human life (Latour 2014), not limited to raw materials directly from the Earth. In this sense, human artifacts, such as newspapers, space shuttles (Latour 2011), and digital maps (Latour and Weibel 2020; November et al. 2010), are not less material or dematerialized, but rather, "whatever is

woven together … becomes 'material'" and terrestrial (Latour 2014, 508). He and his collaborators thus call human beings to "land (back) on Earth" epistemologically with the hope of finding other ways of living (Latour and Weibel 2020). A harbinger of this grand call lies in Latour's earlier reminder of newspapers as preceding material platforms of "heterogeneous data" and his associated suggestion to "reinvent the platform … of digital datascapes" today or to re-materialize the Internet (2011, 810).

Furthermore, in Latour's call, to "land on Earth" does not mean a "withdrawal from (nation-state-based) territorial struggles" to "grasp the Earth as a whole," but rather, "the subversion of scales and of temporal and spatial frontiers (that) defines the Terrestrial" (2018, 81). "The only solution is to re-describe, rethink, re-localize, and reterritorialize the notion of land" (Latour et al. 2018). Then the question is, how? We find helpful the STS and anthropology scholars' long-term work on alternative epistemology and ancestral knowledge from the long colonized and subjugated Global South (e.g. de Sousa Santos and Meneses 2009; Haraway 1988; Roussel and Stolfi 2020). For example, based on his work in South America, Arturo Escobar suggests turning to "the multiplicity of perspectives and (thus) possibilities" (Escobar 2017, 2018, 2020). Therefore, it is worth noting that Latour's call to "land on Earth" might not be fully applicable to peoples and communities who have never been as "modern" or capitalistic as Euro-Americans. This article extends Latour's conception of terrestrial and examines a unique case of "terrestrial Internet" (Suárez and Lehuedé 2022) and its transatlantic reterritorialization. The grassroots innovation, or rather materialization, of this terrestrial Internet could inspire the more "modern" people on how to "land on Earth."

4. From African baobab to Brazilian Baobaxia

The baobab trees in Brazil belong to the most widespread species of baobab in continental Africa. This species' scientific name, *Adansonia digitata*, literally means "digital baobab." The Latin word *digitata* refers to the digits of human hands, as baobab leaves have a compound structure with typically five leaflets extended from the stem, like fingers on a hand. *Adansonia digitata* evolved in today's digital era of information and communication technologies, not towards virtual or dematerialized, but instead, using Latour's wording, "the more digital … the more material" (2011, 7).

Brazilian quilombos developed their digital network Baobaxia with crucial support from the baobab since the very beginning. For example, as is widely known among Baobaxia-connected communities, *Casa Tainã*, founded in 1989, is a quilombo community cultural center in the State of São Paulo and an initiator of the network Baobaxia. It acquired its main building by occupying an abandoned house and later developed a nursery of baobab and other seedlings. Casa Tainã has been networking with other quilombos since its beginning. Its long-term and charismatic leader, known as "TC," cultivated baobab seedlings using seeds brought by his daughter directly from Africa and planted a seedling in each networked quilombo (Lippman 2010). This pre-digital network aimed to share collective memory traced back to Africa and promote quilombo culture. Around 2000, Casa Tainã started posting its project information and cultural activity recordings on its website (n.d.), although short of funding and equipment for its ambition of networking and digital sharing. According to Célio Turino, a cultural activist and ex-government official, and others (personal interviews, 2017), the pioneering

success of Casa Tainã and similar organizations in community culture digitalization was a major inspiration to the development of the federal program "*Cultura Viva*" (Living Culture).

In 2003, Brazil's Minister of Culture, Gilberto Gil, an Afro-Brazilian singer and cultural activist, launched his signature policy, the "Living Culture" Program. Aligned with the social inclusion policies of Lula's government, this policy aimed to recognize and promote the arts and cultural manifestations of historically marginalized groups (e.g. urban slum, Indigenous, and quilombo) that had been long ignored by elitist culture and markets (Seoane 2017). With the quilombo inspirations, this policy aimed to facilitate community-based, collaborative cultural and intellectual practices (Ministério da Cultura 2005), or in Gil's words, to support culture as in the "anthropological definition" and in ways not governed by "the logic of the market" (Gil and Ferreira 2016). The Living Culture Program had a component of Cultura Digital (Digital Culture) and provided multimedia kits and funding for cultural centers or groups to widen lower-income populations' access to digital tools and resources. Gil built a partnership between his Ministry of Culture and Creative Commons and integrated the scheme of open and free sharing into the Living Culture Program (Dibbell 2004; LaMonica 2007). While this program arrived at only a few quilombos (e.g. Quilombo do Sopapo, n.d.), it helped politically justify non-market circulation of digital technologies, free and open-source software, and alternative licenses, especially Creative Commons (Seoane 2017).

In response to the digital needs of historically marginalized communities in Brazil, free software developers and "technology recyclers" (Metarecicla, n.d.) stepped up to help, starting with equipment. Many of them contributed under the banner of *MetaReciclagem* (Meta-Recycling), a major project of the free software, hackers, and anti-electronic waste communities in Brazil. The project collects electronic devices and parts, malfunctioning or outdated, for recycling and reuse or "creative upcycling" in their own words. As a key "technology recycler" described in our interview, "In Meta-recycling, we put the old computers to work, run the operating system, and exchange parts between them. We have a 'bank' of old computer parts … that are used to assemble computers later." For example, much of the digital equipment for quilombos in the State of Goiás was abandoned by big banks such as Bradesco. As a resident of a networked quilombo shared, "We have a collaborative (digital) portal that, if it were to be paid, would cost around 40 thousand Reais[1] and would not be installed." Beyond that, as a leader of another networked community emphasized, "We were encouraged to develop communication technologies, especially with 'free software' to not depend on the market. So it was ideal that we used it with open (software) programs." The "technology recyclers" and software developers thus treat quilombo residents as "comrades" ("*camaradas*" in their own words as recorded constantly in participant observation and personal interviews) in their joint efforts in resisting the dominant market system and transforming digital technologies.

In this broad social-technological setting, baobab turned out to play a significant role in building the quilombo digital networks. The baobabs, including those from Casa Tainã, built up the pre-digital networks and served as social links to initiate digital sharing mostly at a regional scale. The regional digital networks thus continued being called *Rota de Baobás* (The Route of Baobabs). Moreover, the baobab fruit, called *mucua* (or *mukua*),

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[1]Brazilian currency.

Figure 1. (a, b) Digital mucuas (exterior and inside). Source: pictures taken on site by the first author in August 2017.

started a new job of storing and transporting electronic devices, especially flash disks and external hard drives of digital recordings and documents (Figure 1(a, b)). Despite the recent hype of commercializing baobab, the fruit shells have been an "agro-industrial waste" in massive quantities (Vunain and Biswick 2019). However, they had been long used as containers and made into handicrafts in Brazilian quilombos and African communities (da Silva Gomes 2009). They turned out to be perfect for keeping the digital devices safe and dry from bad weather, poor road conditions, and rough transport *en route* between communities. This "new technology" of digital mucua, as a key "technology recycler" called it, started in the early 2000s when there was no Internet connection in almost all quilombos. Mucua shells are locally available in abundance and thus conveniently replaceable, easily biodegradable, and overall without economic or environmental cost to the quilombos and the Earth.

The baobab hence linked up digital sharing networks between quilombos, first in Southeastern Brazil and soon nationwide. These networks in the 2000s were regional in terms of exchange frequency given the geographic distance and affordable local transport, such as a relatively close network in Goiás and Federal District. While the quilombos certainly always had their living culture, the digital mucua networks helped their culture to spread and evolve in new material and territorial settings. Quilombos could re-appropriate, produce, express, and innovate by learning and integrating cultural content from other communities and the broader world without intellectual property rights issues. The mucuas (Figure 1(a, b)), with their biological content removed for food or profit, are refilled with digital content also grown out of the same land. A leader of one networked community shared his reflection upon the early efforts, "We cannot stay isolated or reject

Figure 2. People and baobab (hand-drawing instead of photo used here for anonymity). Source: drawn and provided by Nina Xinzhi Zhangshao.

this system (Internet) that facilitates communication. What we need is to understand and own these tools in order to use them for our own benefit!" According to some in our informal interviews, the name "*Baobáxia*" is a combination of *baobá* (baobab), *boa* (good), and *baixar* (download), meaning "good for downloading," while some others said *Baobáxia* means a *galáxia de baobá* (a galaxy of baobabs) as upgraded from Routes of Baobab.

5. Baobaxia from Brazil to Africa and Europe

The genus "scientific name" of all baobab species, *Adansonia*, was assigned to honor the French naturalist Michel Adanson who first "discovered" baobab in west Africa around 1750 (Eggli and Newton 2004, 3; Sabina, Nihmot, and Ifechukwu 2020). Long before Adanson, Africans had been living with baobab and benefited from its offerings: source of water, food, medicine, dire, and crafting materials, space for water storage and human shelter in case of emergency, and sites for the communities' social, cultural, political, and religious activities (Figure 2) (Agúndez et al. 2018; Sanchez, Osborne, and Haq 2011). They and their quilombo descendants have also developed meaningful knowledge about baobab, "subjugated knowledge" but not inferior to Adansonian science (Haraway 1988).

Since around 2009, the quilombo digital network Baobaxia has gradually evolved into a hybrid Internet. For example, a few communities in Goiás (Rede mocambos, n.d.) built cell phone towers for Internet connection with governments' institutional and Meta-recycling's technological support. Even with that, the Internet connection is too limited and slow to transfer multimedia data. The connection of many quilombos with Baobaxia was built through satellite hookups and free software without going through mainstream Internet portals. Baobaxia continues serving as a distributed database, but more than simply through physical transport of digital devices. A foundational step was building the Git data repository. Git (n.d.) is a free and open-source version control system widely used for large distributed software development projects. The

Figure 3. Mucuas/nodes of the Baobaxia network. Source: screenshot from https://mapa.mocambos. net/.

use of Git in Baobaxia is unique because it was designed to allow data locally uploaded to individual community stations of Baobaxia without Internet connection, and later shared with the whole network with Internet connection. This unique design (Rede mocambos, n.d.) makes Baobaxia continuously adaptive to the quilombos' needs, with or without Internet connection, and in high or low bandwidth. While each community station is a node or local server of the network, it is more often called a Mucua (with capital M) (Figure 3). In addition to the community Mucuas, there are also mobile Mucuas, including external hard drives continuously used for data transport in mucua shells and also laptop Mucuas. As an active technology recycler proudly shared, "for example, when we walk around, my laptop is a Mucua! We place it in a plaza, people join this network, and we can make an event or something like that with people browsing on the internet."

The further development of Baobaxia has also been as community-based and collaborative as before. A few more involved software developers have been the key specialists in implementing the technologically challenging parts of the network. But as one of them clarified, "I always worked with the understanding that those communities had their own autonomy. They created their autonomy there." In practice, Baobaxia's community nodes have always been designed and built based on meetings, conversations, and rituals in and between individual quilombos. Software developers participated in these events, and the community collectively decided the technical choices in setting up their community Mucua, such as the distribution of capacities and the access to the common network

(Roussel and Stolfi 2020). Accumulated mutual understandings between the networked quilombos and the involved software developers guided the design of the overall network as well. Also to adapt to the precarious and limited local infrastructure, Baobaxia was built for parallel synchronization of updates from individual communities and the common network with "catalogs," filters, and functional tags, rather than immediate synchronization of all data. Functional tags include "*patrimônio*" for multimedia and textual data of cultural heritage and "*privado*" for data only for individual communities' internal use. The functional tags were designed to allow different ways of distributing and routing content and visualizing the interface for different purposes and users at each Mucua, as we observed in community use (also introduced by Agger 2016). In this way, community members can do their own "digital recombination" (de Mul 2009) for functional, aesthetic, political, or spiritual purposes, such as creating special playlists or protecting their community's internal data. Therefore, users of the network are also curators and guardians of the database. In the words from a networked quilombo, "we are making content here from black people to black people, a material made by us that will be posted on the portal as a political tool."

The upgraded Baobaxia continues being a decentralized and autonomous network with its design rooted in quilombos' history. It does not use a central server, and furthermore, its server nodes are more often called Mucua, avoiding using the word "server" (*servidor*), a word easily conjuring up the haunting nightmare of slavery as more than one interviewee mentioned. Such naming, much earlier and more meaningful than big tech companies' similar moves (Brown 2020), also transcends the dilemma of "(people) enslaving machines" or "people being enslaved by machines" (Borges 2019, 16); and instead, in their own words, it "gives machines life like mucuas," growing them by adding content of ancestral knowledge and living culture. In the words of a community member, "in the knowledge exchange (through Baobáxia), (our) ancestral knowledge is also part of the technological process–one does not invalidate the other." While baobab trees host community activities (Figure 2) not as often anymore (da Silva Gomes 2009), some special events still center on baobab and are recorded and shared digitally on Baobaxia, such as ritualized ceremonies of shared land and history (Rede mocambos, n.d.). More importantly, quilombos' concerns with and strategies of visibility and invisibility, crucial to their long history of resistance, have been integrated into the development of Baobaxia, such as the decentralized network and functional tags. A leader of a later joined urban ghetto community put it clearly: "they (the quilombos) are independent; they are autonomous, and they are so exchanging materials." Baobaxia thus became quilombos' new autonomous platform where information of value to the communities can be stored and shared in their own ways, not controlled by some central commercial or governmental server (Roussel and Stolfi 2020; Agger 2016).

This geographically adaptive and politically autonomous network empowered many other marginalized communities' cause of autonomy and occupation across the Atlantic. Networked quilombos increased to over 200, later joined communities include Indigenous villages and urban ghettos across South America, poor communities in Africa, and occupied farms in Europe (Figure 3). Carsten is a Danish free software developer who joined the cause of Baobaxia in 2015. He had worked in the industries for long and was used to the "product-consumer mindset" (Agger 2016). Then he met earlier Boabaxia developers at the *I Festival Internacional de Tecnoxamanismo*[2] (The First International

Technoshamanism Festival) in Brazil in 2014 and was intrigued by the questions raised at that festival: "do new technologies have to contribute only to the dominant way of human society which is "eating up" our planet? Could new technologies contribute to the life of those people who carry on ancestral ways of living, such as Indigenous peoples and quilombos in Brazil? Could we, modern technology people, learn from people with ancestral ways of looking at things?" After that, he committed himself to exploring new technologies that arise in and for the communities.

Since before its upgrading, this network had been the communities' open organizational tool hosting and sharing community reports, meeting notes, funding requests, *pajelança* (ritualized assembly) recordings, etc. Networked communities thus get to learn from each other and apply the spiritual and strategic inspirations even across continents (Figure 3). During fieldwork in a networked community in Brazil in September 2017, we wanted to meet and interview another software developer but we were told: "he was helping harvest wheat in Italy." The wheat was grown on farms in an abandoned village in Sicily. A group of landless people occupied the farms for permaculture and formed an autonomous community in 2011. They set up a Mucua to become digitally connected with Baobaxia and to learn political strategies of autonomous community organization and resistance to the dominant capitalist system, especially the private land regime. At the "2016 Free and Open Source Software Developers' European Meeting" in Belgium, Carsten introduced Baobaxia as a computer science experiment by marginalized communities and advocated for this community-based collaborative approach of technology development that integrates ancestral wisdom and protects the planet. He encouraged Europeans to build Mucuas for both alternative Internet access and shared resistance strategies, such as in remote rural communities in Nordic Europe and Greenland also short of Internet infrastructure, or in abandoned mountainous villages retaken by landless people for ecovillages or permaculture in the Iberian Peninsula (Agger 2016).

Brazil's current far-right presidency and the COVID-19 pandemic have posed challenges to, but also ironically revealed the value of, the Baobaxia network. In 2020 and 2021, our key interviewees in Brazil reported their recent and still developing challenges. First, the current "government has been even more authoritarian and more contrary to the people's interests." Then the pandemic makes in-person travel and community activities even more difficult. "But the fight continues!," they affirmed, a point well manifested in the continuous use and growth of Baobaxia in 2020 and 2021, as is evidenced by the increase in the sharing of early experiences in community struggle and new development of baobab nurseries from Brazil and Africa, visible and accessible to all on the Internet.

6. Baobaxia as a terrestrial Internet

Baobab, "the tree of life" in Africa, is known for its giant size, long life, and various contributions to human beings and local ecosystems. Unfortunately, since entering the twenty-first century, baobabs in Africa have been dying off rapidly from causes associated with climate changes, especially the species *Adansonia digitata* (Sanchez, Osborne, and Haq

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[2]More about technoshamanism in Roussel and Stolfi (2020) and Borges (2019).

2011). Baobaxia, or the evolved baobab, could "offer a glimmer of hope" towards "new ways of being in the world" (Tsing 2015, 4).

The materialization of Baobaxia poses questions about the materiality and terrestriality of the Internet and digital capitalism. The nomenclatures (Route of Baobab, Mucua, and Baobaxia) of this network are not solely symbolic referencing to quilombos' ancestral legacy and shared identity, but indicative of the essential roles that baobab trees and other "terrestrial" actors (Latour 2018, 2019) play in the development and functioning of this network. Baobab took up these roles thanks to quilombos' historical connection to it and its adaptiveness to the infrastructurally challenging geography of the networked communities across the Atlantic. We thus see the human and non-human actors in forming Baobaxia and their social, technical, and ecological relations embedded in this network (Latour 1996, 2005). These heterogeneous actors, across a wide range of living and nonliving beings, are all earthbound rather than dematerialized. Therefore, we call them "terrestrial" actors (Latour 2018, 2019). Calling them so is an acknowledgement of the materiality and terrestriality of Baobaxia and also an invitation of the follow-up question in relation to "this damaged planet" (Tsing 2015; Tsing et al. 2017): isn't the whole Internet and digital capitalism also rooted in some forms of materiality?

Since its very beginning, Baobaxia grew, in both physical and metaphorical terms, out of global "capitalist ruins" (Tsing 2015). The people, baobab, and mucuas grown out of land and even quilombos' land are survivors of historical and contemporary capitalist expansion. Furthermore, most of the digital equipment of Baobaxia was recycled, or rather "creatively upcycled" (Metarecicla, n.d.) electronic wastes from urban digital capitalism. Indeed, Baobaxia not only relies on recycling but also inspires the regrowing of life out of capitalist ruins and wastes (Tsing 2015). The content shared and grown in this network has inspired and supported more communities across the Atlantic to explore and practice resistance, sustainability, and autonomy. For its materialization and shared content, Baobaxia turns out to be a terrestrial Internet (Suárez and Lehuedé 2022) that debunks the capitalist illusion of dematerialization. It brings humans and non-humans (baobab) together as agents responsible for the collective survival and well-being of the networked communities and demonstrates an earth-oriented approach to technology development amid the planetary crises. Baobaxia is thus indeed an experiment "to remodel technology" (Roussel and Stolfi 2020), to interrogate the materiality of the whole Internet, to defy the imperatives of digital capitalism, and to reimagine ways of life on the damaged planet today (Latour 2018; Tsing 2015; Agger 2016; Sadowski 2020).

It is thus not surprising that the development of Baobaxia led to a cause of geographical and digital reterritorialization of the world, opposite to the common North–South or center-to-periphery path of technology industries and ICT4D interventions. Baobaxia emerged and evolved in the quilombos that have been at the frontiers of the slavery colonial capitalism in history, the advancing contemporary agro-industry, and industrial urbanization today. It expanded to maroon, Indigenous, and poor peripheral communities across South America. It extended, or rather, returned to Africa, the origin of quilombos' ancestors and baobab, reversing the geographical route of the slave trade and baobab seeds in history. It also landed in Europe, the origin of European slavery colonialism. It did so by inspiring and receiving crucial technological support from the Free Software, Creative Commons, hackers, and similar communities who have also been at the margin or even outside of digital capitalism in their own ways different from the

quilombos. These marginalized communities in the capitalist world collaboratively as "comrades" formed a decentralized network and gained control over their own digital territories (Agger 2016). Overall, Baobaxia has recharted the transatlantic territories through collaboration between autonomous communities from both the Global North and South, subverting the historical routes of the slave trade and colonial expansion as well as the contemporary postcolonial borders of nation-states.

7. Concluding remarks

To sum up, Baobaxia is a unique case of terrestrial Internet for multiple reasons. The way in which it was developed is an alternative to the centuries' long-dominant system of capitalism that is supposedly detached from but actually "eating up" the planet. Drawing upon ancestral knowledge and historical legacy, Baobaxia materializes the Internet not with some ready-made digital equipment but through human cohabitation and co-evolution with non-human lives and upcycled wastes on the planet. It is a social–technical–ecological network of various actors grown out of the land, or a network of "terrestrial" actors (Latour 2018, 2019). As a decentralized autonomous network disregarding boundaries of nation-states and ethnic groups, Baobaxia has turned out to be also a cause of "reterritorialization" (Latour et al. 2018), digital and geographical, at a global level and in a five-century historical framework. Overall, the development and expansion of Baobaxia, historically rooted and future-oriented, has been an enlightening experiment in exploring and sharing alternative ways of making a world that may sustain life.

Such a broad spatial–temporal framework inspires us to recognize the limitations of the ethnographic methodology and key theoretical conceptions of this study, and thus to open up to alternative perspectives and cosmologies from research collaborators and interlocutors in the future study. Baobaxia foreruns Latour's call of reterritorialization of land for future life (2018) and helps us to extend the historical and ontological perspectives of this call. Baobaxia shares the forward-thinking of alternative ways for the future. It envisions and explores alternative futures by retrieving the ancestral knowledge and historical legacy of the quilombos in Brazil and their ancestors in Africa. However, Latour disagrees on the "returning to the land of old," referring to the land of old as the world "within national or ethnic borders" (2018). To the quilombos, Latour's land of old is not old enough and a little Euro-centered. The nation-states and racial/ethnic identities in Latour's land of old were established first in Europe over two centuries ago and later imposed upon the rest of the world (never fully successfully though due to, for example, quilombos' continuous resistance) (Anderson 2006; Banton 2019). Over three centuries ago, the legendary quilombo leader Zumbi dos Palmares made his call for a better world, "*Vamos fazer um mundo mais do nosso jeito*" (Let's make a world more in our way), as posted on the front page of Baobaxia (Figure 3). Revitalizing Zumbi's call, Baobaxia draws a new, or rather, reminds us of an old, cartography of the world, from longer and non-Eurocentric historical perspectives that can guide academic understandings of the world (Fujikane 2021; Wolf 2010).

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